Contract Documents

Downtown Area Collection System and Pumping Stations

Contract No. 2019-02 and SRF No. 4486

Town of Orleans, MA

Prepared For

Department of Public Works & Natural Resources

AECOM Technical Services, Inc.

January 2020

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MISCELLANEOUS

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NOTE: Bidders shall check the attached documents with the above list before submitting a bid.

END OF DOCUMENT

February 13, 2020

ADDENDUM NO. 1

TO

DOCUMENTS AND SPECIFICATIONS

FOR

Downtown Area Collection System and Pumping Stations

Contract No. 2019-02 and SRF No. 4486

Town of Orleans, MA

Department of Public Works & Natural Resources

This Addendum No. 1 forms a part of the Contract Documents and modifies the Bidding Documents dated January 2020 as noted below. Acknowledge receipt of this Addendum in the space provided in SECTION 00410, FORM OF GENERAL BID. Failure to do so may subject the Bidder to disqualification.

This Addendum consists of 6 pages and 22 pages of attachments for a total of 28 pages.

ATTACHMENTS

1. Orleans_MA-2019-02-Bid Form_v2
2. Drawing Number 99 C-501
3. Drawing Number 01 C-108
4. Drawing Number 99 C-501
5. Drawing Number 02 C-110
6. Drawing Number 99 C-501
7. Drawing Number 02 C-401

CHANGES TO BE MADE TO THE CONTRACT SPECIFICATIONS

1. SECTION 00410, FORM OF GENERAL BID
   A. Delete ATTACHMENT A – PROPOSAL FORM in its entirety and replace with the attached new ATTACHMENT A – PROPOSAL FORM_R1 in both hard copy and Microsoft Excel format.
2. SECTION 00950, WAIVER OF LIENS
   A. Page 00950-1, delete Notary Public “Jill Cunningham” in its entirety.
3. SECTION 01025, MEASUREMENT AND PAYMENT
   A. Page 01025-1, ITEM 24 – FIBER OPTIC CONDUITS AND HANDHOLES, delete the item in its entirety and replace with the new ITEM 24 – TRACER WIRE IN STATE ROADWAYS.

B. Page 01025-1, add the following new Article to the Table of Contents:

1.06 – BASIS OF MEASUREMENT AND PAYMENT - ALTERNATIVES

ITEM A-1 – FIBER OPTIC CONDUCTS AND HANDHOLES

ITEM A-2 – TRACER WIRE IN TOWN ROADWAYS

C. Page 01025-3, 1.03, PAYMENT ITEMS, Paragraph A, ITEM 24 – FIBER OPTIC CONDUITS AND HANDHOLES, delete the item in its entirety and replace with the new ITEM 24 – TRACER WIRE IN STATE ROADWAYS.

D. Page 01025-3, 1.03, PAYMENT ITEMS, Paragraph B, delete Paragraph B. in its entity and replace with the following new Paragraph:

C. SRF Ineligible Items

Item	Description
B-1	Water Mains
B-2	Bituminous Concrete Trench Pavement
B-3	Stormwater Improvement Structures

E. Page 01025-3, 1.03, PAYMENT ITEMS, add the following new Paragraph B.:

B. Alternatives

Item	Description
A-1	Fiber Optic Conduits and Handholes
A-2	Stormwater Improvement Structures

F. Page 01025-17, ITEM 24 – FIBER OPTIC CONDUITS AND HANDHOLES, delete the item in its entirety and replace with the new ITEM 24 – TRACER WIRE IN STATE ROADWAYS.

ITEM 24 – TRACER WIRE IN STATE ROADWAYS

A. General. The price bid under the Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include placement of tracer wire, connectors, termination points, grounding, testing and all other incidental Work relative thereto.

B. Measurement. Measurement for furnishing and installing tracer wire shall be the horizontal measured length of tracer wire installed.

C. Payment. Payment for furnishing and installing tracer wire listed in DOCUMENT 00410, FORM OF GENERAL BID, shall be made at the unit price bid per linear foot under Item 24.

G. Page 01025-22, add the following as new Article 1.06 – BASIS OF MEASUREMENT AND PAYMENT – ALTERNATIVES.

1.06 – BASIS OF MEASUREMENT AND PAYMENT - ALTERNATIVES

ITEM A-1 - FIBER OPTIC CONDUITS AND HANDHOLES

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include: transportation; handling and dispersal of materials; cutting and removal of existing bituminous and cement concrete or reinforced cement concrete pavement; excavation, backfill above trench grade including all bedding materials (controlled density fill and road gravel); conduits and handholes; compacting trenches; sheeting and shoring not ordered left in place; loaming and seeding; landscaping; removing and resetting curbing, property markers, signs and mail boxes; dust control including mechanical sweeping; all fittings, caps, plugs, restraints and the like; traffic control devices; flushing/cleaning of conduits; testing (pressure, leakage, compaction, etc.); dewatering of trenches; daily cleanup; restoration of all areas disturbed by the Contractor's operations; all Work as specified in DIVISION 1 – GENERAL REQUIREMENTS; and all other incidental Work relative thereto.

B. Measurement. Measurement for furnishing and installing fiber optic conduits and handholes shall be as follows:

1. The length of conduits to be paid for under the appropriate subdivision of this Bid Item shall be the horizontal measured length of conduit in place from centerline of handhole to centerline of handhole. Measurement shall be by the linear foot with no deductions made for fittings.

2. The number of handholes to be paid under the appropriate subdivision of this Bid Item and shall be equal to the actual number installed.

C. Payment. Payment for furnishing and installing conduits and handholes listed in DOCUMENT 00410, FORM OF GENERAL BID, shall be made at the unit prices bid under the applicable divisions of this Bid Item.

1. Only eighty-five (85) percent of the price bid per linear foot of conduit shall be paid for upon its installation, the balance shall be withheld until such time as the conduits have been successfully cleaned and tested (as required) and the site(s) has been fully restored. This percentage is exclusive of normal Contract retainage.

2. Payment for handholes will be paid under the appropriate subdivisions of this Bid Item and shall be equal to the actual number installed.

ITEM A-2 – TRACER WIRE IN TOWN ROADWAYS

A. General. The price bid under the Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include placement of tracer wire, connectors, termination points, grounding, testing and all other incidental Work relative thereto.

B. Measurement

1. Measurement for furnishing and installing tracer wire along the gravity sewer or low-pressure sewer shall be the horizontal measured length of tracer wire in place from centerline of manhole to centerline of manhole. Measurement shall be by the linear foot with no deductions made for manholes, connections and the like.

2. Measurement for furnishing and installing tracer wire along the force main shall be the horizontal measured length of tracer wire in place from the face of the Pumping Station Valve Vault to the centerline of the terminus manhole. Measurement shall be by the linear foot with no deductions made for manholes, connections and the likes.

3. Measurement for furnishing and installing tracer wire along the service connections shall be the horizontal measured length of tracer wire in place from the face of the wye, tee or chimney to the terminus of the service pipeline. Measurement shall be by the linear foot with no deductions made for manholes, connections and the likes.

C. Payment. Payment for furnishing and installing tracer wire listed in DOCUMENT 00410, FORM OF GENERAL BID, shall be made at the unit price bid unit linear foot under this Bid Item.

4. SECTION 0130, SPECIAL REQUIREMENTS

A. Page 01030-4, Article 1.07 – SPECIFICATIONS AND DRAWINGS, delete the words "…consisting of 81 sheets, all made by…" and replace with the words "…consisting of 103 sheets, all made by…".

B. Page 01030-4, Article 1.08 - PROGRESS OF WORK, add the following new paragraph:

C. Furnish to the Engineer a "two-week look ahead" that summarizes the anticipated construction activities. The "two-week look ahead" shall be provide to the Engineer on Thursday of every week throughout the duration of the Project.

5. SECTION 13330, PROCESS INSTRUMENTS

A. Delete page number reference from "01171" to "13330".

CHANGES TO BE MADE TO THE CONTRACT DRAWINGS

1. DRAWING NUMBER 00 C-001

A. Delete Note 59 in its entirety and replace with the following new note:

59. CONTRACTOR IS RESPONSIBLE FOR REPLACING ALL EXISTING PAVEMENT MARKINGS INCLUDING CENTER LINES, EDGE LINES, STOP LINES, CROSSWALKS AND LETTERING FOLLOWING PLACEMENT OF TEMPORARY PAVEMENT AND FOLLOWING PERMANENT PAVEMENT OR AS DIRECTED BY THE ENGINEER. THERMOPLASTIC PLASTIC ROAD PAINT SHALL BE UTILIZED FOR ALL PAVEMENT MARKING IN STATE ROADWAYS. ACETONE ROAD PAINT SHALL BE UTILIZED FOR ALL ROADWAY MARKING IN TOWN ROADWAYS. REFER TO SECTION 02503, PAVING, CURBING, SIDEWALKS AND ROADWAYS.

2. DRAWING NUMBER 01 C-107

A. SMH F-03-02, Service Lateral, delete "40 LF 6" DIA. @ 0.40%" in its entirety and replace with the following "40 LF 8" DIA. @ 0.40%".

3. DRAWING NUMBER 01 C-108

A. Delete the drawing in its entirety and replace with the new drawing attached.

4. DRAWING NUMBER 02 C-110

A. Delete the drawing in its entirety and replace with the new drawing attached.

5. DRAWING NUMBER 02 C-401

A. Delete the drawing in its entirety and replace with the new drawing attached.

6. DRAWING NUMBER 02 C-401

A. Building No. 28, Service Lateral, add the following "40 LF 8" DIA. @ 0.40%".

7. DRAWING NUMBER 03 C-401

A. Delete the words "Proposed Permanent Pump Station Easement (75' x 150')" and replace with the words "Permanent Pump Station Easement (75' x 150')".

B. Add the following as new Note 4:

Nine existing Cedar trees located within the Permanent Pump Station Easement (75' x 150') to be remove and legally disposed of.

C. Delete the words “Proposed 20’ Wide Permanent Easement” and replace with the words “20’ Wide Permanent Easement”

D. Delete the words “Proposed 10’ Wide Temporary Construction Easement” and replace with the words “10’ Wide Temporary Construction Easement”.

8. DRAWING NUMBER 99 C-501

   A. Delete the drawing in its entirety and replace with the new drawing attached.

9. DRAWING NUMBER 99 C-502

   A. Delete the drawing in its entirety and replace with the new drawing attached.

10. DRAWING NUMBER 99 C-504

    A. Delete the drawing in its entirety and replace with the new drawing attached.

11. DRAWING NUMBER 99 C-509

    A. Guard Post, delete the words “Paint Post International Yellow w/ 2-4” Blank Bands” and replace with the words “Low-density Polyethylene Thermoplastic Tube”.

12. DRAWING NUMBER 99 C-510

    A. Driveway Apron, delete the title of the detail in its entirety and replace with the new title “Pump Station No. 1 Driveway Apron”.

CHANGES TO BE MADE TO THE CONTRACT ATTACHMENTS

1. SHEET NO. 111-86085-C01 – LOCUST ROAD SITE PLAN AND DETAILS

   A. Standard Manhole Frame and Cover Detail - Delete the detail in its entirety and replace with “Orleans Standard Manhole Frame” detail and “Orleans Standard Drain and Sewer Manholes Cover” detail shown on DRAWING NUMBER 99 C-503.

   B. Normal Trench Detail – Delete the detail in its entirety and replace with “Typical H.P.D.E. Drain Trench Detail” shown on DRAWING NUMBER 99 C-507.

2. SHEET NO. 111-86085-C02 – BREWSTER CROSS ROAD SITE PLAN AND DETAILS

   A. Orleans Standard Catch Basin Frame and Cover - Delete the detail in its entirety and replace with “Orleans Standard 4-Flange Catch Basin Frame” detail and “Orleans Standard Heavy Catch Basin Grate” detail shown on DRAWING NUMBER 99 C-503.

END OF ADDENDUM NO. 1

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Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS			
1.	For Mobilization/Demobilization, as specified (maximum of five (5) percent of System Expansion bid), the sum of $ -	l.s.	1	$ -
2.A.	For furnishing and installing 1-1/2-inch through 2-inch, inclusive, Polyvinyl Chloride/High Density Polyethylene Low Pressure Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	2,030	$ -
2.B.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Less Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	7,000	$ -
2.C.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Greater Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	13,750	$ -
2.D.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,950	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.E.	For furnishing and installing 12-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	2,410	$ -
2.F.	For furnishing and installing 18-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,900	$ -
2.G.	For furnishing and installing 6-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	3,060	$ -
2.H.	For furnishing and installing 8-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	710	$ -
2.I.	For furnishing and installing 8-inch PVC Effluent Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	3,590	$ -
2.J.	For furnishing and installing 1-1/4-inch Polyvinyl Chloride Low-Pressure Sewer Service Connections and Associated Fittings from main line to property line, All Depths, as specified, the sum of $ -	per l.f.	600	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.K.	For furnishing and installing 6-inch Polyvinyl Chloride Service Connections and Associated Fittings from main line to property line as specified, the sum of $ -	per l.f.	6,100	$ -
2.L.	For furnishing and installing LPS Wyes, All Depths, as specified, the sum of $ -	per each	21	$ -
2.M.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	109	$ -
2.N.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	12	$ -
2.O.	For furnishing and installing 12-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	11	$ -
2.P.	For furnishing and installing 18-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	18	$ -
2.Q.	For furnishing and installing Low Pressure Sewer Main Line Valves, All Sizes and Depths, as specified, the sum of $ -	per each	4	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
3.A.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Less Than 10 feet in Depth, the sum of $ -	per each	24	$ -
3.B.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Greater Than 10 feet in Depth, the sum of $ -	per each	102	$ -
3.C.	For furnishing and installing 5-foot Diameter Precast Concrete Sewer Manholes, All Depths, as specified, the sum of $ -	per each	9	$ -
3.D.	For furnishing and installing 6-foot Diameter Precast Concrete Low Pressure Sewer Terminal Flushing Manholes, All Depths, as specified, the sum of $ -	per each	5	$ -
3.E.	For furnishing and installing 6-foot Diameter Precast Concrete Effluent Force Main In-Line Flushing Manholes, All Depths, as specified, the sum of	per each	1	$ -
3.F.	For furnishing and installing 6-foot Diameter Precast Concrete Leaching Catch Basins with Grates, All Depths, as specified, the sum of	per each	4	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
4.A.	For furnishing and installing Standard Manhole Frames and Covers, as specified, the sum of $ -	per each	108	$ -
4.B.	For furnishing and installing Bolted and Gasketed Manhole Frames and Covers, as specified, the sum of $ -	per each	37	$ -
5.	For furnishing and installing Interior Manhole Drop Connections, as specified, the sum of $ -	per v.f.	80	$ -
6.	For furnishing and installing chimneys, as specified, the sum of $ -	per v.f.	490	$ -
7.	For furnishing and placing miscellaneous cement concrete, as specified, the sum of $ -	per c.y.	440	$ -
8.	For Rock and Boulder Excavation including Replacement with Suitable Fill Material, as specified, the sum of $ - * Minimum Bid = $80/c.y.	per c.y.	550	$ -
9.A.	For Replacement of Unsuitable Material Below Trench Grade and/or Subgrade, as specified, the sum of $ -	per c.y.	820	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
9.B.	For Replacement of Unsuitable Material Above Trench Grade, as specified, the sum o			
	$ -	per c.y.	1,630	$ -
10.	For Experimental Excavation, as specified, the sum of			
	$ -	per c.y.	440	$ -
11	Fill for embankments – Not Used			
12.	Sheeting and/or shoring ordered left in place – Not Usec			
13.	For performing Soil Compaction Tests, as specified, the sum of			
	$ -	per each	150	$ -
14.	For furnishing and placing Road Gravel Material, as specified, the sum of			
	$ -	per c.y.	10,740	$ -
15.A.	For furnishing and placing 3-inch Temporary Bituminous Concrete Trench Pavement (base course), as specified, the sum of *			
	$ -	per ton	5,320	$ -

* Minimum Bid = $80/ton

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.B.	For furnishing and placing 7-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in State Roadways, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	4,060	$ -
15.C.	For milling and furnishing and placing 2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in State Roadways, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	6,050	$ -
15.D.	For furnishing and placing 4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	480	$ -
15.E.	For furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (base course) in Town Roadways, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	490	$ -
15.F.	For furnishing and placing Dense Graded Gravel, as specified, the sum of $ -	per c.y.	350	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.G.	For furnishing and placing 4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	4,460	$ -
	* Minimum Bid = $80/ton			
15.H.	For milling and furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	7,050	$ -
	* Minimum Bid = $80/ton			
15.I.	For Miscellaneous Restoration of State and Town Roadways, as specified, the sum of *			
	$ -	per ton	550	$ -
	* Minimum Bid = $80/ton			
15.J.	For furnishing and placing Miscellaneous Bituminous Concrete Pavement, as specified, the sum of *			
	$ -	per ton	660	$ -
	* Minimum Bid = $80/ton			
15.K.	For repair and/or replacement of the Vehicle Loop Detectors, as specified, the sum of			
	$ -	per each	20	$ -
15.L.	For repainting of Traffic Markings - Lines, Symbols and Wording, as specified, the sum of			
	$ -	per l.s.	1	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
16.A.	For removal and relaying and/or replacement of Existing Water Mains and services, as specified, the sum o			
	$ -	per inch-foot	4,000	$ -
16.B.	For removal and relaying and/or replacement of Existing Storm Drains, as specified, the sum o			
	$ -	per inch-foot	20,000	$ -
16.C.	For removal and relaying and/or replacement of Existing Gas Mains and services, as specified, the sum o			
	$ -	per inch-foot	10,000	$ -
16.D.	For removal and relaying and/or replacement of Existing Miscellaneous Utilities, as specified, the sum o			
	Seventy Five Thousand Dollars and No Cents $ 75,000.00	Allowance	1	$ 75,000.00
16.E.	For furnishing, installing and removal of Water Main Line Stops, as specified, the sum of			
	$ -	per each	20	$ -
16.F.	For removing and replacement of existing Water Mains (6-inch, 8-inch, 10-inch and 12-inch) and Associated Fittings specified, the sum of			
	$ -	per inch-foot	1,520	$ -
17.	Uniformed Traffic Police Officers - Paid by Owner			

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
18.A.	For furnishing, installing, and removing Engineer's Field Office, as specified, the sum of $ -	per l.s.	1	$ -
18.B.	For maintaining Engineer's Field Office, as specified, the sum of $ -	per week	91	$ -
19.	For furnishing, installing, maintaining and removing Environmental Protection, as specified, the sum of $ -	per l.s.	2,830	$ -
20.	For furnishing, installing, maintaining and removing Trench Dewatering Equipment, as specified, the sum of $ -	per l.f.	11,220	$ -
21.	Temporary By-pass Pumping - Not Used			
22.	For furnishing and installing Highway Crossing, as specified, the sum of $ -	per l.s.	1	$ -
23.A.	For furnishing and installing Pumping Station No. 1, as specified, the sum of $ -	per l.s.	1	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
23.B.	For furnishing and installing Pumping Station No. 2, as specified, the sum of			
	$ -	per l.s.	1	$ -
23.C.	For furnishing and installing Pumping Station No. 3, as specified, the sum of			
	$ -	per l.s.	1	$ -
23.D.	For Electric Company Connection/Service Fee, as specified, the sum of			
	Seventy Five Thousand Dollars and No Cents			
	$ 75,000.00	Allowance	1	$ 75,000.00
23.E.	For Telephone Company Connection/Service Fee, as specified, the sum of			
	Thirty Thousand Dollars and No Cents			
	$ 30,000.00	Allowance	1	$ 30,000.00
23.F.	For Planting Operations, as specified, the sum of			
	Thirty Thousand Dollars and No Cents			
	$ 30,000.00	Allowance	1	$ 30,000.00
24.	For furnishing and installing Tracer Wire in State Roadways, All Depths, as specified, the sum of			
	$ -	l.f.	15,000	$ -

TOTAL AMOUNT OF BID (SRF ELIGIBLE BID ITEMS) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF (Bid Items 1 through 24, inclusive).

Two Hundred Ten Thousand Dollars and No Cents

$ 210,000.00

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	ALTERNATIVES			
A-1A.	For furnishing and installing 4-inch Fiber Optic Conduits and Associated Fittings, All Depths, as specified, the sum of $ -	l.f.	3,590	$ -
A-1B.	For furnishing and installing Fiber Optic Handhole, All Depths, as specified, the sum of $ -	ea.	10	$ -
A-2.	For furnishing and installing Tracer Wire in Town Roadways All Depths, as specified, the sum of $ -	l.f.	28,100	$ -

TOTAL AMOUNT OF BID (ALTERNATIVE BID ITEMS) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF (Bid Items A-1 through A-2., inclusive).

$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF INELIGIBLE BID ITEMS			
Item B-1 - Replacement of Water Services				
B-1A.	For furnishing and installing 1-inch Polyvinyl Chloride Water Services and Associated Fittings from water main to property line as specified, the sum of $ -	per l.f.	2,040	$ -
B-1B.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	480	$ -
B-1C	For furnishing and placing Temporary Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	290	$ -
B-1D.	For furnishing and placing Permanent Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	100	$ -
	Item B-1 - Replacement of Water Services (Bid Items B-1A. through B-1D., inclusive)			**$ -**

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
Item B-2 - Replacement of Canal Road Water Main				
B-2A.	For furnishing and installing 8-inch DI water main and Associated Fittings, as specified, the sum of $ -	per l.f.	2,060	$ -
B-2B.	For furnishing and installing 1-inch Polyvinyl Chloride Water Services and Associated Fittings from water main to property line as specified, the sum of $ -	per l.f.	320	$ -
B-2C.	For furnishing and installing 6-inch Gate Valves and Boxes, as specified, the sum of $ -	per each	6	$ -
B-2D.	For furnishing and installing 8-inch Gate Valves and Boxes, as specified, the sum of $ -	per each	7	$ -
B-2E.	For furnishing and installing Fire Hydrants, as specified, the sum of $ -	per each	6	$ -
B-2F.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	560	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
B-2G.	For furnishing and placing Temporary Bituminous Concrete Trench Pavement, as specified, the sum of *			
	$ -	per ton	340	$ -
	* Minimum Bid = $80/ton			
B-2H.	For furnishing and placing Permanent Bituminous Concrete Trench Pavement, as specified, the sum of *			
	$ -	per ton	120	$ -
	* Minimum Bid = $80/ton			
	Item B-2 - Replacement of Canal Road Water Main (Bid Items B-2A. through B-2H., inclusive)			**$ -**
Item B-3 - Water Quality Improvements				
B-3A.	For Brewster Cross Road Water Quality Improvements, as specified, the sum of			
	$ -	per l.s.	1	$ -
B-3B.	For Locust Road Water Quality Improvements, as specified, the sum of			
	$ -	per l.s.	1	$ -
	Item B-2 - Water Quality Improvements (Bid Items B-3A. through B-3B., inclusive)			**$ -**

TOTAL AMOUNT OF BID (SRF INELIGIBLE BID ITEMS) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF (Bid Items B-1 through B-3, inclusive).

$ -

Note: **Funding for the SRF Ineligible Bid Items is anticipated to be obtained at the Annual Town Meeting proposed to be held in May 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

Company's Name

Date

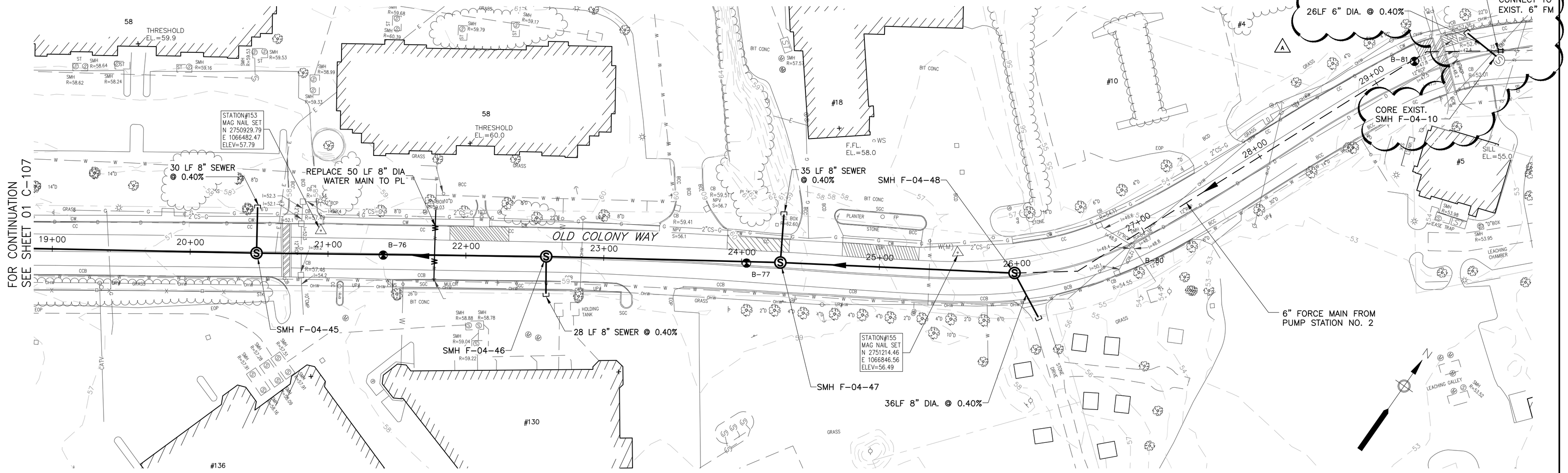
Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
BASIS OF AWARD				
BASIS OF AWARD = TOTAL AMOUNT SRF ELIGIBLE BID ITEMS BASED ON ENGINEER'S ESTIMATE OF QUANTITIES (Bid Items 1 through 24, inclusive) + TOTAL AMOUNT OF ALTERNATIVES BID ITEMS BASED ON ENGINEER'S ESTIMATE OF QUALTITIES (Bit Items A-1 throguh A-2, inclusive) + TOTAL AMOUNT OF SRF INELIGIBLE BID ITEMS BASED ON ENGINEER'S ESTIMATE OF QUANTITIES (Bid Items B-1 through B-3, inclusive).				

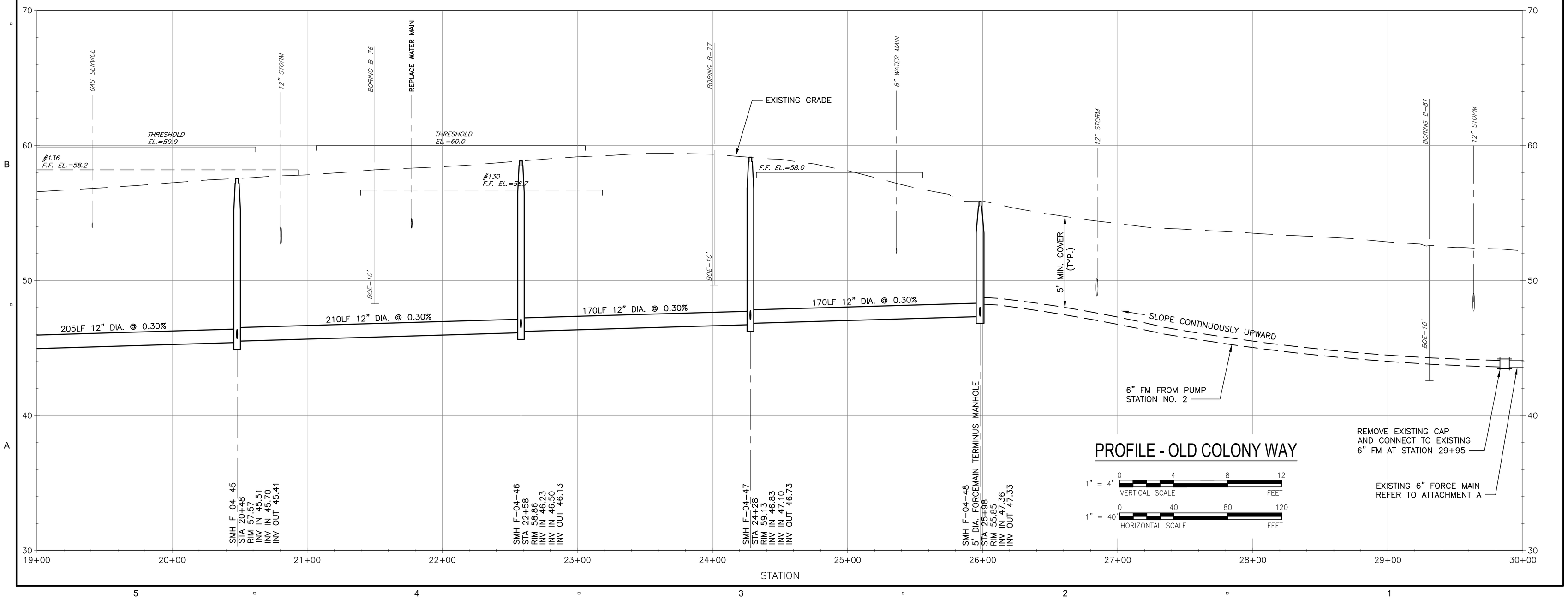
Two Hundred Ten Thousand Dollars and No Cents

$ 210,000.00



PLAN - OLD COLONY WAY

SCALE: 1"=40'



PROFILE - OLD COLONY WAY

1" = 4' VERTICAL SCALE 0 4 8 12 FEET

1" = 40' HORIZONTAL SCALE 0 40 80 120 FEET

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AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

OWNER

TOWN OF ORLEANS, MA
19 SCHOOL ROAD
ORLEANS, MA 02653
(508) 240-3700

ENGINEER

AECOM TECHNICAL SERVICES, INC.
9 JONATHAN BOURNE DRIVE
POCASSET, MA 02559
PHONE: (508) 833-6950
www.aecom.com

REGISTRATION

COMMONWEALTH OF MASSACHUSETTS
THOMAS E. PARECE
CIVIL
No. 34493
REGISTERED PROFESSIONAL ENGINEER

ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	02-11-2020	ADDENDUM NO. 1

PROJECT NUMBER

60587515

Designed By:	M. CURRAN
Drawn By:	M. CURRAN
Dept Check:	T. PARECE
Proj Check:	M. DONOGHUE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

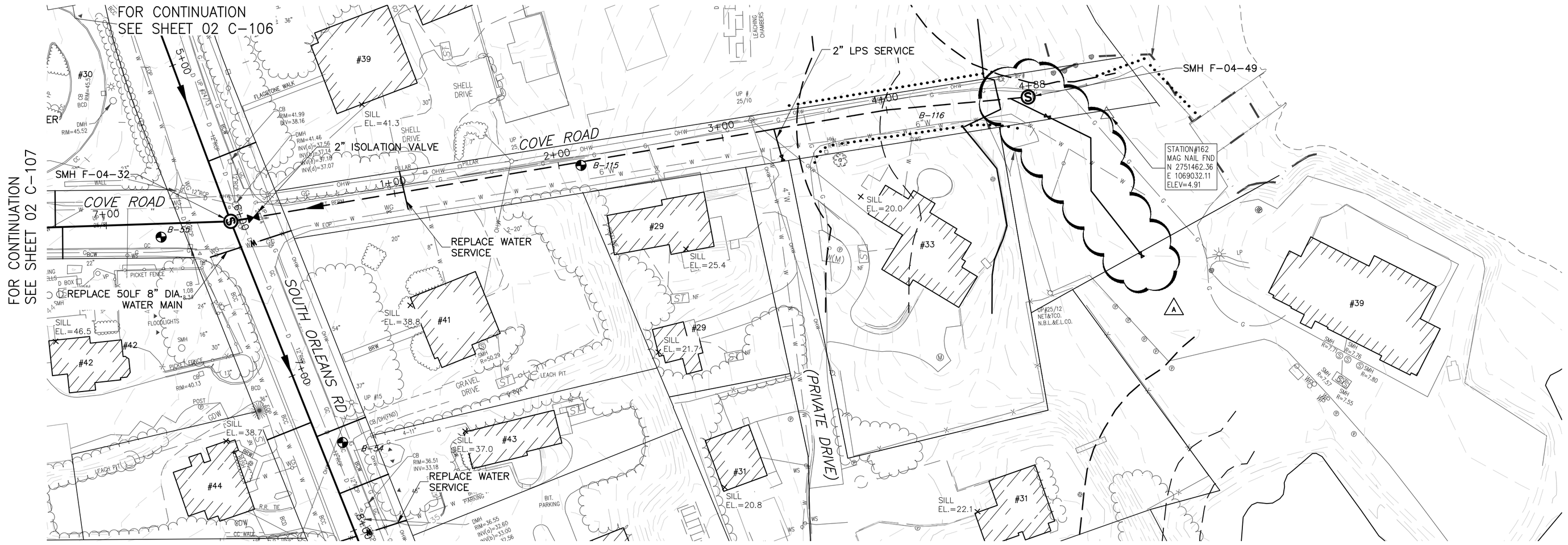
CIVIL

SHEET TITLE

PLAN AND PROFILE SEWER OLD COLONY WAY III

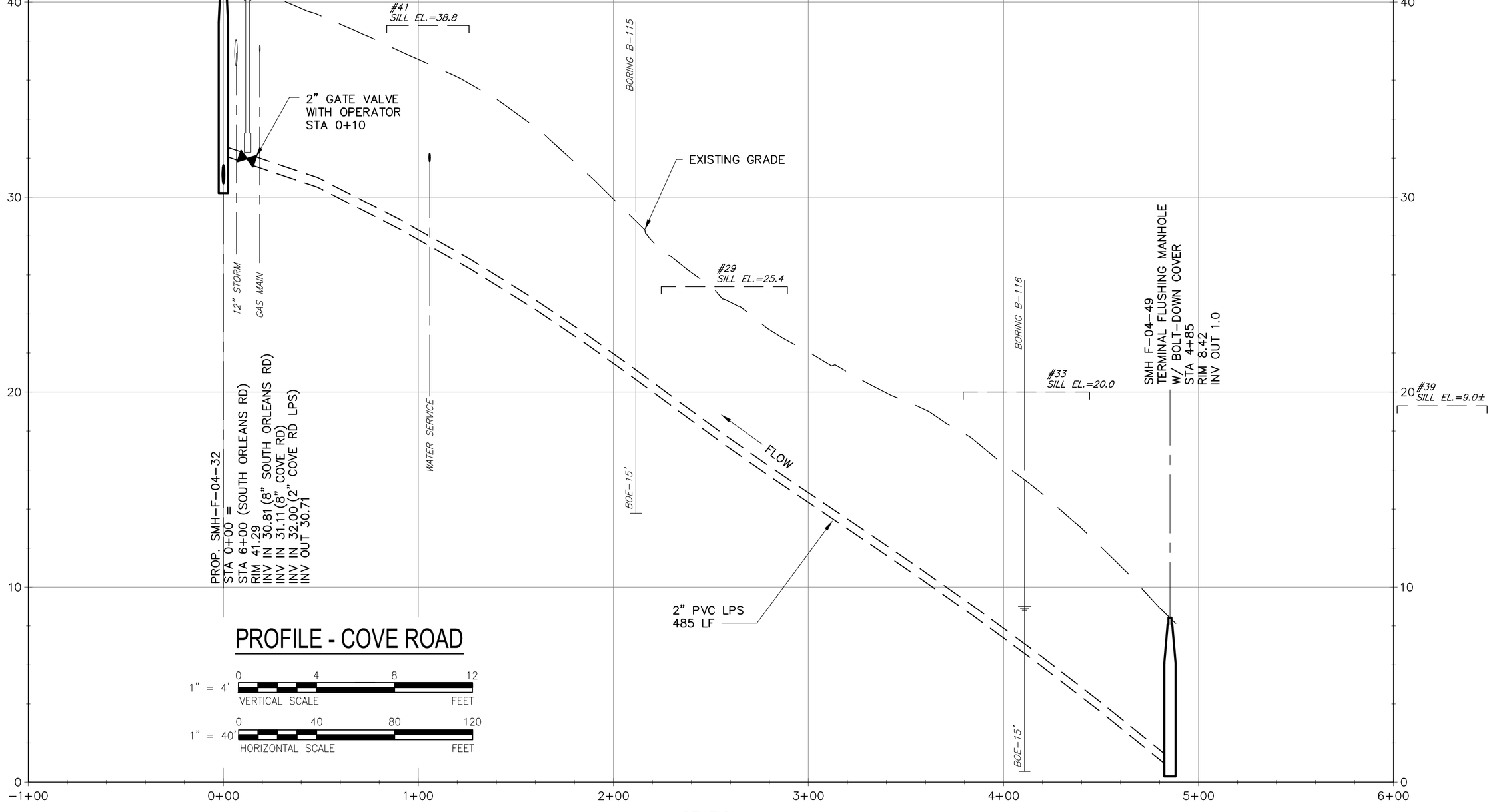
SHEET NUMBER

01 C-108



PLAN - COVE ROAD

SCALE: 1"=40'



PROFILE - COVE ROAD

1" = 4' VERTICAL SCALE 0 4 8 12 FEET

1" = 40' HORIZONTAL SCALE 0 40 80 120 FEET

FOR CONTINUATION
SEE SHEET 02 C-106

AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

OWNER

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REGISTRATION

COMMONWEALTH OF MASSACHUSETTS
THOMAS E. PARECE
CIVIL
No. 34463
REGISTERED PROFESSIONAL ENGINEER

ISSUE/REVISION

I/R	DATE	DESCRIPTION
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PROJECT NUMBER

60587515

Designed By:	M. CURRAN
Drawn By:	M. CURRAN
Dept Check:	T. PARECE
Proj Check:	M. DONOGHUE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

CIVIL

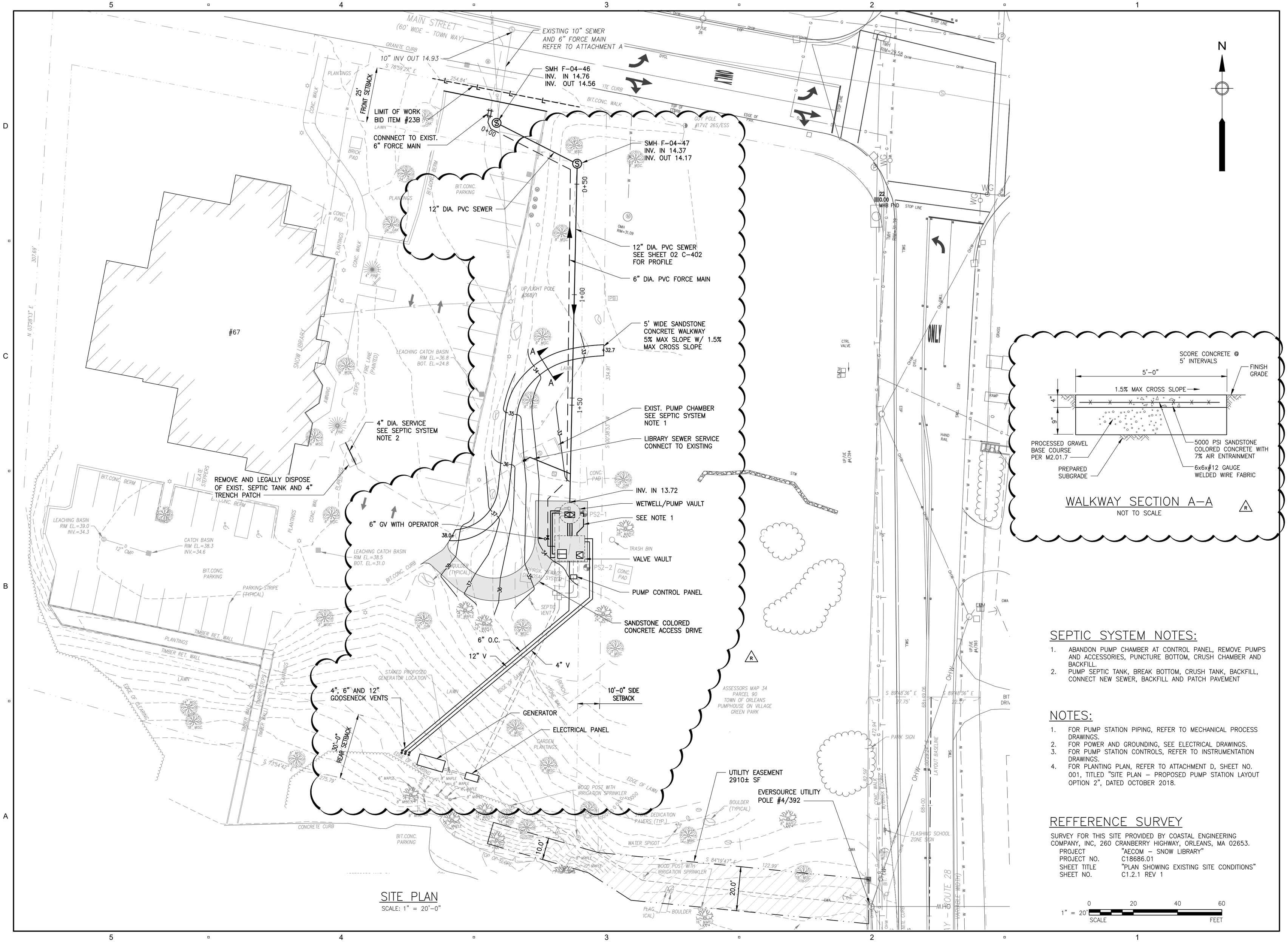
SHEET TITLE

PLAN AND PROFILE SEWER COVE ROAD II

SHEET NUMBER

02 C-110

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SEPTIC SYSTEM NOTES:

1. ABANDON PUMP CHAMBER AT CONTROL PANEL, REMOVE PUMPS AND ACCESSORIES, PUNCTURE BOTTOM, CRUSH CHAMBER AND BACKFILL.
2. PUMP SEPTIC TANK, BREAK BOTTOM, CRUSH TANK, BACKFILL, CONNECT NEW SEWER, BACKFILL AND PATCH PAVEMENT

NOTES:

1. FOR PUMP STATION PIPING, REFER TO MECHANICAL PROCESS DRAWINGS.
2. FOR POWER AND GROUNDING, SEE ELECTRICAL DRAWINGS.
3. FOR PUMP STATION CONTROLS, REFER TO INSTRUMENTATION DRAWINGS.
4. FOR PLANTING PLAN, REFER TO ATTACHMENT D, SHEET NO. 001, TITLED "SITE PLAN – PROPOSED PUMP STATION LAYOUT OPTION 2", DATED OCTOBER 2018.

REFFERENCE SURVEY

SURVEY FOR THIS SITE PROVIDED BY COASTAL ENGINEERING COMPANY, INC, 260 CRANBERRY HIGHWAY, ORLEANS, MA 02653.

PROJECT	"AECOM – SNOW LIBRARY"
PROJECT NO.	C18686.01
SHEET TITLE	"PLAN SHOWING EXISTING SITE CONDITIONS"
SHEET NO.	C1.2.1 REV 1

AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

OWNER

TOWN OF ORLEANS, MA

19 SCHOOL ROAD
ORLEANS, MA 02653
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REGISTRATION

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THOMAS E. PARECE
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REGISTERED
PROFESSIONAL ENGINEER

ISSUE/REVISION

A	02-11-2020	ADDENDUM NO. 1
I/R	DATE	DESCRIPTION

PROJECT NUMBER

60587515

Designed By:	M. CURRAN
Drawn By:	M. CURRAN
Dept Check:	T. PARECE
Proj Check:	M. DONOGHUE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

CIVIL

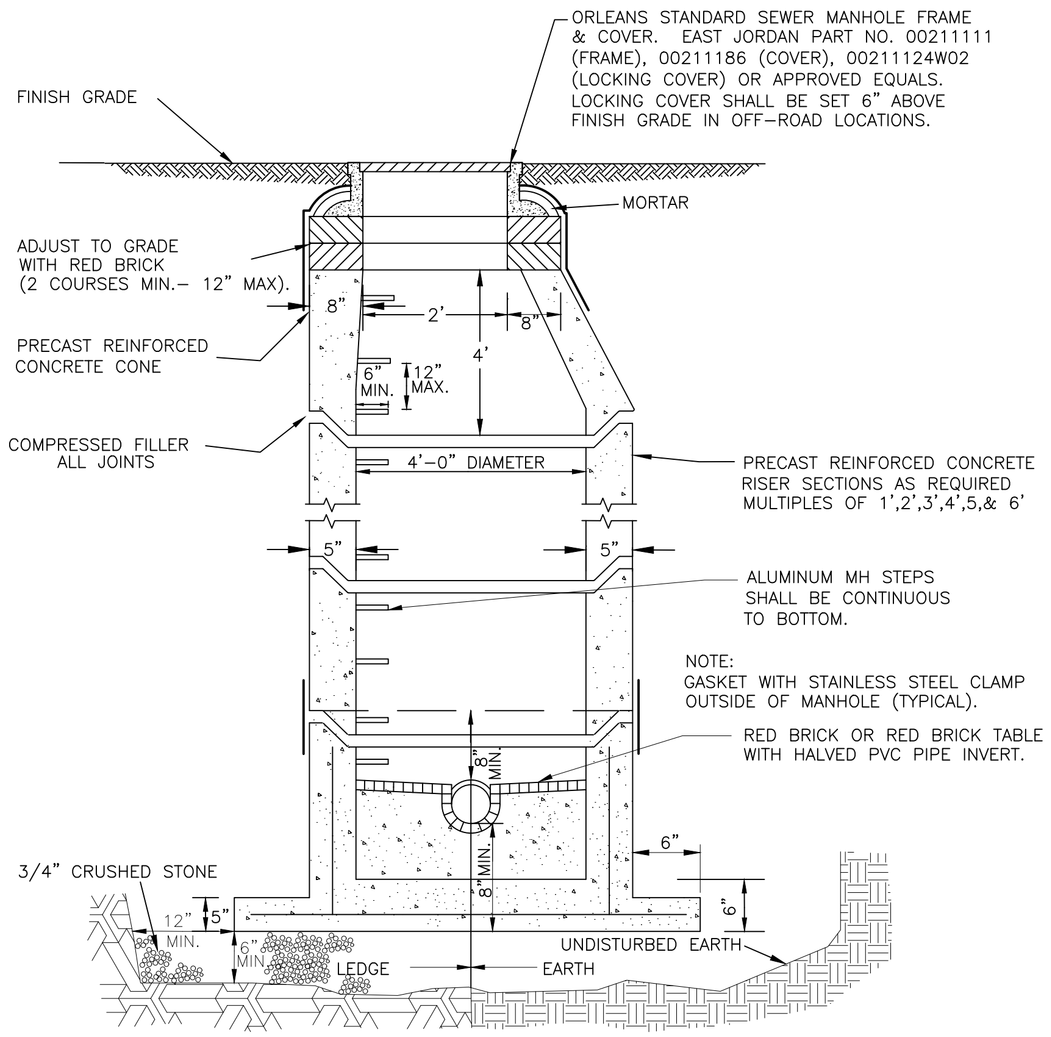
SHEET TITLE

PUMP STATION NO. 2
SITE PLAN

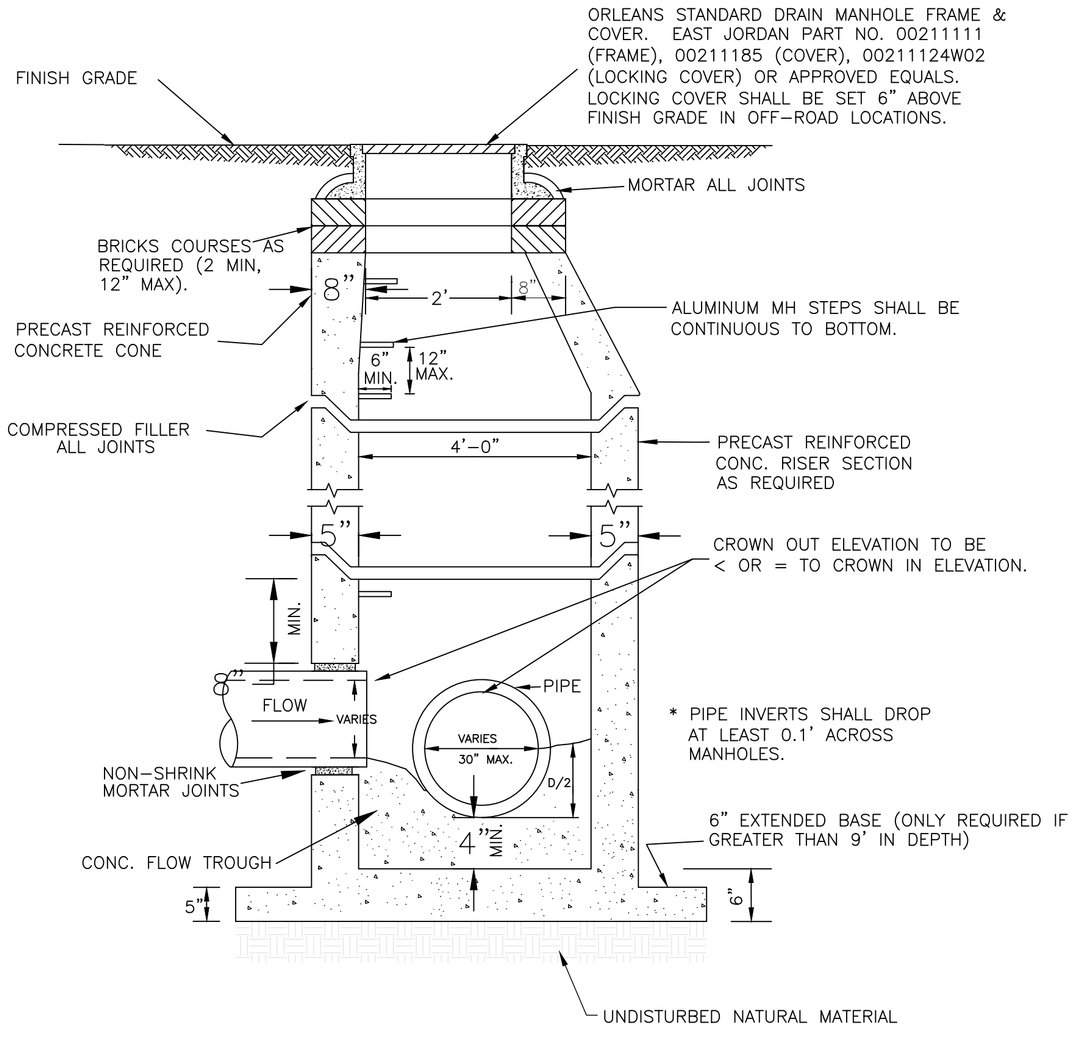
SHEET NUMBER

02 C-401

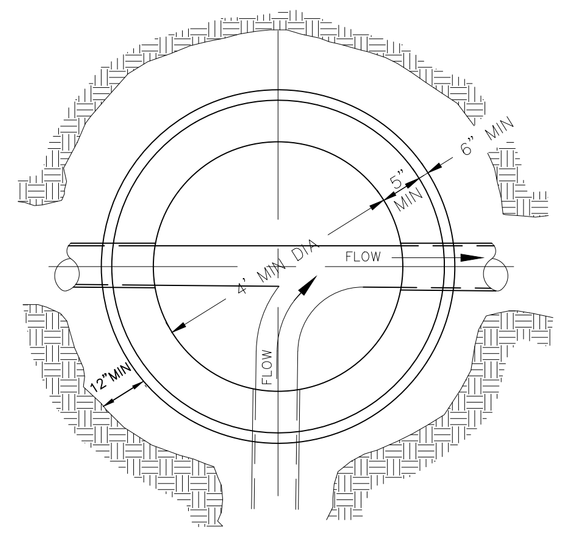
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TYPICAL PRECAST CONCRETE SEWER MANHOLE
(NOT TO SCALE)

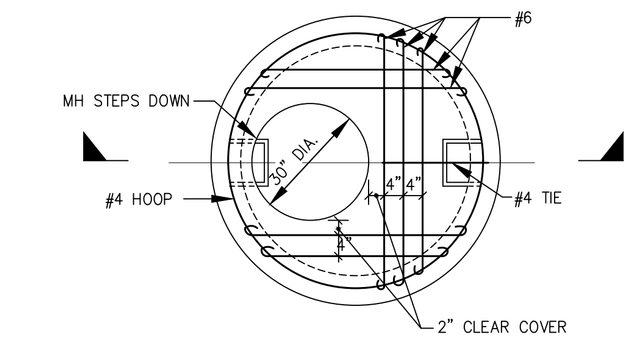


TYPICAL PRECAST CONCRETE DRAIN MANHOLE
ENTIRE STRUCTURE TO BE H20 LOADING
(NOT TO SCALE)

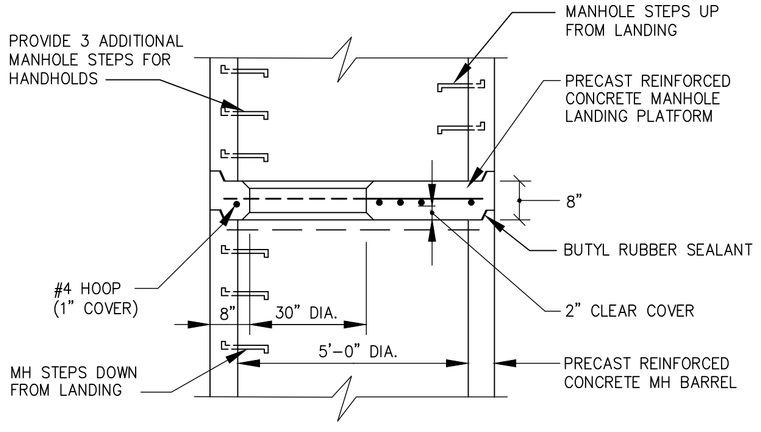


TOP VIEW

INVERT TABLE PLAN
(NOT TO SCALE)



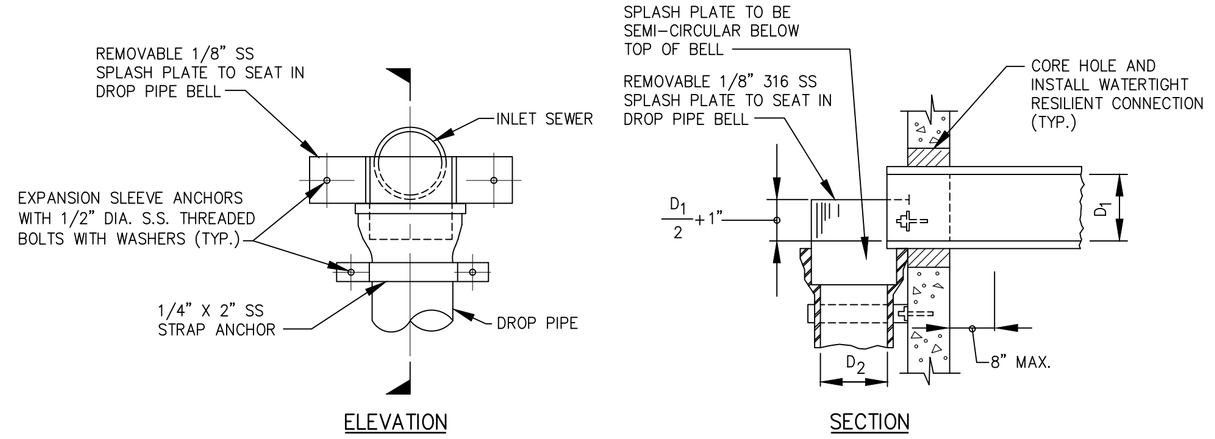
PLAN OF PRECAST SLAB



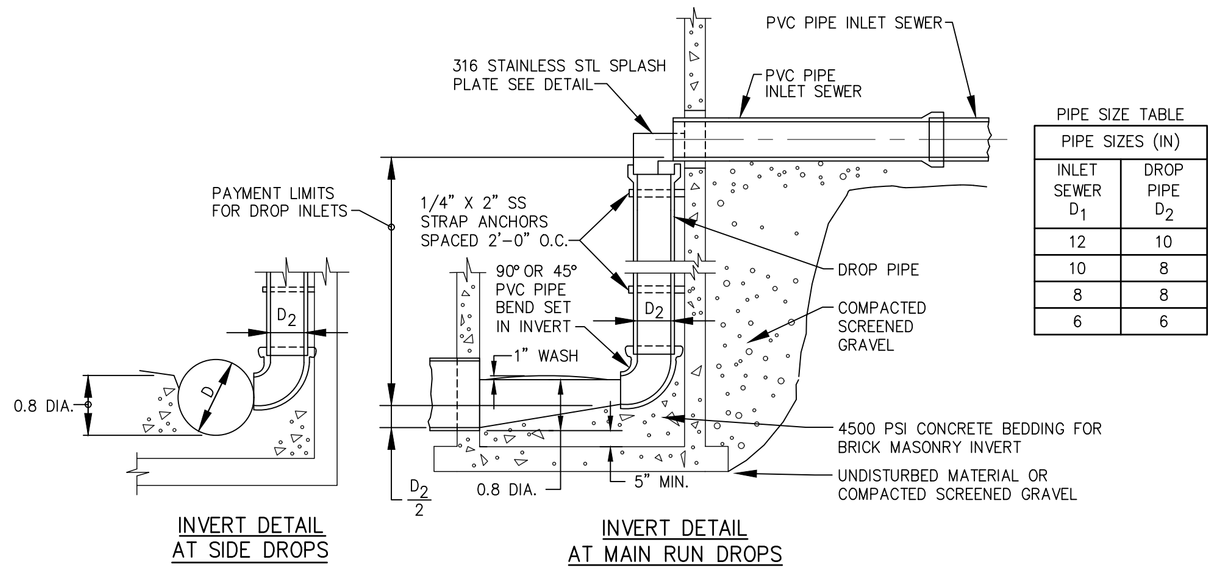
SECTION

NOTE:
LANDING PLATFORMS ARE TO BE INSTALLED AT THE MIDPOINT OF MANHOLES EXCEEDING 20' IN DEPTH.

PRECAST MANHOLE LANDING PLATFORM
NOT TO SCALE

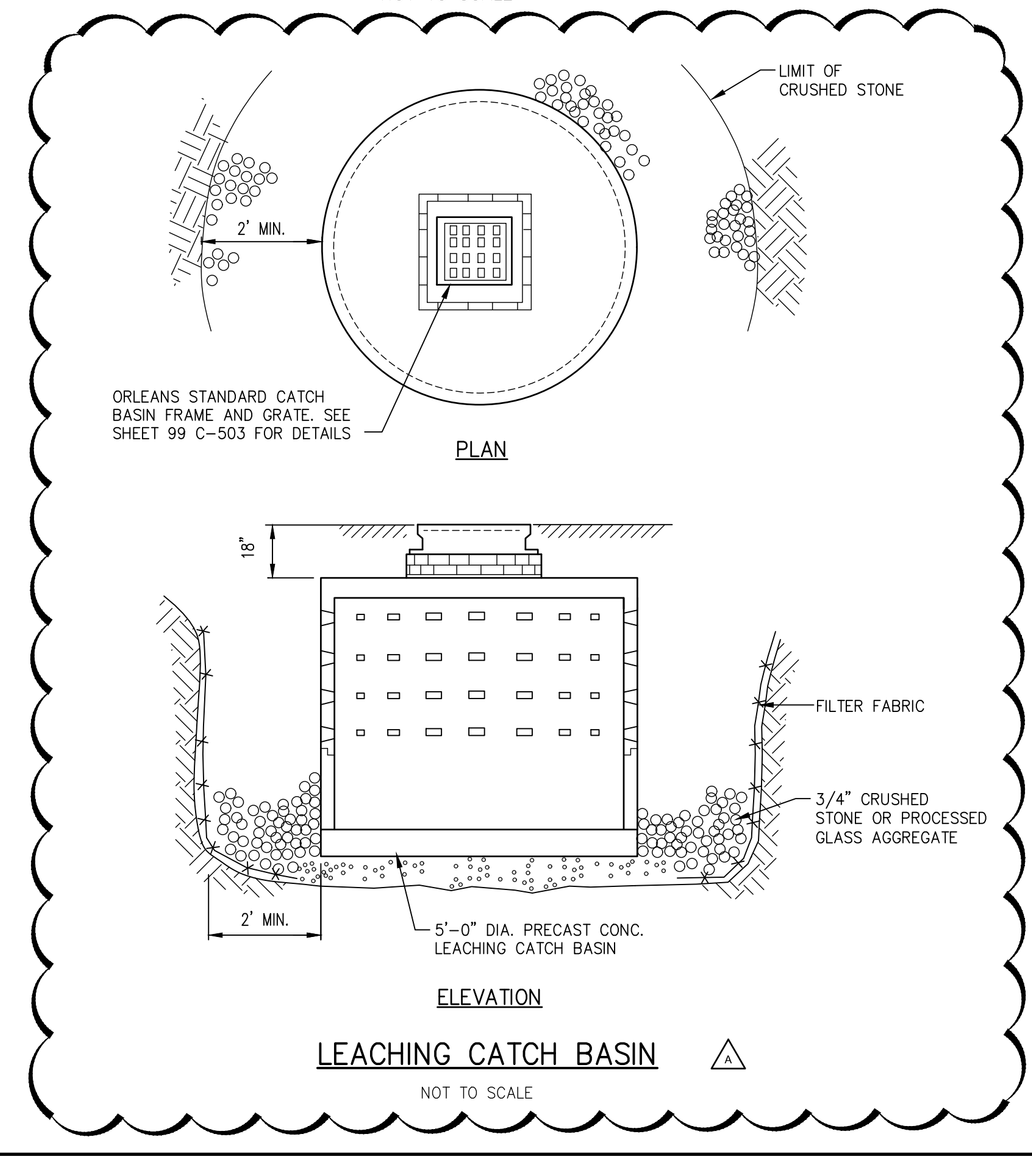


316 SS SPLASH PLATE DETAIL



PIPE SIZE TABLE	
PIPE SIZES (IN)	
INLET SEWER D_1	DROP PIPE D_2
12	10
10	8
8	8
6	6

INSIDE DROP INLETS FOR PVC PIPE SEWERS 12 INCH DIAMETER AND SMALLER
NOT TO SCALE



LEACHING CATCH BASIN A
NOT TO SCALE

AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

OWNER

TOWN OF ORLEANS, MA
19 SCHOOL ROAD
ORLEANS, MA 02653
(508) 240-3700

ENGINEER

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REGISTRATION

COMMONWEALTH OF MASSACHUSETTS
THOMAS E. PARECE
CIVIL
No. 34483
REGISTERED PROFESSIONAL ENGINEER

ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	02-11-2020	ADDENDUM NO. 1

PROJECT NUMBER

60587515

Designed By:	M. CURRAN
Drawn By:	M. CURRAN
Dept Check:	T. PARECE
Proj Check:	M. DONOGHUE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

CIVIL

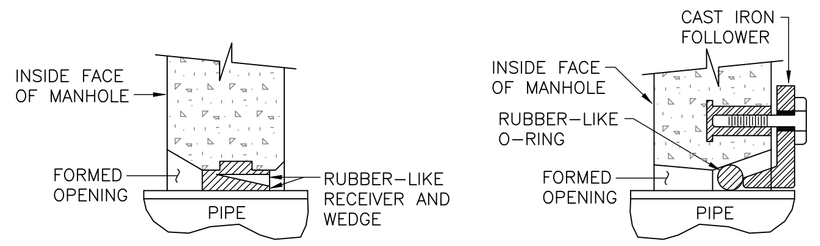
SHEET TITLE

DETAILS I

SHEET NUMBER

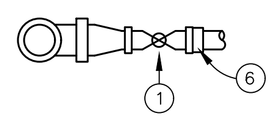
99 C-501

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NOTE:
ALL GASKETS, SEALANTS, MORTAR ETC. SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURERS WRITTEN INSTRUCTIONS.

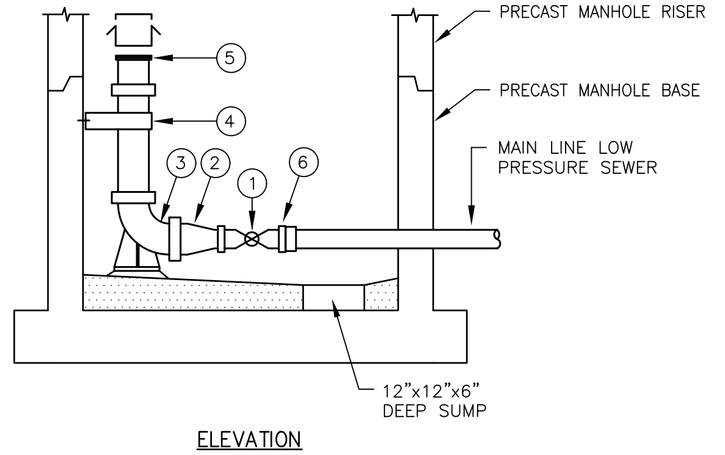
TYPICAL SLEEVE DETAILS
NOT TO SCALE



PLAN

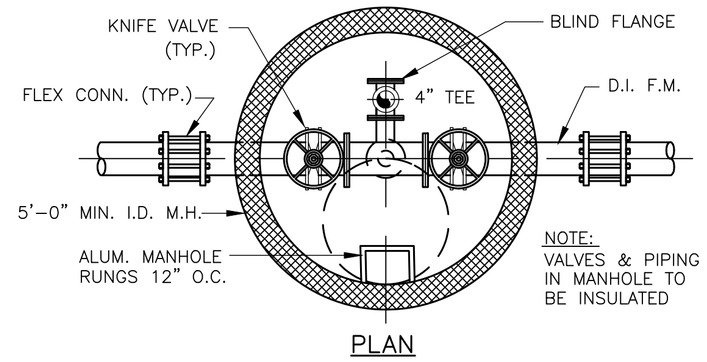
CLEANOUT MATERIALS

1. S.S. BALL VALVE – 2"
2. 4"x2" REDUCER, DUCTILE IRON
3. 90° BASE ELBOW – DUCTILE IRON
4. S.S. STRAP SUPPORT
5. HOSE CONNECTION – 4" QUICK DISCONNECT WITH CAP, BRASS
6. PVC/DUCTILE IRON ADAPTERS

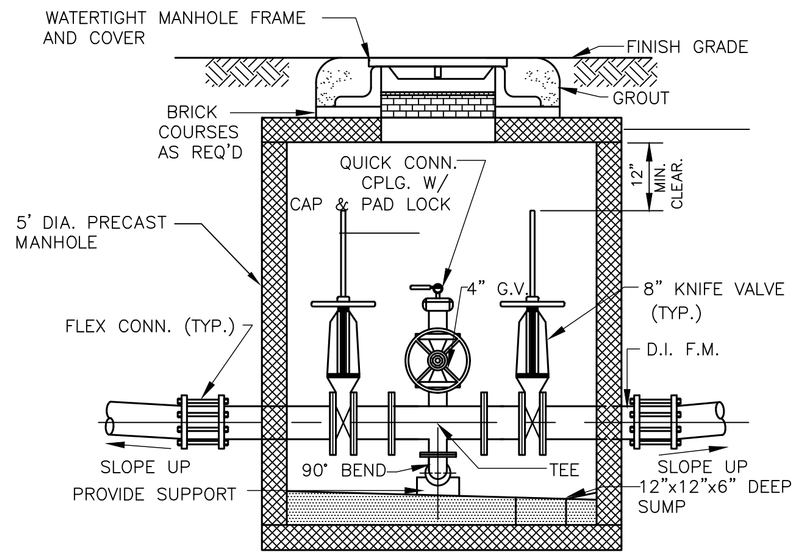


ELEVATION

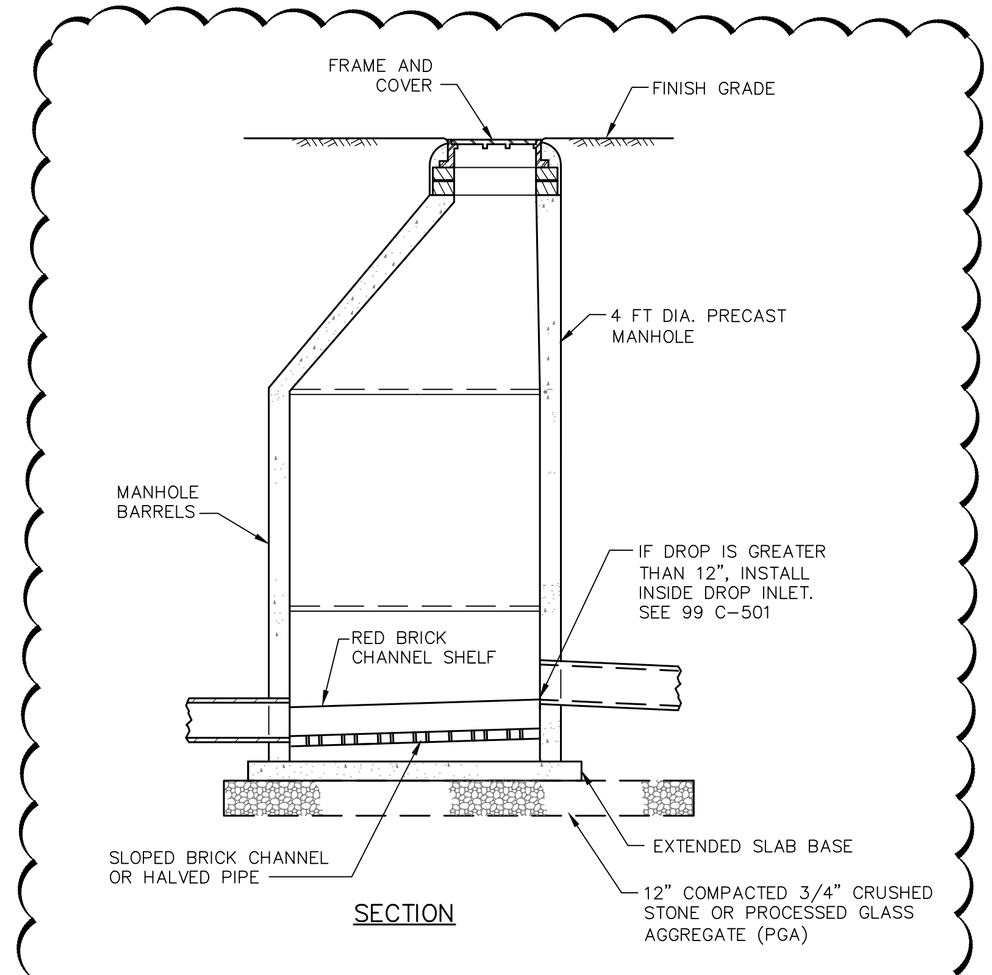
LOW PRESSURE SEWER TERMINAL FLUSHING DETAIL
NOT TO SCALE



PLAN

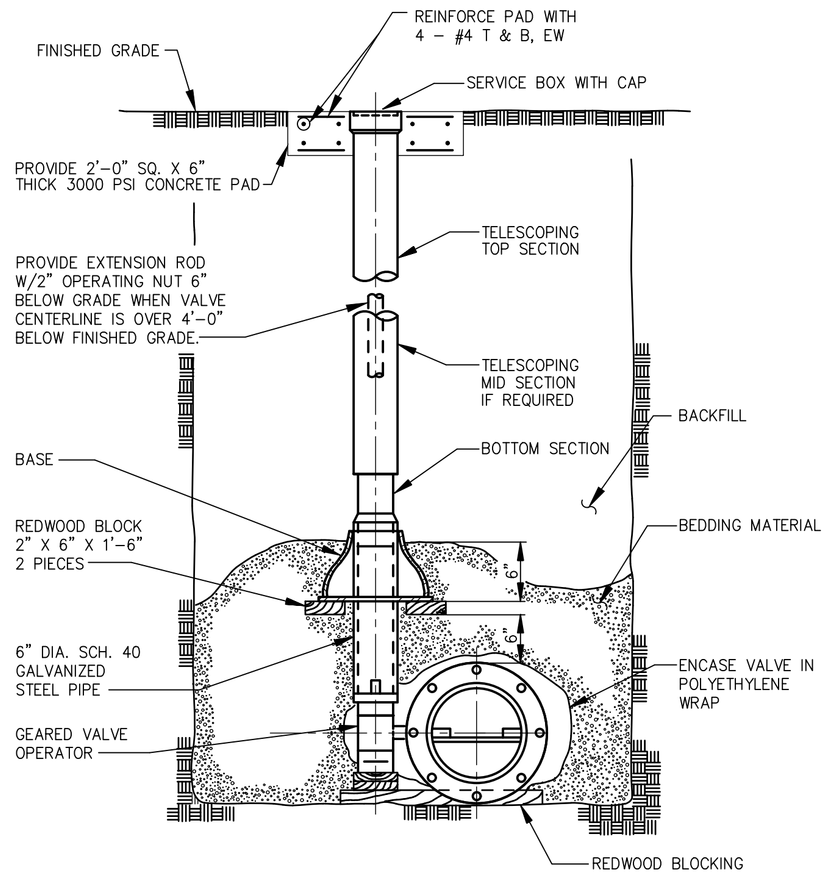


FORCE MAIN DRAIN MANHOLE

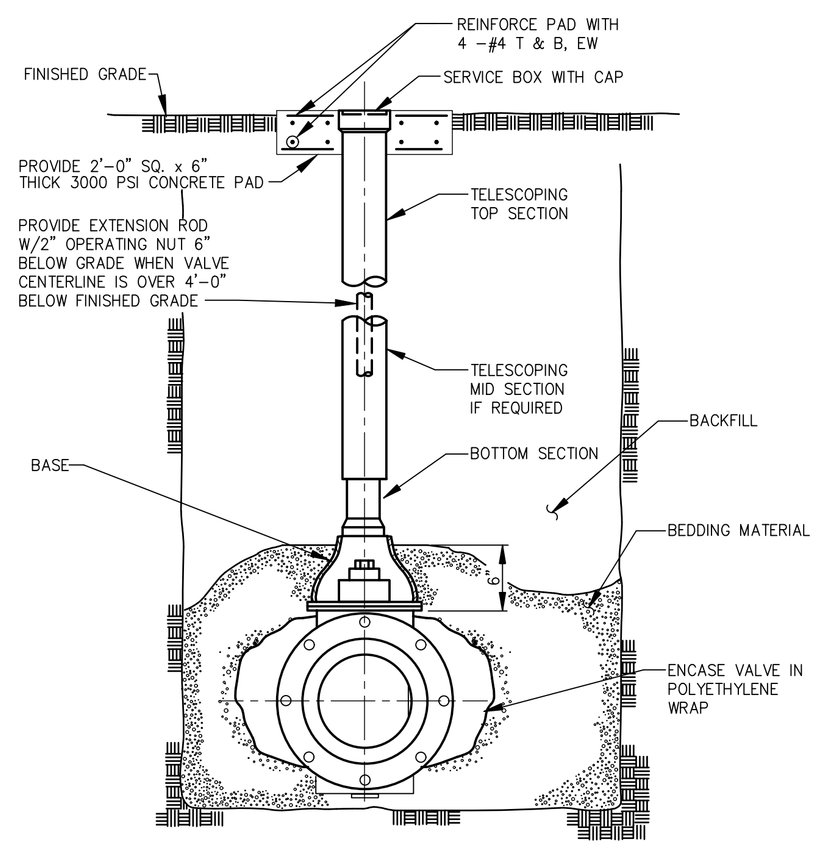


SECTION

FORCE MAIN DISCHARGE INTO MANHOLE
NOT TO SCALE



BURIED PLUG VALVE
NOT TO SCALE



BURIED GATE VALVE
NOT TO SCALE

AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

OWNER

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19 SCHOOL ROAD
ORLEANS, MA 02653
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REGISTRATION

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
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Scale:	AS NOTED

DISCIPLINE

CIVIL

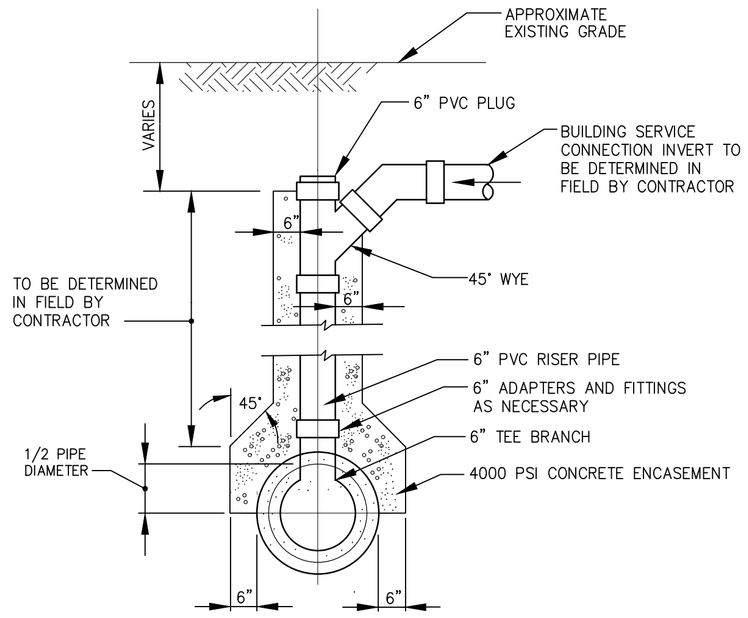
SHEET TITLE

DETAILS II

SHEET NUMBER

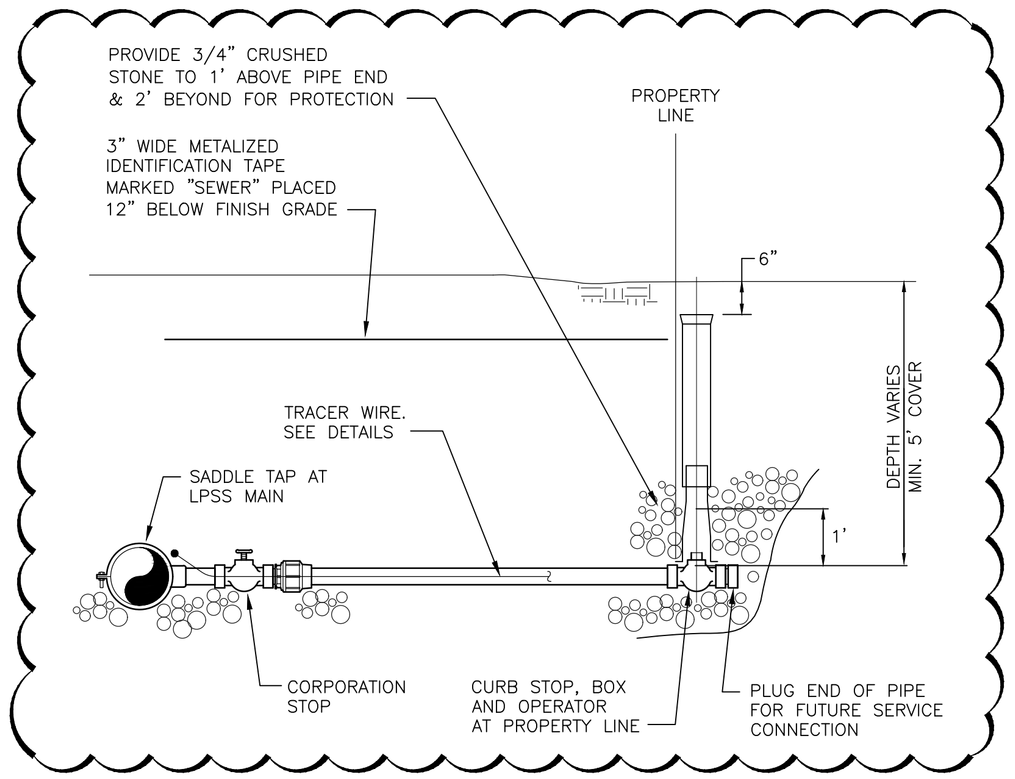
99 C-502

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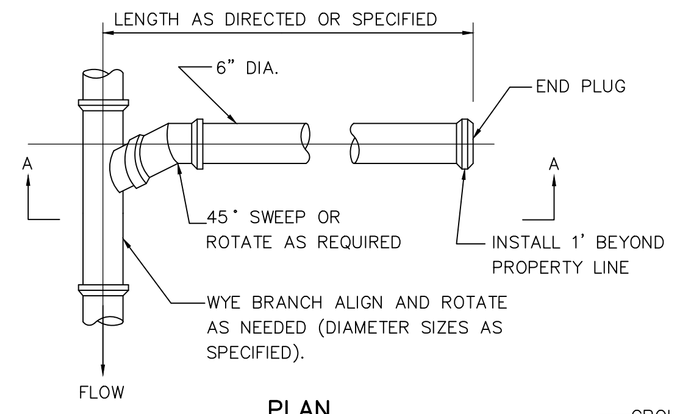
TYPICAL CHIMNEY DETAIL FOR SEWER CONNECTION

NOT TO SCALE

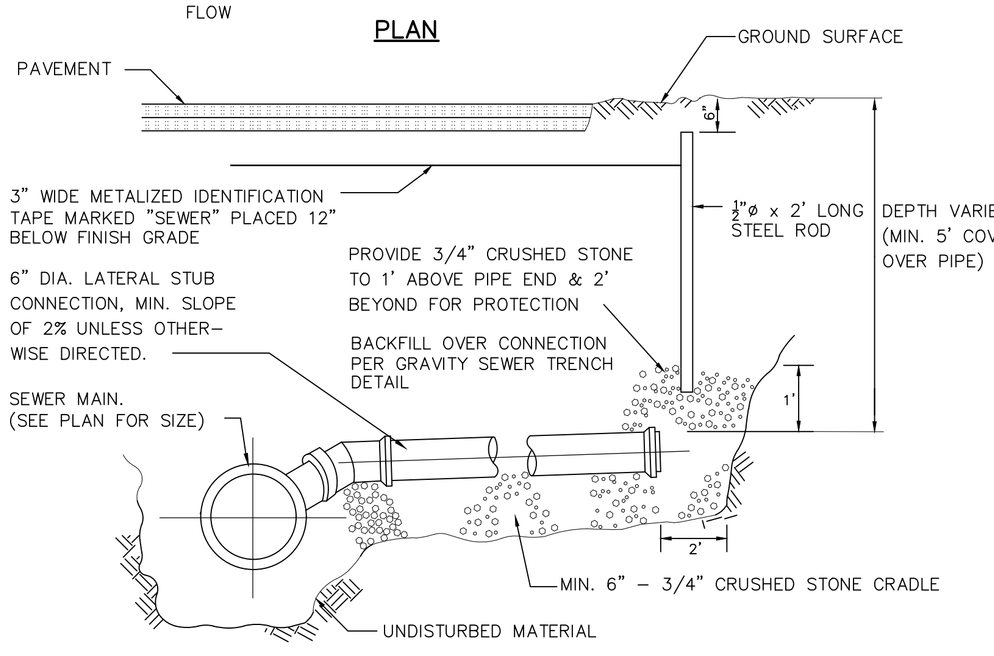


TYPICAL LATERAL STUB CONNECTION ON LOW PRESSURE SEWER MAIN

(NOT TO SCALE)



PLAN



SECTION A-A

LATERAL CONNECTION MANHOLE

WHERE REQUIRED, A MANHOLE TO BE CONSTRUCTED ON A LATERAL CONNECTION. THIS MANHOLE SHALL CONFORM TO THE SAME STANDARDS AS THE MAIN SEWER MANHOLES. (SEE SEWER MANHOLE DETAILS.)

TYPICAL LATERAL STUB CONNECTION

(NOT TO SCALE)

AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

OWNER

TOWN OF ORLEANS, MA
19 SCHOOL ROAD
ORLEANS, MA 02653
(508) 240-3700

ENGINEER

AECOM TECHNICAL SERVICES, INC.
9 JONATHAN BOURNE DRIVE
POCASSET, MA 02559
PHONE: (508) 833-6950
www.aecom.com

REGISTRATION

COMMONWEALTH OF MASSACHUSETTS
THOMAS E. PARECE
CIVIL
No. 34493
REGISTERED PROFESSIONAL ENGINEER

ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	02-11-2020	ADDENDUM NO. 1

PROJECT NUMBER

60587515

Designed By:	**M. CURRAN**
Drawn By:	**M. CURRAN**
Dept Check:	**T. PARECE**
Proj Check:	**M. DONOGHUE**
Date:	**JANUARY 2020**
Scale:	**AS NOTED**

DISCIPLINE

CIVIL

SHEET TITLE

DETAILS IV

SHEET NUMBER

99 C-504

Last saved by: CURRANM(2020-02-12) Last Plotted: 2020-02-12
Filename: L:\WORK\60476644 - ORLEANS DOWNTOWN SEWER\SHEETS\C\99 C-504.DWG

February 19, 2020

ADDENDUM NO. 2

TO

DOCUMENTS AND SPECIFICATIONS

FOR

Downtown Area Collection System and Pumping Stations

Contract No. 2019-02 and SRF No. 4486

Town of Orleans, MA

Department of Public Works & Natural Resources

This Addendum No. 2 forms a part of the Contract Documents and modifies the Bidding Documents dated January 2020 as noted below. Acknowledge receipt of this Addendum in the space provided in SECTION 00410, FORM OF GENERAL BID. Failure to do so may subject the Bidder to disqualification.

This Addendum consists of 2 pages and 0 pages of attachments for a total of 2 pages.

CHANGES TO BE MADE TO THE CONTRACT SPECIFICATIONS

1. SECTION 00200, INSTRUCTIONS TO BIDDERS

   A. Page 00200-2, ARTICLE 1.01, RECEIPT AND OPENING OF BIDS, Paragraph E., delete the paragraph in its entirety and replace with the flowing new paragraph:

      "E. A non-mandatory Pre-Bid Conference was held on February 20, 2020 at 9:00 am at the Town of Orleans, 19 School Road, Orleans, MA 02653. Refer to the attached Attendance List."

2. SECTION 00410, FORM OF GENERAL BID

   A. Page 00410-2, Paragraph 2, second sub-paragraph, delete the words "…the proposed work, attended the mandatory pre-bid conference, and…" and replaced with the words "…the proposed work and…".

3. SECTION 02053, PAVING, CURBING, SIDEWALKS AND ROADWAYS

   A. Page 02053-4, Article 2.07, Paragraph A., delete the paragraph in its entirety and replace with the following new paragraph:

      A. Cement concrete for walks shall be of 5,000 psi compressive strength at 28 days and shall conform to Section M4.02.00 (air entrained) of the State Specifications.

CHANGES TO BE MADE TO THE CONTRACT DRAWINGS

1. DRAWING NUMBER 99 C-501

   A. Typical Precast Concrete Sewer Manhole

      1. Delete the words “3/4” Crushed Stone” and replace with words “3/4” Crushed Stone or Processed Glass Aggregate”.

   B. Leaching Catch Basin

      2. Delete the words “5’-0” Dia. Precast Conc. Leaching Catch Basin” and replace with words “5’-0” Dia. Precast Conc. (H-20 Loading) Leaching Catch Basin”.

CHANGES TO BE MADE TO THE CONTRACT ATTACHMENTS

None

END OF ADDENDUM NO. 2

February 26, 2020

ADDENDUM NO. 3

TO

DOCUMENTS AND SPECIFICATIONS

FOR

Downtown Area Collection System and Pumping Stations

Contract No. 2019-02 and SRF No. 4486

Town of Orleans, MA

Department of Public Works & Natural Resources

This Addendum No. 3 forms a part of the Contract Documents and modifies the Bidding Documents dated January 2020 as noted below. Acknowledge receipt of this Addendum in the space provided in SECTION 00410, FORM OF GENERAL BID. Failure to do so may subject the Bidder to disqualification.

This Addendum consists of 4 pages and 46 pages of attachments for a total of 50 pages.

ATTACHMENTS

1. Non-mandatory Pre-Bid Conference Attendance List and Presentation dated February 20, 2020
2. SECTION 00310, BID BOND
3. Orleans_MA-2019-02-Bid Form_Add_3-02-26-20
4. MassDOT Permit No. 5-2019-0473
5. Town of Orleans, MA, Downtown Area Collection System Layout, dated February 2020

CHANGES TO BE MADE TO THE CONTRACT SPECIFICATIONS

1. GENERAL
   - A. General Bid Opening - March 11, 2020 at 2:00 pm.
   - B. Delete all references from DOCUMENT 00300, BID FORM and replace with SECTION 00410, FORM OF GENERAL BID.
2. TABLE OF CONTENTS
   - A. Page TOC-2, DIVISION 0 – BIDDING AND CONTRACT REQUIREMENTS, add SECTION 00310, BID BOND, as attached.

3. SECTION 00200, INSTRUCTIONS TO BIDDERS

   A. Page 00200-2, ARTICLE 1.01 - RECEIPT AND OPENING OF BIDS, Paragraph E., delete the paragraph in its entirety and replace with the flowing new paragraph:

      E. A non-mandatory Pre-Bid Conference was held on February 20, 2020 at 9:00 am at the Town of Orleans, 19 School Road, Orleans, MA 02653. Refer to the attached Attendance List and Presentation.

4. SECTION 00310, BID BOND

   A. Add new SECTION 00310, BID BOND as attached.

5. SECTION 00410, FORM OF GENERAL BID

   A. Delete "Orleans_MA-2019-02-Bid Form_Add_1-02-13-20" in its entirety and replace with the attached new "Orleans_MA-2019-02-Bid Form_Add_3-02-26-20" in both hard copy and Microsoft Excel format.

6. SECTION 00800, SUPPLEMENTARY CONDITIONS

   A. Page 00800-2, ARTICLE 5 - BONDS AND INSURANCE NOTICE TO CONTRACTOR, SC-5.04, add the following new paragraph:

      The General Contractor shall carry the coverage for Subcontractors naming the Subcontractors, the Town of Orleans, Tighe & Bond and AECOM Technical Services, Inc. as additional insured in the limits specified herein. SECTION 05020A-3, INSURANCE REQUIREMENTS FOR INCLUSION IN ALL SPECIFICATIONS AND CONTRACTS are separate from the Owners and Contractors Protective Liability and shall name the Town of Orleans, Tighe & Bond and AECOM Technical Services, Inc. as additional insured.

7. SECTION 00858, SPECIAL CONDITIONS – PERMITS AND LICENSES

   A. Page 00858-01, ARTICLE 1.01 - LIST OF PERMITS AND/OR LICENSES, Paragraph A., add the following new subparagraph:

      8. Massachusetts Department of Transportation (MassDOT) - Roadway 6 Crossing

   B. Page 00858-01, ARTICLE 1.01 - LIST OF PERMITS AND/OR LICENSES, Paragraph B., delete subparagraph 1. In its entirety and replace with the following new subparagraph:

      1. Not Used

   C. ATTACHMENTS, Add MassDOT Permit No. 5-2019-0473 as attached.

9. SECTION 01020, ALLOWANCES

   A. Page 01020-2, ARTICLE 1.05 - ALLOWANCES FOR PRODUCTS, delete Paragraph C. in its entity and replace with the following new paragraph:

      C. The scheduled allowances are as follows:

SCHEDULED ALLOWANCES

Item Number	Description	Amount	Bid Item
1	Traffic Markings	$75,000	15.L.
2	Removal and Relaying and/or Replacement of Existing Gas Mains and Services	$100,000	16.C.
3	Removal and Relaying and/or Replacement of Existing Miscellaneous Utilities	$75,000	16.D.
4	MassDOT Inspections	$10,000	22.B.
5	Electric Company Connection/Service Fee	$125,000	23.D.
6	Telephone Company Connection/Service Fee	$30,000	23.E.

Item Number	Description	Amount	Bid Item
7	Planting Operations	$30,000	23.F.

10. SECTION 01025, MEASUREMENT AND PAYMENT

    A. Page 01025-13, ITEM 16 - REMOVE AND RELAY OR REPLACE EXISTING UTILITIES, Paragraph C., delete subparagraph 6. in its entirety and replace with the following new subparagraph:

        6. The following utility allowance(s) shall be included in the applicable subdivision of this Bid Item:

            a) Removal and Relaying and/or Replacement of Existing Gas Main and Services at $100,000.

            b) Removal and Relaying and/or Replacement of Existing Miscellaneous Utilities at $75,000. This allowance includes the scope of work to Remove and Relay and/or Replace the Existing Underground Electrical System and Underground Irrigation System located at the Snow Library and The Village Green.

    B. Page 01025-16, ITEM 22 – HIGHWAY CROSSING, Paragraph C., add the following new subparagraph 4.:

        7. The following allowance shall be included in the applicable subdivision of this Bid Item:

            4. MassDOT Inspections at $10,000.

11. SECTION 01030, SPECIAL REQUIREMENTS

    A. Page 01030-5, ARTICLE 1.11 - SCOPE OF WORK AND SEQUENCE OF CONSTRUCTION, Paragraph F.3.a, add the following to the end of the paragraph:

        The archaeological machine monitoring shall involve the close visual examination of exposed subsoils by the project Archaeologist to identify any potential archaeological deposits and/or human remains that may be located within construction impact areas. The goal of the machine monitoring will be to ensure that if any significant archaeological resources, including human remains and/or burials, are exposed during the construction activities that they are treated appropriately in accordance with the Massachusetts Unmarked Burial Law.

    B. Page 01030-5, ARTICLE 1.11 - SCOPE OF WORK AND SEQUENCE OF CONSTRUCTION, Paragraph Y., delete the words “No construction activity shall be allowed on the Project for two working days prior to the following dates:” in its entirety and replace with the words “No construction activity shall be allowed on the Project on the following dates and for the two working days prior to the following dates, unless otherwise approved by the Owner:”

12. SECTION 02150, HIGHWAY CROSSING (JACKING)

    A. Page 02150-3, ARTICLE 1.02 - MEASUREMENT AND PAYMENT, add the following new Paragraph C.:

        C. An allowance of $10,000 has been identified in the Bid Proposal to cover the salary, subsistence and travel expenses for any inspector appointed by the MassDOT to supervise the work contemplated.

13. SECTION 02435, CRUSHED STONE

    A. Page 02435-2, ARTICLE 2.01 - MATERIAL, Paragraph B, add the following new subparagraph:

        5. Sources of PGA are as follows:

        David Johansen, Director Department of Public Works
        Town of Dennis
        120 Theophilus F. Smith Road
        South Dennis, MA 02660
        Phone: 508-760-6220
        e-Mail: djohansen@town.dennis.ma.us

        Reagan Bissonnette, Executive Director
        Northeast Resource Recovery Association
        2101 Dover Road
        Epsom, NH 03234
        Phone: 603-736-4401
        e-Mail: rbissonnette@nrra.net

CHANGES TO BE MADE TO THE CONTRACT DRAWINGS

1. DRAWING 01 E-001, PUMP STATION NO. 1 – ELECTRICAL SITE PLAN
   A. Pump Station No. 1 – Duct Bank Sections, add the following new note:

      Note: Only the duct banks that contain primary service conductors from the utility (Duct Bank No. 01) are to be concrete encased.
2. DRAWING 02 E-001, PUMP STATION NO. 2 – ELECTRICAL SITE PLAN
   A. Pump Station No. 2 – Duct Bank Sections, add the following new note:

      Note: Only the duct banks that contain primary service conductors from the utility (Duct Bank No. 01) are to be concrete encased.
3. DRAWING 03 E-001, PUMP STATION NO. 3 – ELECTRICAL SITE PLAN
   A. Pump Station No. 3 – Duct Bank Sections, add the following new note:

      Note: Only the duct banks that contain primary service conductors from the utility (Duct Bank No. 01) are to be concrete encased.
4. DRAWING 03 DI-603, PUMP STATION 3 - ODOR CONTROL P&ID
   A. Revise the sheet number from “03 DI-603” to “03 DI-602”.

CHANGES TO BE MADE TO THE CONTRACT ATTACHMENTS

1. Add new “Town of Orleans, MA, Downtown Area Collection System Layout, dated February 2020”, as attached

END OF ADDENDUM NO. 3

AECOM
9 Jonathan Bourne Drive
Pocasset, MA 02559
www.aecom.com

508.833.6950 tel
508.833.6951 fax

Attendance List

Subject	**Town of Orleans, MA** **Downtown Area Collection System and Pumping Stations** **Contract No. 2019-02 and SRF No. 4486** **Non-Mandatory Pre-Bid Conference**
Project Number	60587515
Date and Time	February 20, 2020, 9:00 am

Attendee	Affiliation	e-Mail and Telephone Number
Bill McMahon	Robert B. Our Co Inc	bmcmahon@robertbour.com office 508 432-0530 508 509-4053 cell
Chris Gates	RJV Construction Corp	cgates@rjvconstruction.com 781-821-1469
Joe Annese	Annese Electric	bleggo@annesselectric.com 781 337 6462
Ian Catlow	Tighe & Bond	ibcatlow@tighebond.com

Attendee	Affiliation	e-Mail and Telephone Number
Tom Daley	Orleans DPW	Tdaley@town.orleans.ma.us
Craig Fleming	Williamson Pump + Motor	CraigF@weco-Group.com.
Todd Bodreau	Williamson Pump + motor	Todd B@weco-group.com
TRSS Jaffer	AECOM	TRSS.Jaffer@aecom.com
REGGIE DONOGHUE	AECOM	MARTIN.DONOGHUE@AECOM.COM
THOMAS PORÉE	AECOM	TOM.PORÉE@AECOM.COM

Downtown Area Collection System and Pumping Stations

Contract No. 2019-02 and SRF No. 4486

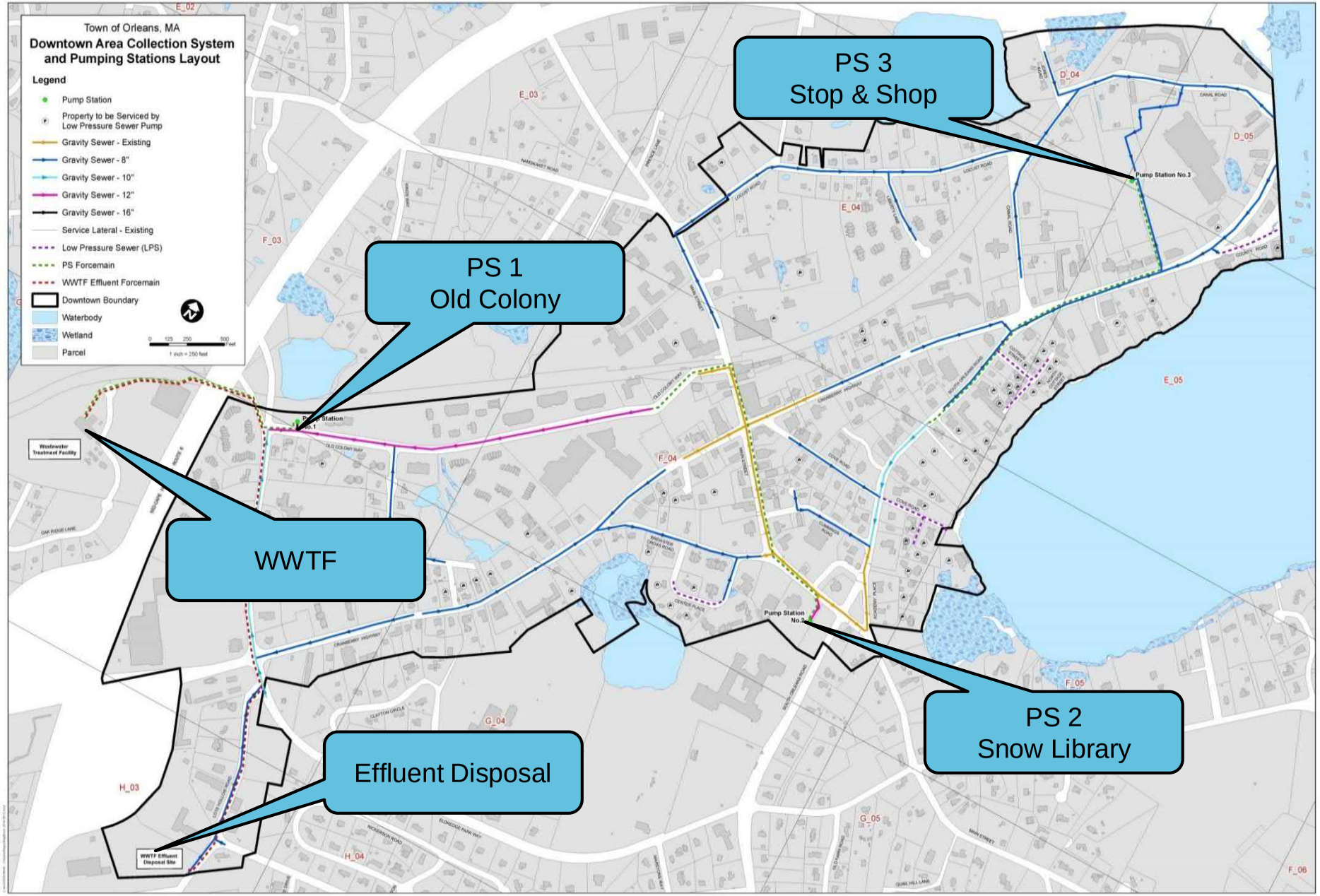
Non-Mandatory Pre-Bid Conference

February 20, 2020

9:00 am

Agenda

- **Welcome and Introduction**
  - Orleans, MA
  - Tighe & Bond
  - AECOM
- **Project Overview**
- **Special Attention to Specifications and Bidding Conditions**
- **Addendums**
- **Open Floor for Questions**
- **Site Visit**


Town of Orleans, MA
Downtown Area Collection System and Pumping Stations Layout
Legend
Pump Station
Property to be Serviced by Low Pressure Sewer Pump
Gravity Sewer - Existing
Gravity Sewer - 8"
Gravity Sewer - 10"
Gravity Sewer - 12"
Gravity Sewer - 16"
Service Lateral - Existing
Low Pressure Sewer (LPS)
PS Forcemain
WWTF Effluent Forcemain
Downtown Boundary
Waterbody
Wetland
Parcel
PS 3
Stop & Shop
PS 1
Old Colony
WWTF
PS 2
Snow Library
Effluent Disposal
Pump Station No.3
Pump Station No.1
Pump Station No.2
Wastewater Treatment Facility
WWTF Effluent Disposal Site

Project Overview (cont.)

- **General Scope of Work**
  - About 32,200 Linear Feet of 8-inch through 18-inch PVC Gravity Sewer
  - About 11,400 Linear Feet of 6-inch and 8-inch PVC and HDPE Force Main
  - About 2,100 Linear Feet of 2-inch Low Pressure Sewer
  - Route 6 Pipe Jacking
  - 3 Submersible Pumping Stations
- **Time for Completion - 751 Calendar Days / 304 Working Days**
- **Bidding Submission Requirements**
  - Bids due to Orleans, MA: March 11, 2020 by 2:00 pm E.S.T.
  - Attachments to the Bid
- **No DCAMM Certification or MassDOT Highway Division Certification Required**

Project Overview (cont.)

Attachments to the Bid

- Insurance Requirements
- Statement of State Tax Compliance
- Certificate of Non-Collusion
- Acknowledgement of Principal, If a Corporation or a Partnership
- Certification of OSHA 10-Hour Training
- Massachusetts Diesel Retrofit Form

Post Bid Attachments

- State Revolving Loan
  - Disadvantaged Business Enterprise (DBE) Goals
    - Minimum 4.2 Percent D/MBE Participation
    - Minimum 4.5 Percent D/WBE Participation
  - Two Low Bidders to Submit Close of Business on the Third Business Day After Bid Opening
    - DBE Forms - EEO-DEP-190C and EEO-DEP-191C
    - DBE Certification of United States Citizenship Form

Special Attention to Specifications and Bidding Conditions

- **Preconstruction Requirements**
  - Submittals
  - Digital Videodisc Recording
  - Health and Safety Plan
  - Traffic Management Plan
    - Prepare and Submit to Town, Engineer and MassDOT for Review and Approval
    - Detours and Road Accessibility
    - Responsible for Ordering and Coordinating Traffic Details
  - Project Schedule
- **Progress Schedule - “Two-week Look Ahead”**
  - Summarizes Anticipated Construction Activities
  - Thursday of Each Week

Special Attention to Specifications and Bidding Conditions (cont.)

- **Easements Obtained**
- **Permits and Licenses Obtained**
  - Cape Cod Commission – Consistency Review
  - Massachusetts Historical Commission
  - MassDEP – CWMP Approval
  - Orleans, MA - Conservation Commission - Order of Conditions
  - United States Army Corps of Engineers
  - MassDOT - Route 6 Crossing
- **Permits and Licenses Anticipated to be Obtained**
  - MassDOT – Route 6A and Route 28 Road Opening
  - Winter and Summer Work Moratorium
- **Town Permits to be Issued After the Contract Award**

Special Attention to Specifications and Bidding Conditions (cont.)

- **EPA Construction General Permit**
  - Prepare a SWPPP and File an NOI with EPA
  - Implement SWPPP and Perform Required Inspections
- **Hours of Operation**
  - No Outdoor Activities Permitted Before 7:00 am or After 5:00 pm
  - No Outdoor Activities Permitted Saturday, Sunday, Legal Holidays and the Two Days Preceding the Legal Holidays
- **Number of Crews**
  - Minimum Number of Mainline Crews
  - One Service Connection Crew
  - One Cleanup/Restoration Paving Crew
- **Sequence of Construction**
  - Specified under Section 01030, Special Requirements

Special Attention to Specifications and Bidding Conditions (cont.)

Summer Season Work
May 15 through September 15

- Brewster Crossroads
- Jones Road
- Canal Road - Roundabout to Locust Road
- Liberty Lane
- Center Place
- Route 6 Crossing
- Cove Road – North of Route 28

Winter Season Work
October 15 through March 31

- Cottage Street
- North Cottage Street
- Cove Road – South of Route 28
- Old County Road
- Cranberry Cove Plaza

Special Attention to Specifications and Bidding Conditions (cont.)

- **Pavement Repair and Restoration**
  - Specified under Section 01030, Special Requirements
  - Required to Place Temporary Pavement Every Friday or As Specified in MassDOT Permit for State Roadways
- **Archeological Sensitive Areas**
  - Cultural Resource Training
  - Machine Monitoring
- **Existing Brick Sidewalks**
  - Installation of Service Laterals
  - Minimize the Number of Bricks Removed
  - Replace the Existing Bricks Following Installation of Service Laterals
  - No Saw Cutting and/or Splitting of Existing Bricks

Special Attention to Specifications and Bidding Conditions (cont.)

- **Monthly Photographs**
- **Crushed Stone and Processed Glass Aggregate**
- **Active Vehicle Loop Detectors**
  - Cranberry Highway with Eldredge Park Way and West Road
  - Cranberry Highway with Old County Road and Stop and Shop Plaza Entrance
- **Sensitive Sites**
  - Pump Station 2 - Snow Library
  - Pump Station 3 - Cranberry Cove Plaza with Off Season Work at Cranberry Cove Plaza
  - Minimize Disruption of Facility Operation During Construction
  - Continue on-site Sewage Disposal System Service During Construction
  - On-Site Sewage Disposal System Demolition and Restoration

Special Attention to Specifications and Bidding Conditions (cont.)

- **Water System Upgrades**
  - Water Main Replacements
  - Water Service Replacements (Pending Town Meeting Approval)
  - Canal Road Water Main Replacement (Pending Town Meeting Approval)
- **Water Quality Projects – Pending Town Meeting Approval**
  - Brewster Crossroads
  - Locust Road
- **Post Construction**
  - Photographs and Record Drawings
  - Collection System Cleaning, Testing and CCTV
  - Operation and Maintenance Manuals
  - Manufacturer's Services
  - Spare Parts

Addendums

- **Addendum No. 1 – Issued on February 13, 2020**
- **Addendum No. 2 – Issued on February 19, 2020**
- **Addendum No. 3 – Issue by March 6, 2020**
  - Bid Form (Excel)
  - Non-Mandatory Pre-Bid Conference Attendance List
  - Applicable Questions and Answers

Site Visit

- **Pumping Station No. 3**
- **Pumping Station No. 2**
- **Pumping Station No. 1**
- **Route 6 Crossing**
  - Jacking Pit
  - Receiving Pit

Questions and Answers

SECTION 00310

BID BOND

Know all men by these presents, that we, the undersigned, _____

_____ as Principal, and _____

as Surety, are hereby held and firmly bound unto the Town of Orleans, MA, 19 School Road, Orleans, MA 02653 hereinafter called "Owner", in the penal sum of five (5) percent of the value of the Bid for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors and assigns.

Signed, this _____ day of _____.

The Condition of the above obligation is such that whereas the Principal has submitted to the Town of Orleans, MA, 19 School Road, Orleans, MA 02653, hereinafter called "Owner", attached hereto and hereby made a part hereof to enter into a Contract in writing for Contract No. 2019-02, Downtown Area Collection System and Pumping Stations.

Now, therefore,

(a) If said Bid shall be rejected, or

(b) If said Bid shall be accepted and the Principal shall execute and deliver a Contract in SECTION 00520, AGREEMENT attached hereto (properly completed in accordance with said Bid) and shall furnish a Bond for its faithful performance of said Contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Bid, then this obligation, shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its Bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such Bid and said Surety does hereby waive notice of any such extension.

In witness whereof, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

Principal	Surety
Principal Signature	Surety Signature

Important - Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State where the

END OF SECTION

This Page Intentionally Left Blank.

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS			
1.	For Mobilization/Demobilization, as specified (maximum of five (5) percent of System Expansion bid), the sum of $ -	l.s.	1	$ -
2.A.	For furnishing and installing 1-1/2-inch through 2-inch, inclusive, Polyvinyl Chloride/High Density Polyethylene Low Pressure Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	2,030	$ -
2.B.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Less Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	7,000	$ -
2.C.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Greater Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	13,750	$ -
2.D.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,950	$ -

Company's Name

Date

Company's Address

**Refer to the Instructions in SECTION 00410,
Page 2 - Bid Proposal
in filling out this Proposal Form.**

Item	Description	Unit of Measure	Quantity	Extended Total
2.E.	For furnishing and installing 12-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	2,410	$ -
2.F.	For furnishing and installing 18-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,900	$ -
2.G.	For furnishing and installing 6-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	3,060	$ -
2.H.	For furnishing and installing 8-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	710	$ -
2.I.	For furnishing and installing 8-inch PVC Effluent Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	3,590	$ -

Company's Name

Date

Company's Address

**Refer to the Instructions in SECTION 00410,
Page 2 - Bid Proposal
in filling out this Proposal Form.**

Item	Description	Unit of Measure	Quantity	Extended Total
2.J.	For furnishing and installing 1-1/4-inch Polyvinyl Chloride Low-Pressure Sewer Service Connections and Associated Fittings from main line to property line, All Depths, as specified, the sum of $ -	per l.f.	600	$ -
2.K.	For furnishing and installing 6-inch Polyvinyl Chloride Service Connections and Associated Fittings from main line to property line as specified, the sum of $ -	per l.f.	6,100	$ -
2.L.	For furnishing and installing LPS Wyes, All Depths, as specified, the sum of $ -	per each	21	$ -
2.M.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	109	$ -
2.N.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	12	$ -
2.O.	For furnishing and installing 12-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	11	$ -

Company's Name

Date

Company's Address

**Refer to the Instructions in SECTION 00410,
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Item	Description	Unit of Measure	Quantity	Extended Total
2.P.	For furnishing and installing 18-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	18	$ -
2.Q.	For furnishing and installing Low Pressure Sewer Main Line Valves, All Sizes and Depths, as specified, the sum of $ -	per each	4	$ -
3.A.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Less Than 10 feet in Depth, the sum of $ -	per each	24	$ -
3.B.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Greater Than 10 feet in Depth, the sum of $ -	per each	102	$ -
3.C.	For furnishing and installing 5-foot Diameter Precast Concrete Sewer Manholes, All Depths, as specified, the sum of $ -	per each	9	$ -

Company's Name

Date

Company's Address

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Item	Description	Unit of Measure	Quantity	Extended Total
3.D.	For furnishing and installing 6-foot Diameter Precast Concrete Low Pressure Sewer Terminal Flushing Manholes, All Depths, as specified, the sum of $ -	per each	5	$ -
3.E.	For furnishing and installing 6-foot Diameter Precast Concrete Effluent Force Main In-Line Flushing Manholes, All Depths, as specified, the sum of	per each	1	$ -
3.F.	For furnishing and installing 6-foot Diameter Precast Concrete Leaching Catch Basins with Grates, All Depths, as specified, the sum of	per each	4	$ -
4.A.	For furnishing and installing Standard Manhole Frames and Covers, as specified, the sum of $ -	per each	108	$ -
4.B.	For furnishing and installing Bolted and Gasketed Manhole Frames and Covers, as specified, the sum of $ -	per each	37	$ -
5.	For furnishing and installing Interior Manhole Drop Connections, as specified, the sum of $ -	per v.f.	80	$ -

Company's Name

Date

Company's Address

**Refer to the Instructions in SECTION 00410,
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Item	Description	Unit of Measure	Quantity	Extended Total
6.	For furnishing and installing chimneys, as specified, the sum of $ -	per v.f.	490	$ -
7.	For furnishing and placing miscellaneous cement concrete, as specified, the sum of $ -	per c.y.	440	$ -
8.	For Rock and Boulder Excavation including Replacement with Suitable Fill Material, as specified, the sum of * $ - * Minimum Bid = $80/c.y.	per c.y.	550	$ -
9.A.	For Replacement of Unsuitable Material Below Trench Grade and/or Subgrade, as specified, the sum of $ -	per c.y.	820	$ -
9.B.	For Replacement of Unsuitable Material Above Trench Grade, as specified, the sum of $ -	per c.y.	1,630	$ -
10.	For Experimental Excavation, as specified, the sum of $ -	per c.y.	440	$ -

Company's Name

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Item	Description	Unit of Measure	Quantity	Extended Total
11	Fill for embankments – Not Used			
12.	Sheeting and/or shoring ordered left in place – Not Used			
13.	For performing Soil Compaction Tests, as specified, the sum of $ -	per each	150	$ -
14.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	10,740	$ -
15.A.	For furnishing and placing 3-inch Temporary Bituminous Concrete Trench Pavement (base course), as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	5,320	$ -
15.B.	For furnishing and placing 7-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in State Roadways, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	4,060	$ -

Company's Name

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.C.	For milling and furnishing and placing 2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in State Roadways, as specified, the sum of *			
	$ -	per ton	6,050	$ -
	* Minimum Bid = $80/ton			
15.D.	For furnishing and placing 4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	480	$ -
	* Minimum Bid = $80/ton			
15.E.	For furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (base course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	490	$ -
	* Minimum Bid = $80/ton			
15.F.	For furnishing and placing Dense Graded Gravel, as specified, the sum of			
	$ -	per c.y.	350	$ -
15.G.	For furnishing and placing 4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	4,460	$ -
	* Minimum Bid = $80/ton			

Company's Name

Date

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Item	Description	Unit of Measure	Quantity	Extended Total
15.H.	For milling and furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	7,050	$ -
15.I.	For Miscellaneous Restoration of State and Town Roadways, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	550	$ -
15.J.	For furnishing and placing Miscellaneous Bituminous Concrete Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	660	$ -
15.K.	For repair and/or replacement of the Vehicle Loop Detectors, as specified, the sum of $ -	per each	20	$ -
15.L.	For repainting of Traffic Markings - Lines, Symbols and Wording, as specified, the sum of Seventy Five Thousand Dollars and No Cents $ 75,000.00	Allowance	1	$ 75,000.00
16.A.	For removal and relaying and/or replacement of Existing Water Mains and services, as specified, the sum of $ -	per inch-foot	4,000	$ -

Company's Name

Date

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**Refer to the Instructions in SECTION 00410,
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Item	Description	Unit of Measure	Quantity	Extended Total
16.B.	For removal and relaying and/or replacement of Existing Storm Drains, as specified, the sum of $ -	per inch-foot	20,000	$ -
16.C.	For removal and relaying and/or replacement of Existing Gas Mains and services, as specified, the sum of One Hundred Thousand Dollars and No Cents $ 100,000.00	Allowance	1	$ 100,000.00
16.D.	For removal and relaying and/or replacement of Existing Miscellaneous Utilities, as specified, the sum of Seventy Five Thousand Dollars and No Cents $ 75,000.00	Allowance	1	$ 75,000.00
16.E.	For furnishing, installing and removal of Water Main Line Stops, as specified, the sum of $ -	per each	20	$ -
16.F.	For removing and replacement of existing Water Mains (6-inch, 8-inch, 10-inch and 12-inch) and Associated Fittings specified, the sum of $ -	per inch-foot	1,520	$ -
17.	Uniformed Traffic Police Officers - Paid by Owner			
18.A.	For furnishing, installing, and removing Engineer's Field Office, as specified, the sum of $ -	per l.s.	1	$ -

Company's Name

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Item	Description	Unit of Measure	Quantity	Extended Total
18.B.	For maintaining Engineer's Field Office, as specified, the sum of $ -	per week	91	$ -
19.	For furnishing, installing, maintaining and removing Environmental Protection, as specified, the sum of $ -	per l.s.	2,830	$ -
20.	For furnishing, installing, maintaining and removing Trench Dewatering Equipment, as specified, the sum of $ -	per l.f.	11,220	$ -
21.	Temporary By-pass Pumping - Not Used			
22.A.	For furnishing and installing Highway Crossing, as specified, the sum of $ -	per l.s.	1	$ -
22.B.	For MassDOT Inspections, as specified, the sum of Ten Thousand Dollars and No Cents $ 10,000.00	Allowance	1	$ 10,000.00
23.A.	For furnishing and installing Pumping Station No. 1, as specified, the sum of $ -	per l.s.	1	$ -

Company's Name

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Company's Address

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Item	Description	Unit of Measure	Quantity	Extended Total
23.B.	For furnishing and installing Pumping Station No. 2, as specified, the sum of $ -	per l.s.	1	$ -
23.C.	For furnishing and installing Pumping Station No. 3, as specified, the sum of $ -	per l.s.	1	$ -
23.D.	For Electric Company Connection/Service Fee, as specified, the sum of One Hundred Twenty Five Thousand Dollars and No Cents $ 125,000.00	Allowance	1	$ 125,000.00
23.E.	For Telephone Company Connection/Service Fee, as specified, the sum of Thirty Thousand Dollars and No Cents $ 30,000.00	Allowance	1	$ 30,000.00
23.F.	For Planting Operations, as specified, the sum of Thirty Thousand Dollars and No Cents $ 30,000.00	Allowance	1	$ 30,000.00
24.	For furnishing and installing Tracer Wire in State Roadways, All Depths, as specified, the sum of $ -	l.f.	15,000	$ -

TOTAL AMOUNT OF BID (SRF ELIGIBLE BID ITEMS) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF (Bid Items 1 through 24, inclusive).

Four Hundred Forty Five Thousand Dollars and No Cents

$ 445,000.00

Company's Name

Date

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Item	Description	Unit of Measure	Quantity	Extended Total
	ALTERNATIVES			
A-1A.	For furnishing and installing 4-inch Fiber Optic Conduits and Associated Fittings, All Depths, as specified, the sum of $ -	l.f.	3,590	$ -
A-1B.	For furnishing and installing Fiber Optic Handhole, All Depths, as specified, the sum of $ -	ea.	10	$ -
A-2.	For furnishing and installing Tracer Wire in Town Roadways All Depths, as specified, the sum of $ -	l.f.	28,100	$ -
	TOTAL AMOUNT OF BID (ALTERNATIVE BID ITEMS) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF (Bid Items A-1 through A-2., inclusive).			**$** -
	SRF INELIGIBLE BID ITEMS			
	Item B-1 - Replacement of Water Services			
B-1A.	For furnishing and installing 1-inch Polyvinyl Chloride Water Services and Associated Fittings from water main to property line as specified, the sum of $ -	per l.f.	2,040	$ -

Company's Name

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Item	Description	Unit of Measure	Quantity	Extended Total
B-1B.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	480	$ -
B-1C	For furnishing and placing Temporary Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	290	$ -
B-1D.	For furnishing and placing Permanent Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	100	$ -
	Item B-1 - Replacement of Water Services (Bid Items B-1A. through B-1D., inclusive)			**$ -**
Item B-2 - Replacement of Canal Road Water Main				
B-2A.	For furnishing and installing 8-inch DI water main and Associated Fittings, as specified, the sum of $ -	per l.f.	2,060	$ -
B-2B.	For furnishing and installing 1-inch Polyvinyl Chloride Water Services and Associated Fittings from water main to property line as specified, the sum of $ -	per l.f.	320	$ -

Company's Name

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Item	Description	Unit of Measure	Quantity	Extended Total
B-2C.	For furnishing and installing 6-inch Gate Valves and Boxes, as specified, the sum of $ -	per each	6	$ -
B-2D.	For furnishing and installing 8-inch Gate Valves and Boxes, as specified, the sum of $ -	per each	7	$ -
B-2E.	For furnishing and installing Fire Hydrants, as specified, the sum of $ -	per each	6	$ -
B-2F.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	560	$ -
B-2G.	For furnishing and placing Temporary Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	340	$ -
B-2H.	For furnishing and placing Permanent Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	120	$ -
	Item B-2 - Replacement of Canal Road Water Main (Bid Items B-2A. through B-2H., inclusive)			**$** -

Company's Name

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Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
Item B-3 - Water Quality Improvements				
B-3A.	For Brewster Cross Road Water Quality Improvements, as specified, the sum of $ -	per l.s.	1	$ -
B-3B.	For Locust Road Water Quality Improvements, as specified, the sum of $ -	per l.s.	1	$ -
	Item B-2 - Water Quality Improvements (Bid Items B-3A. through B-3B., inclusive)			**$ -**

TOTAL AMOUNT OF BID (SRF INELIGIBLE BID ITEMS) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF (Bid Items B-1 through B-3, inclusive).

$ -

Note: **Funding for the SRF Ineligible Bid Items is anticipated to be obtained at the Annual Town Meeting proposed to be held in May 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

BASIS OF AWARD

BASIS OF AWARD = TOTAL AMOUNT SRF ELIGIBLE BID ITEMS BASED ON ENGINEER'S ESTIMATE OF QUANTITIES (Bid Items 1 through 24, inclusive) + TOTAL AMOUNT OF ALTERNATIVES BID ITEMS BASED ON ENGINEER'S ESTIMATE OF QUALTITIES (Bit Items A-1 throguh A-2, inclusive) + TOTAL AMOUNT OF SRF INELIGIBLE BID ITEMS BASED ON ENGINEER'S ESTIMATE OF QUANTITIES (Bid Items B-1 through B-3, inclusive).

Four Hundred Forty Five Thousand Dollars and No Cents

$ 445,000.00

5-2019-0473

PERMIT – ORLEANS

Subject to all terms, conditions, and restrictions printed or written below, permission is hereby granted to the **TOWN OF ORLEANS,** Tom Daley, 19 School Road, Orleans, MA 02653 to enter upon the State Highway in the Town of **ORLEANS** on Auto Route 6, locally known as Mid-Cape Highway, for the purpose of installing three (3) 8" sewer force mains and conduits in a 48" sleeve under Route 6 (Mid-Cape Highway) to be installed by Horizontal Directional Drilling. The purpose of the proposed work is to extend sewer force main service to a new Sanitary Sewer Collection, Treatment, and Disposal System to serve the Downtown Area of the Town of Orleans, Massachusetts.

The sewer force main installation will enter the State Highway Layout by the use of horizontal directional drilling from two (2) jacking pits, one on each side of Route 6 between Exit 12 and Rock Harbor Road, at approximate Station 99+25. Both the southerly pit (30'x12'), and northerly pit (20'x12'), will be located outside the SHLO on Town-owned property.

THE SEWER FORCE MAIN MUST BE INSTALLED UNDER THE STATE HIGHWAY BY THE USE OF TRENCHLESS TECHNOLOGY.

This Permit is being issued on the condition that the grant of a utility easement by MassDOT, Highway Division will be conveyed to the Town of Orleans once the necessary protocols for disposition are met. Additionally, the Grantee(s) must meet all conditions described in the Standard Operating Procedures S.O.P. NO. ROW-10-10-1-000 for "State Highway Layout Alterations or Easements needed for State Highway Access Permits".

This work will include survey work to monitor road surface settlement during the installation of the underground pipeline. Survey work includes the installation of monitoring points for road surface settlement. All points should be surveyed prior to initiating any construction to establish a baseline record. Subsequent surveying must take place at the completion of each day and should continue until the pipe is successfully installed and work is complete. Additionally, the Grantee(s) must inform MassDOT, Highway Division, District 5 Permits Office and Boston Geotechnical Section whenever monitoring points indicate a vertical change in elevation of one-half (1/2) inch or more or any surface disruption is observed. All drilling and pipe installation operations will stop until the problem is resolved.

The Grantee(s) must fulfill all conditions described in the document for "Geotechnical Section Application Requirements and Permit Conditions: Trenchless Pipe Installation" by the Massachusetts Department of Transportation, dated June 1996 and March 2015.

PRIOR TO THE COMMENCEMENT OF SAID WORK, THE GRANTEE(S) SHALL CONTACT THE DISTRICT PERMITS ENGINEER AT (508) 884-4306 TO SET UP A PRECONSTRUCTION CONFERENCE. THE CONFERENCE MUST BE HELD AT LEAST FIVE (5) BUSINESS DAYS PRIOR TO PERFORMING WORK WITHIN THE S.H.L.O.

Due to the fact that a second Permit (#5-2019-0487) is also to be issued to you to install gravity sewer, sewer manholes, sewer force mains, sewer services and communications conduit on Routes 6A and 28 and within the State Highway Layout, only one Preconstruction Conference will therefore be required for both Permits.

District 5, 1000 County Street Taunton, MA 02780
Tel: (508) 824-6633, FAX: (508) 880-6102
www.mass.gov/orgs/highway-division

All work is to be done as described herein and as shown on the plan(s) entitled "Town of Orleans, MA – Downtown Area Collection System and Pump Stations, Contract No. 2019-02" as drafted by AECOM Technical Services, Inc., 9 Jonathan Bourne Drive, Pocasset, MA 02559, tel.: (508) 833-6950 and last revised December 09, 2019.

BE ADVISED THAT THE GEOTECHNICAL REVIEW DID NOT INCLUDE THE PROPOSED HORIZONTAL DIRECTIONAL DRILLING AREAS THAT ARE LOCATED OUTSIDE OF ROUTE 6 HIGHWAY EMBANKMENTS.

THIS PERMIT IS BEING ISSUED FOR WORK WITHIN THE STATE HIGHWAY LAYOUT (S.H.L.O.) ONLY. AUTHORIZATION TO PERFORM ASSOCIATED WORK OUTSIDE OF S.H.L.O. MUST BE GRANTED BY IMPACTED PROPERTY OWNERS.

MASSDOT, HIGHWAY DIVISION, DISTRICT 5 RESERVES THE RIGHT TO REQUIRE THE TOWN OF ORLEANS TO PERFORM NECESSARY REPAIRS IN THE EVENT THAT THE EXISTING MASSDOT OWNED 18-INCH DRAINAGE MAIN IS IMPACTED BY THIS WORK.

ADDITIONALLY, IF ANY SETTLEMENT OCCURS ON THE ROADWAY DUE TO THIS WORK, THE GRANTEE WILL BE RESPONSIBLE TO PERFORM REPAIR OF THE SETTLED AREA PLUS MILLING AND OVERLAYING THE ENTIRE PAVEMENT CURB TO CURB (LENGTH TO BE DETERMINED AT THE DISCRETION OF THE DEPARTMENT).

Prior to any work being done within the State Highway Layout, the Grantee(s) must upload/submit a Work Request in State Highway Access Permit System (SHAPS) to obtain approval for the proposed work schedule. Said form to be completed/uploaded can be found under the Forms and Sample Submission Documents tab and is entitled "Work Request Form D1 - D5". One (1) of these forms must be uploaded by the close of business every Thursday for the entire duration of the project in order to request approval for the following week's work schedule.

The Grantee(s) must adhere to 520 CMR 14.00: Excavation and Trench Safety as promulgated by the Department of Public Safety in conjunction with the Division of Occupational Safety pursuant to authority granted by M.G.L. c. 82a § 1. If not already approved, a Trench Permit Rider must be completed and uploaded to SHAPS before any trench work is performed under this Permit.

The Grantee(s) must strictly adhere to the Order of Conditions issued by the Orleans Conservation Commission (D.E.P. #SE 54-2481) which is considered an integral part of this Permit.

The Grantee(s) shall be responsible for all litter and debris generated from their property during the work as described herein and/or from all prospective residents, visitors or patrons of all existing or proposed facilities mentioned herein. This responsibility shall remain in effect for the entirety of all current or future owners of said property. The Grantee(s) shall perform routine inspections and upkeep within the State Highway Layout. If conditions warrant an individual to enter in or within the proximity of a travelled way, the Grantee(s) shall assume all liability and responsibility for the removal of all litter and debris or the hiring of an appropriate party to perform such duties. Significant work within the travelled way may require a police detail. In consideration to all abutters, the Grantee(s) must take notice to the drifting of debris and the removal thereof. If it is found that this requirement is not being fulfilled in a satisfactory manner, MassDOT, Highway Division may decide to clean the area at the Grantee's expense.

District 5, 1000 County Street Taunton, MA 02780
Tel: (508) 824-6633, FAX: (508) 880-6102
www.mass.gov/orgs/highway-division

THE BACKFILLING METHOD FOR WORK WITHIN THE SHOULDER AREA WILL BE AS FOLLOWS:

Backfill for conduit or pipe shall be selected from excavation free from large lumps, clods, or rock placed between the pipe and the walls of the trench in layers not exceeding 6-inch in depth and thoroughly compacted. Each layer, if dry, shall be moistened and then compacted by rolling or by tamping with mechanical rammers. Special care should be taken to thoroughly compact the fill under the haunches of the pipe or conduit. This method of filling and compacting shall be continued until the material is level with the top of the pipe or conduit. The remainder of the filling shall consist of suitable material placed in successive layers not more than 6-inch in depth. Each layer shall be thoroughly compacted as specified above.

If the work is to be performed within the soft shoulder, the excavation might be performed within the immediate area along the edge of road and may diminish the integrity of the hardened surface. Therefore, if the excavation directly abuts or tapers under the hardened surface of the roadway, the opening must be backfilled with Controlled Density Fill (CDF) to prevent undermining and preserve the roadway.

The Grantee(s) shall be responsible for the shoulder and roadway areas affected by the proposed work to be performed as described herein and shall routinely inspect said areas for deficiencies such as settling, heaving, cracks etc. This responsibility shall remain until work is performed at the subject location by MassDOT, Highway Division.

TIME RESTRICTIONS AND NOTIFICATIONS

DUE TO HEAVY SUMMER TRAFFIC, NO WORK SHALL BE PERFORMED ON THIS PROJECT BETWEEN MEMORIAL DAY WEEKEND AND LABOR DAY WEEKEND WITHOUT PRIOR APPROVAL FROM THE DISTRICT HIGHWAY DIRECTOR.

Special attention shall be given when performing work that will impact MassDOT, Highway Division, snow and ice operations.

No work shall be performed in the hardened surface of the roadway between November 15th and April 1st of any year without prior written approval from the District Highway Director.

No pavement shall be laid between November 15th and April 1st of any year without prior written approval from the District Highway Director.

No work shall be performed on this project on Saturdays, Sundays, and Holidays, or on the Friday after a Thursday Holiday. Work is also restricted on the day before and the day after a long Holiday weekend without prior written approval by the District Highway Director.

No equipment, trucks, etc., shall occupy any part of the travelled way except between the hours of **9:00 a.m. and 3:00 p.m., Monday - Friday**. In no case will operations exceed the specified hours. This includes the placement of traffic control devices, equipment, or anything that restricts the flow of traffic through the construction zone. Any change in work hours will require prior written approval by the District Highway Director. The 12-minute rule will remain in effect for the duration of the permit.

All other work, off the pavement on this project is restricted to a normal 8-hour day, Monday - Friday, with the prime Contractor and all subcontractors working on the same shift. Any change in work hours will require prior written approval by the District Highway Director.

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Tel: (508) 824-6633, FAX: (508) 880-6102
www.mass.gov/orgs/highway-division

GENERAL TRAFFIC MANAGEMENT AND SAFETY REQUIREMENTS

If required by MassDOT, Highway Division District 5, variable message boards (VMBs) shall be utilized as part of the approved traffic management plan under this Permit which must be properly secured with regards to hacking and unauthorized tampering prevention. The Grantee(s) shall adhere to all appropriate security specifications and take all necessary precautions to mitigate the risk of the boards being hacked. All VMBs shall be stored in a secured area and shall have a lockable, weatherproof enclosure for the operator interface, removable local keyboards which shall be removed whenever possible, and a password protected controller with local administrative passwords changed on a regular basis.

When any portion of the roadway will be blocked with equipment to facilitate the proposed work, the Grantee(s) will be required to adhere to the attached Traffic Management Plan (TMP) or submit a proposed TMP to MassDOT, Highway Division, to be reviewed and approved by the District Traffic Maintenance Engineer prior to working within or impacting the roadway. The plan must include information relating to proper signing, traffic control device placement and police details.

It is imperative to maintain two-way traffic at all times and these operations are managed so that motorists travel "delay" is minimized. At any time during the operation when a traffic delay of over twelve (12) minutes occurs and the situation is worsening, the Resident Engineer, Contractor, or Police Detail will begin to suspend operations. Continuously increasing "delays" of over twelve (12) minutes are not to be permitted.

If traffic must be "stopped", the duration shall not be more than five (5) minutes.

Uniformed State/Local Police Officer(s) and their official vehicle(s) may be necessary to provide protection for those installing and removing all temporary traffic warning signs and devices and to perform all traffic management as required.

The Grantee(s) will monitor the flow of traffic during peak traffic volumes and if necessary, shall suspend all operations. Work will resume at the discretion of the Police detail officer and/or to the satisfaction of the supervising MassDOT, Highway Division, Engineer.

In the event of inclement weather or dense fog, which lessens the visibility of advance warning signs, vehicles and workers, the Grantee(s) will suspend all operations so as not to interfere with the safety of the motoring public and the operations of work. In the event of snow or icing conditions, all vehicles and equipment must be removed from the roadway and/or shoulder area so as not to interfere with Snow and Ice Operations.

The Grantee(s) shall provide safe and ready means of access and egress to all public and private roads and drives 24 hours per day. Every effort must be made as not to interfere with or inconvenience all abutters throughout the duration of this project.

Signs and traffic control devices are required for advance notice of the work and within the work area.

The Grantee(s) or Applicant will supply all required signs and traffic warning devices and shall be in accordance with the Massachusetts Manual on Uniform Traffic Control Devices. The number and location of all signs and devices shall be as deemed necessary by the Engineer for the safe and efficient performance of the work and the safety of the travelling public.

All warning devices shall be subject to removal, replacement, and/or repositioning by the applicant as often as deemed necessary by the Engineer.

Cones or non-reflectorized warning devices shall not be left in operating position on the highway when the daytime operations have ceased. If it becomes necessary for MassDOT, Highway Division, to remove the construction warning devices or their appurtenances from the project due to negligence by the applicant, all costs for this work will be charged to the Grantee(s).

All vehicles, except passenger's cars, which are assigned to the permitted project and which operate on the site at speeds of 25 MPH or less, shall have an official SLOW-MOVING VEHICLE emblem displayed. All vehicles and equipment on this project must be equipped with back-up alarms.

All personnel who are working on the travelled way or breakdown lanes shall wear approved safety vests and hard hats.

GENERAL CONDITIONS AND APPROVED PROCEDURES

The Grantee(s) must contact the "Dig Safe" Center at 811 to obtain a "Dig Safe" number prior to starting the proposed excavation for the purpose of identifying the location of underground utilities.

IF THE PROPOSED WORK FALLS WITHIN THE AREA OF A SIGNALIZED INTERSECTION, the Grantee(s) must contact the District Traffic Maintenance Engineer at (508) 884-4208 at least two (2) weeks prior to the commencement of said work to locate the existing traffic signal conduit/detectors and to coordinate this work so as not to disturb the traffic signals. The Grantee(s) will be responsible to repair/replace all damaged items and will be billed for any cost incurred to restore normal operation to MassDOT, Highway Division, signal equipment to the satisfaction of the Engineer.

Unless otherwise stated, no hardened surface of the State Highway may be disturbed.

When an opening in the roadway is required and permitted herein, the opening must be as small as possible to perform the proposed work.

If the integrity of any existing sidewalks, catch basins, manholes or any other underground structures or equipment is compromised, the Grantee(s) will reconstruct and/or replace all items according to MassDOT, Highway Division, Standards at the cost of the Grantee(s) and to the satisfaction of the Engineer.

The Grantee(s) must not disturb or remove any MassDOT, Highway Division, bound(s) (MHB) associated with this project. If so disturbed or missing, the bound(s) must be reset/replaced by a Registered Land Surveyor. All procedures and materials must be in compliance with Massachusetts Design and Construction Standards. A copy of the paid bill must be submitted to this office upon completion of said work.

All traffic safety lines if disturbed shall be replaced in kind.

All disturbed areas within the State Highway Layout must be graded, loamed, and seeded to the Engineer's satisfaction.

All debris and litter remaining from the proposed construction shall be removed by the Grantee(s) and the area left clean daily.

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DRAINAGE AND UTILITY CASTINGS

"The use of risers to adjust drainage and utility structures will not be allowed. All adjustment work done to existing or new drainage structures shall conform to Section 220 of MassDOT, Highway Division, Standard Specifications and according to Plates 201.3.0 and 202.9.0 of MassDOT, Highway Division, Construction Standards."

ENVIRONMENTAL LIABILITY AND COMPLIANCE

The Grantee(s) assumes all risk associated with any environmental condition within the subject property and shall be solely responsible for all costs associated with evaluating, assessing, and remediating, in accordance with all applicable laws, any environmental contamination (1) discovered during Grantee's work or activities under this Permit to the extent such evaluation, assessment or remediation is required for Grantee's work, or (2) resulting from the Grantee's work or activities under this Permit. The Grantee(s) shall notify MassDOT, Highway Division, of any such assessment and remediation activities.

The Grantee(s) is hereby held solely responsible for obtaining and maintaining any and all environmental compliance permits required by local, state, and federal laws and regulations when regular or emergency work is proposed within, or in close proximity to, any wetland area. These environmental compliance requirements include, but are not limited to, a Negative Determination of Applicability or Order of Conditions from the local Conservation Commission, a Water Quality Certificate from the Department of Environmental Protection, and a Programmatic General Permit from the U.S. Army Corps of Engineers. The Grantee(s) shall forward to MassDOT, Highway Division, a copy of each such environmental compliance permit.

CLOSING CONDITIONS

All of said work shall comply with the terms and conditions herein and must be done as directed by and to the satisfaction of the engineer.

All work done under this contract shall be in conformance with the 2020 Edition of the MassDOT Highway Division Standard Specifications for Highways and Bridges. All construction shall conform to the October 2017 edition of the Massachusetts Department of Transportation, Highway Division "Construction Standard Details (English Edition)"; the latest Manual on Uniform Traffic Control Devices with Massachusetts Amendments; the latest edition to the following: the 1996 Construction and Traffic Standard Details (as related to Traffic Standard details only); the 1990 Standard Drawings for Traffic Signs and Supports; the 1968 Standard Drawings for Traffic Signals and Highway Lighting; the latest edition of American Standard for Nursery Stock; the Plans and these Special Provisions.

The Grantee(s) shall indemnify and save harmless the Commonwealth and MassDOT, Highway Division, against all suits, claims or liability of every name and nature arising at the time out of or in consequence of the acts of the Grantee(s) in the performance of the work covered by this Permit and/or failure to comply with the terms and conditions of this Permit whether by themselves or their employees or subcontractors.

It is noted that the Grantee(s) will be responsible for future corrective actions resulting from defective work under the subject permit. Any damage to roadway and/or shoulder as a result of the permitted work is the Grantee's responsibility and shall be repaired at his/her expense.

The Completion of Work Form and supporting photos shall be electronically uploaded, via the State Highway Access Permit System (SHAPS), as soon as possible after the completion of the physical work to begin the sign-off process.

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Tel: (508) 824-6633, FAX: (508) 880-6102
www.mass.gov/orgs/highway-division

MassDOT, Highway Division, will hold the Permit on file for a period of not less than three (3) years. If the Completion of Work Form is not uploaded, the liability assumed under this Permit will continue.

A copy of this Permit must be on the job site at all times for inspection. Failure to have this Permit available at the site will result in suspension of the rights granted by the Permit.

"FOLLOWING CONDITIONS APPLY TO PERMITS"
Conditions Relating Particularly to Permits for the Laying of Pipes, Conduits, etc.

After any pipes, conduits, drains or other underground structures are laid, or any excavation is made in the roadway, the trenches or openings shall be properly backfilled with suitable material, the back-filling shall be thoroughly tamped, and the surface of the road over said structures shall be left even with the adjoining ground. If the work is done in cold weather no frozen material shall be used for backfilling.

Wherever the hardened surface of the roadway, gutters, or any part of the surface of the highway is disturbed it shall be replaced in as good condition as before it was disturbed, and if new materials are required they shall correspond with those already in place on the road.

Where service pipes are to cross the highway, the connections shall be made without disturbing the hardened surface of the roadway, by driving the pipes under the roadway, or the service pipes shall be carried under and across the road in a larger pipe, unless otherwise ordered by the Director.

The Grantee shall maintain the surface of the roadway over said structures as long as MassDOT may deem necessary, until all signs of the trenches shall have been eliminated.

CONDITIONS RELATING PARTICULARLY TO PERMITS FOR THE ERECTION OF POLES, WIRES, AND OVERHEAD STRUCTURES, AND THE CUTTING AND TRIMMING OF TREES

In the erection of pole lines, unless otherwise herein provided, no trees located within the limits of the State Highway shall be cut or trimmed. No guy wires shall be attached to trees without a special permit from MassDOT, and in no event shall they be so attached as to girdle the trees or in any way interfere with their growth. The wires shall be so protected at all time and places that they shall not interfere with or injure the trees either inside or outside the location of the highway.

Where the cutting or trimming of trees is authorized by this permit, only such cutting and trimming shall be done as may be designated by the Director.

In the construction or reconstruction of pole lines no guy wires shall be erected nearer to the surface of the ground than six feet; provided, however, that the owners of such lines may maintain such guy wires at a lower elevation than six feet from the ground until such time as MassDOT shall notify them to remove said wires or to the elevation first stated.

In order to protect the trees through which any wires may pass, said wires shall be insulated and such other tree guards used as may be directed by the Director.

Where high tension wires are erected under this permit, they shall be so located that, under conditions of maximum severity as regards a coating of ice or snow, there shall be a space of at least eight feet between such high-tension wires and other wires.

The Grantee shall, within sixty days from the date of completion of the work, file in the office of MassDOT a plan showing the location of each pole erected in accordance with the permit, said plan to be of such size and in such form as MassDOT may direct.

GENERAL AND ADDITIONAL CONDITIONS

Whenever the word "MassDOT" is used herein it shall mean the Massachusetts Department of Transportation of the Commonwealth of Massachusetts.

Whenever the word "Director" is used herein it shall mean the District Highway Director or other authorized representative of MassDOT.

Whenever the word "Grantee" is used herein it shall mean the person or persons, corporation or municipality to whom this permit is granted, or their legal representatives.

During the progress of the work all structures underground and above ground shall be properly protected from damage or injury; such barriers shall be erected and maintained as may be necessary for the protection of the traveling public; the same shall be properly lighted at night; and the Grantee shall be responsible for the damages to persons or property due to or resulting from any work done under this permit.

Except as herein authorized, no excavation shall be made, or obstacle placed within the limits of the State highways in such a manner as to interfere unnecessarily with the travel over said road.

lf any grading of sidewalk work done under this permit interferes with the drainage of the State highway in any way, such catch basins and outlets shall be constructed as may be necessary, in the opinion of the Director, to take proper care of such drainage.

Wherever the hardened surface of the roadway is disturbed and the Director may consider it necessary or advisable to do so, said surface will be restored by the employees of MassDOT, at such time as MassDOT may direct, and the expense thereof shall be borne by the Grantee, who shall purchase and deliver on the road the materials necessary for said work if and when directed by the Director. All payments to the supplier and to laborers, inspectors, etc., employed by MassDOT for or on account of the work herein contemplated shall be made by said Grantee forthwith on receipt of written orders, pay rolls, or vouchers approved by MassDOT.

IF THE GRANTEE DOES ANY WORK CONTRARY TO THE ORDERS OF THE DIRECTOR, AND, AFTER DUE NOTICE, FAILS TO CORRECT SUCH WORK OR TO REMOVE STRUCTURES OR MATERIALS ORDERED TO BE REMOVED, OR FAILS TO COMPLETE WITHIN THE SPECIFIED TIME THE WORK AUTHORIZED BY TIDS PERMIT, MASSDOT MAY, WITH OR WITHOUT NOTICE, CORRECT OR COMPLETE SUCH WORK IN WHOLE OR IN PART, OR REMOVE SUCH STRUCTURES OR MATERIALS, AND THE GRANTEE SHALL REIMBURSE MASSDOT FOR ANY EXPENSE INCURRED IN CORRECTING AND/OR COMPLETING THE WORK OR REMOVING THE STRUCTURES OR MATERIALS.

ALL OF THE WORK HEREIN CONTEMPLATED SHALL BE DONE UNDER THE SUPERVISION AND TO THE SATISFACTION OF THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, AND THE ENTIRE EXPENSE THEREOF SHALL BE BORNE BY THE GRANTEE.

On the completion of the work herein contemplated all rubbish and debris shall be removed and the roadway and roadsides shall be left neat and presentable and satisfactory to the Director.

MassDOT hereby reserves the right to order the change of location or the removal of any structure or' structures authorized by this permit at any time, said change or removal to be made by and at the expense of the Grantee or its I their successors or assigns.

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This permit may be modified or revoked at any time by MassDOT without rendering said MassDOT or the Commonwealth of Massachusetts liable in any way.

The Grantee shall pay the salary, subsistence and travel expenses of any inspector appointed by MassDOT to supervise the work herein contemplated.

All of the above conditions shall be applicable to the work herein authorized, unless the same are inconsistent with the conditions on the face of the permit, in which case the conditions written or printed on the face of the permit shall apply.

The acceptance of this permit or the doing of any work thereunder shall constitute an agreement by the Grantee to comply with all of the conditions and restrictions printed or written herein.

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www.mass.gov/orgs/highway-division

Charles D. Baker. Governor
Karyn E. Polito, Lieutenant Governor
Stephanie Pollack, Secretary & CEO
Jonathan L. Gulliver, Highway Administrator

massDOT
Massachusetts Department of Transportation
Highway Division

Approved Signature



Mary-Joe Perry by B.T.
District Highway Director

Date of Issue: February 19, 2020

Permit Expiration: Saturday, February 20, 2021

District 5, 1000 County Street Taunton, MA 02780
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www.mass.gov/orgs/highway-division

Town of Orleans, MA

Downtown Area Collection System Layout

Legend

- WWTP
- Property to be Serviced by Low Pressure Sewer Pump
- Pump Station
- PS Forcemain
- WWTF Effluent Forcemain
- Low Pressure Sewer (LPS)
- Gravity Sewer - Existing
- Gravity Sewer - 8"
- Gravity Sewer - 10"
- Gravity Sewer - 12"
- Gravity Sewer - 16"
- Gravity Sewer - 18"
- Service Lateral - Existing
- Downtown Service Area
- Parcel
- Waterbody
- Wetland

0 125 250 500 Feet

AECOM

February 2020

Wastewater Treatment Facility 20 Overland Way

Route 6 Crossing

84 Old Colony Way

Pump Station No:1

WWTF Effluent Disposal Site 32 Lots Hollow Rd

Downtown Service Area

Pump Station No.3

Cranberry Cove Plaza

Snow Library

Pump Station No.2

Cedar Pond

Boland Pond

Town Cove

EASTHAM

E_02 E_03 E_04 E_05 D_04 D_05 F_03 F_04 F_05 F_06 G_03 G_04 G_05 H_03 H_04

NAMSKAKET ROAD
PRINCE LANE
CEDAR POND ROAD
JONES ROAD
CANAL ROAD
KINGS WAY
LOCUST ROAD
LIBERTY LANE
MAIN STREET
CAPE COD RAIL TRAIL
OLD COUNTY ROAD
OLD COLONY WAY
CRANBERRY HIGHWAY
SOUTH ORLEANS ROAD
COTTAGE STREET
NORTH COTTAGE STREET
MID-CAPE HIGHWAY - ROUTE 6
OAK RIDGE LANE
WEST ROAD
OLD TOTE ROAD
COVE ROAD
DOANE TERRACE
CUMMINGS ROAD
BREWSTER CROSS ROAD
CENTER PLACE
ACADEMY PLACE
CLAYTON CIRCLE
NICKERSON ROAD
ELDREDGE PARK WAY
FINLAY ROAD
LOTS HOLLOW ROAD
MARSTONS WAY
OLD FARM ROAD
QUAIL HILL LANE

I:\acm\605\Work - Orleans\Maps\Downtown Area CSS, 02-24-2020\Dwy.mxd

March 6, 2020

ADDENDUM NO. 4

TO

DOCUMENTS AND SPECIFICATIONS

FOR

Downtown Area Collection System and Pumping Stations

Contract No. 2019-02 and SRF No. 4486

Town of Orleans, MA

Department of Public Works & Natural Resources

This Addendum No. 4 forms a part of the Contract Documents and modifies the Bidding Documents dated January 2020 as noted below. Acknowledge receipt of this Addendum in the space provided in SECTION 00410, FORM OF GENERAL BID. Failure to do so may subject the Bidder to disqualification.

This Addendum consists of 6 pages and 30 pages of attachments for a total of 36 pages.

ATTACHMENTS

1. Orleans_MA-2019-02-Bid Form_Add_4-03-06-20
2. SECTION 00310, BID BOND (EJCDC)
3. SECTION 13330 ATTACHMENT A - INSTRUMENTS PRODUCT SHEETS
4. DRAWING 03 C-112 – PLAN AND PROFILE SEWER CRANBERRY HIGHWAY I - Plate
5. DRAWING 03 C-113 – PLAN AND PROFILE SEWER CRANBERRY HIGHWAY II - Plate

CHANGES TO BE MADE TO THE CONTRACT SPECIFICATIONS

1. GENERAL
   A. General Bid Opening - March 11, 2020 at 2:00 pm.
2. TABLE OF CONTENTS
   A. Page TOC-2, DIVISION 0 – BIDDING AND CONTRACT REQUIREMENTS, add SECTION 00310, BID BOND (EJCDC), as attached.
3. SECTION 00310, BID BOND
   A. Add new SECTION 00310, BID BOND (EJCDC) as an alternative Bid Bond Form, as attached.

4. TABLE OF CONTENTS

   A. Page TOC-2, DIVISION 0 – BIDDING AND CONTRACT REQUIREMENTS, add SECTION 00310, BID BOND (EJCDC), as attached.

5. SECTION 00410, FORM OF GENERAL BID

   A. Delete "Orleans_MA-2019-02-Bid Form_Add_4-02-26-20" in its entirety and replace with the attached new "Orleans_MA-2019-02-Bid Form_Add_4-03-06-20" in both hard copy and Microsoft Excel format.

6. SECTION 00830, STATE STATUTES AND REGULATIONS COMMONWEALTH OF MASSACHUSETTS

   A. Page 00830-1, ARTICLE A. – Revisions to General Conditions, Paragraph A., add the following to the end of Subparagraph 4.:

      Town of Orleans building permit fees are waived.

7. SECTION 01030, SPECIAL REQUIREMENTS

   A. Page 01030-5, ARTICLE 1.11 – SCOPE OF WORK AND SEQUENCE OF CONSTRUCTION, Paragraph F.8., delete subparagraph d. in its entirety and replace with the following new subparagraph:

      d. The Contractor shall provide up to four Portable Changeable Message Signs to provide advance warning to motorists prior to entering the construction area in accordance with SECTION 01570, TRAFFIC MANAGEMENT AND MAINTENANCE. The locations of the Portable Changeable Message Signs shall be as determined by the MassDOT, the Owner and Engineer.

8. SECTION 02150, HIGHWAY CROSSING (JACKING)

   A. Page 02150-5, ARTICLE 2.03 – CASING PIPE (SLEEVE), add the following new Paragraph D.:

      D. Permalok Casing Pipe can be substituted for the Casing Pipe (Sleeve) subject to the Casing Pipe requirements of the previous paragraphs and subject to MassDOT approval.

   B. Page 02150-5, ARTICLE 2.05 – CASING END SEALS, delete Paragraph A. in its entirety and replace with the following new paragraph:

      A. Masonry brick and mortar casing end seals shall be constructed at each end of the casing to seal the casing and around the pipe protrusions.

9. SECTION 02435, CRUSHED STONE

   A. Page 02435-2, ARTICLE 1.04 – SUBMITTALS, delete Paragraph B in its entirety and replace with the following new paragraph:

      B. Submittals required under this section include, but are not limited to the following:

         1. Gradation test result from the Contractor's Independent Testing Laboratory, at least two (2) weeks prior to hauling material, for the Engineer's acceptance.

         2. If crushed stone is utilized, a 10-pound sample shall be submitted, if requested by the Engineer.

         3. If PGA is utilized, a 10-pound sample shall be submitted. In addition, provide a certified test report that indicates that the PGA is free of debris and other materials that is associated with the glass recycling process.

   B. Page 02435-2, ARTICLE 2.01 - MATERIAL, Paragraph B, add the following to the end of subparagraph 2.:

      Other glass products (i.e. fluorescent lights, video screens, automobile glass, lead crystal, etc.) shall not be incorporated into PGA.

10. SECTION 02629, POLYVINYL CHLORIDE LOW-PRESSURE SEWER PIPE

    A. Page 02629-3, ARTICLE 2.01 – MATERIALS, delete Paragraph D. in its entirety and replace with the following new paragraph:

        D. The Contractor has the option of substituting SDR 11 HDPE I.P.S. butt-fused pipe for the SDR 21 PVC gasketed pipe used for pressure main and services at no additional cost to the Owner. All couplings, fittings, adapters, valves, reducers, tees, and wyes shall be compatible with the type of pipe used. HDPE pipe shall be pressure rated for 200 psi and shall conform to ASTM D1248, ASTM D3350, ASTM D2239, and NSF-14. Compression fitting shall be brass and manufactured by Ford, or equal.

    B. Page 02629-3, ARTICLE 2.01 – MATERIALS, add the following new Paragraph K.:

        K. Pipe and fittings using glued connections is not acceptable.

11. SECTION 11398, DIESEL ENGINE-GENERATOR SET AND APPURTENANCES

    A. Page 11398-2, ARTICLE 1.01 – SCOPE, delete Paragraph B. in its entirety and replace with the following new paragraph:

        B. The unit shall be provided in an outdoor, weather proof, non-walk-in, sound attenuated enclosure with an integral sub-base fuel storage tank with a capacity for 24 hours of standby operation running at full load.

12. SECTION 13300, INSTRUMENTATION AND CONTROL SYSTEM – GENERAL

    A. Page 13330-5, ARTICLE 1.08 – WARRANTY, delete the article in its entirety and replace with the following new article:

        1.08 - WARRANTY

            A. Guarantees and warranties shall be furnished in accordance with DOCUMENT 00700, GENERAL CONDITIONS.

            B. Equipment Manufacturer

                1. The Equipment Manufacturer shall provide a warranty that all of the equipment is new and of recent manufacture, all materials and workmanship are of good quality, free from faults or defects in accordance with the requirements of these specifications. In addition, the Equipment Manufacturer shall warrant that the system will function in accordance with the manufacturer's published technical description guides and as specified herein. The Warranty, obtained by the Equipment Manufacturer, shall be secured by a Performance Bond issued jointly to the Equipment Manufacturer and the Owner. The Equipment Manufacturer agrees to furnish a Warranty in the sum of the 100 percent of the equipment price and duly executed by the said Equipment Manufacturer as Principal and by a surety company qualified to do business under the laws of the Commonwealth of Massachusetts and satisfactory to the Owner, as Surety, for the faithful performance of the work proposed. The premiums for such Bonds shall be paid by the Equipment Manufacturer. Bonds must be issued by surety companies listed on the latest IRS Circular 570.

                2. The Warranty shall be for a period of two (2) years from Substantial Completion of the construction contract.

                3. The Equipment Manufacturer shall be responsible for execution of warranties during the warranty period should the need arise.

C. Contactor

1. The Contractor shall provide a warranty that the installation of materials and hardware are in compliance with applicable provisions of the National Electric Code, UL, NEMA, the rules and regulations of the Federal Communications Commission, and state and/or local codes or ordinances that may apply. The Warranty, obtained by the Contractor, shall be secured by a Performance Bond issued jointly to the Contractor and the Owner. The Contractor agrees to furnish a Warranty in the sum of the full amount of the equipment price and duly executed by the said Contactor as Principal and by a surety company qualified to do business under the laws of the Commonwealth of Massachusetts and satisfactory to the Owner, as Surety, for the faithful performance of the work proposed. The premiums for such Bonds shall be paid by the Equipment Manufacturer. Bonds must be issued by surety companies listed on the latest IRS Circular 570.

2. The Warranty shall be for a period of one (1) year from Substantial Completion of the construction contract.

3. The Contractor shall be responsible for execution of warranties during the warranty period should the need arise.

D. It is the Contractor's and Equipment Manufacturer's responsibility to resolve any and all warranty claims.

E. The Warranties shall be provided as part of the shop drawing submittal. Submittals which do not include the required Warranty Bonds will be summarily rejected and returned to the Contractor without further review and consideration.

B. At the end of the section include SECTION 13330 ATTACHMENT A - INSTRUMENTS PRODUCT SHEETS, as attached.

13. SECTION 16900, ELECTRICAL CONTROLS AND MISCELLANEOUS ELECTRICAL EQUIPMENT

A. Page 16900-5, ARTICLE 2.07 – WALL-MOUNTED COMBINATION STARTERS, delete Paragraph A in its entirety and replace with the following new Paragraph:

A. Unless otherwise indicated, provide each combination starter with motor circuit protector and full-voltage magnetic starter. Provide starters in enclosures rated in accordance with the Area Classification Schedule on Contract drawings.

B. Page 16900-6, add the following new ARTICLE 2.13- AUTOMATIC TRANSFER SWITCH:

2.13 – AUTOMATIC TRANSFER SWITCH

A. Provide UL listed, 480VAC, 3-phase, 3-wire, automatic transfer switches (ATS) to automatically transfer between normal utility power source and standby generator power source.

B. Provide open-transition, electrically operated automatic transfer switch of the current, voltage, and short circuit ratings indicated on the Contract drawings capable of switching all classes of load and fully rated.

C. Provide service entrance rated ATS.

D. Provide ASCO 7000 Series or approved equal.

E. Provide ATS with dry-type contacts to PLC for remote indication of transfer switch position and status:

1. Utility Power Position

2. Standby Generator Power Position

3. General Fault Alarm

CHANGES TO BE MADE TO THE CONTRACT DRAWINGS

1. DRAWING 01 C-110 – PLAN AND PROFILE SEWER CRANBERRY HIGHWAY

   A. Delete the words “Replace 45 lf 4” Dia. Water Main to PL” in its entirety and replace with the words “Replace 45 lf 8” Dia. Water Main to PL”.

2. DRAWING 02 C-104 – PLAN AND PROFILE SEWER BREWSTER CROSSROAD I

   A. Delete the words “Relocate 150 lf 8” Dia. Water Main” in its entirety and replace with the words “Relocate 150 lf 12” Dia. Water Main”.

3. DRAWING 03 C-103 – PLAN AND PROFILE SEWER LOCUST ROAD II

   A. Delete the words “Replace 29 lf 6” Dia. Water Main” in its entirety and replace with the words “Replace 29 lf 12” Dia. Water Main”.

4. DRAWING 03 C-112 – PLAN AND PROFILE SEWER CRANBERRY HIGHWAY I

   A. Add water main replacement between SMH E-04-07 and SMH E-04-01 as shown on the attached plate.

5. DRAWING 03 C-113 – PLAN AND PROFILE SEWER CRANBERRY HIGHWAY II

   A. Install and 8-inch Gate Valve and the requirement to maintain water services to adjacent properties during water main replacement as shown on the attached plate.

CHANGES TO BE MADE TO THE CONTRACT ATTACHMENTS

None

END OF ADDENDUM NO. 4

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Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS			
1.	For Mobilization/Demobilization, as specified (maximum of five (5) percent of System Expansion bid), the sum of $ -	l.s.	1	$ -
2.A.	For furnishing and installing 1-1/2-inch through 2-inch, inclusive, Polyvinyl Chloride/High Density Polyethylene Low Pressure Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	2,030	$ -
2.B.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Less Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	7,000	$ -
2.C.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Greater Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	13,750	$ -
2.D.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,950	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.E.	For furnishing and installing 12-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	2,410	$ -
2.F.	For furnishing and installing 18-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,900	$ -
2.G.	For furnishing and installing 6-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	3,060	$ -
2.H.	For furnishing and installing 8-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	710	$ -
2.I.	For furnishing and installing 8-inch PVC Effluent Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	3,590	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.J.	For furnishing and installing 1-1/4-inch Polyvinyl Chloride Low-Pressure Sewer Service Connections and Associated Fittings from main line to property line, All Depths, as specified, the sum of $ -	per l.f.	600	$ -
2.K.	For furnishing and installing 6-inch Polyvinyl Chloride Service Connections and Associated Fittings from main line to property line as specified, the sum of $ -	per l.f.	6,100	$ -
2.L.	For furnishing and installing LPS Wyes, All Depths, as specified, the sum of $ -	per each	21	$ -
2.M.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	109	$ -
2.N.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	12	$ -
2.O.	For furnishing and installing 12-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	11	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.P.	For furnishing and installing 18-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	18	$ -
2.Q.	For furnishing and installing Low Pressure Sewer Main Line Valves, All Sizes and Depths, as specified, the sum of $ -	per each	4	$ -
3.A.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Less Than 10 feet in Depth, the sum of $ -	per each	24	$ -
3.B.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Greater Than 10 feet in Depth, the sum of $ -	per each	102	$ -
3.C.	For furnishing and installing 5-foot Diameter Precast Concrete Sewer Manholes, All Depths, as specified, the sum of $ -	per each	9	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
3.D.	For furnishing and installing 6-foot Diameter Precast Concrete Low Pressure Sewer Terminal Flushing Manholes, All Depths, as specified, the sum of $ -	per each	5	$ -
3.E.	For furnishing and installing 6-foot Diameter Precast Concrete Effluent Force Main In-Line Flushing Manholes, All Depths, as specified, the sum of $ -	per each	1	$ -
3.F.	For furnishing and installing 6-foot Diameter Precast Concrete Leaching Catch Basins with Grates, All Depths, as specified, the sum of $ -	per each	4	$ -
4.A.	For furnishing and installing Standard Manhole Frames and Covers, as specified, the sum of $ -	per each	108	$ -
4.B.	For furnishing and installing Bolted and Gasketed Manhole Frames and Covers, as specified, the sum of $ -	per each	37	$ -
5.	For furnishing and installing Interior Manhole Drop Connections, as specified, the sum of $ -	per v.f.	80	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
6.	For furnishing and installing chimneys, as specified, the sum of $ -	per v.f.	490	$ -
7.	For furnishing and placing miscellaneous cement concrete, as specified, the sum of $ -	per c.y.	440	$ -
8.	For Rock and Boulder Excavation including Replacement with Suitable Fill Material, as specified, the sum of * $ - * Minimum Bid = $80/c.y.	per c.y.	550	$ -
9.A.	For Replacement of Unsuitable Material Below Trench Grade and/or Subgrade, as specified, the sum of $ -	per c.y.	820	$ -
9.B.	For Replacement of Unsuitable Material Above Trench Grade, as specified, the sum of $ -	per c.y.	1,630	$ -
10.	For Experimental Excavation, as specified, the sum of $ -	per c.y.	440	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
11	Fill for embankments – Not Used			
12.	Sheeting and/or shoring ordered left in place – Not Used			
13.	For performing Soil Compaction Tests, as specified, the sum of $ -	per each	150	$ -
14.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	10,740	$ -
15.A.	For furnishing and placing 3-inch Temporary Bituminous Concrete Trench Pavement (base course), as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	5,320	$ -
15.B.	For furnishing and placing 7-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in State Roadways, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	4,060	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.C.	For milling and furnishing and placing 2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in State Roadways, as specified, the sum of *			
	$ -	per ton	6,050	$ -
	* Minimum Bid = $80/ton			
15.D.	For furnishing and placing 4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	480	$ -
	* Minimum Bid = $80/ton			
15.E.	For furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (base course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	490	$ -
	* Minimum Bid = $80/ton			
15.F.	For furnishing and placing Dense Graded Gravel, as specified, the sum of			
	$ -	per c.y.	350	$ -
15.G.	For furnishing and placing 4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	4,460	$ -
	* Minimum Bid = $80/ton			

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.H.	For milling and furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	7,050	$ -
	* Minimum Bid = $80/ton			
15.I.	For Miscellaneous Restoration of State and Town Roadways, as specified, the sum of *			
	$ -	per ton	550	$ -
	* Minimum Bid = $80/ton			
15.J.	For furnishing and placing Miscellaneous Bituminous Concrete Pavement, as specified, the sum of *			
	$ -	per ton	660	$ -
	* Minimum Bid = $80/ton			
15.K.	For repair and/or replacement of the Vehicle Loop Detectors, as specified, the sum of			
	$ -	per each	20	$ -
15.L.	For repainting of Traffic Markings - Lines, Symbols and Wording, as specified, the sum of			
	Seventy Five Thousand Dollars and No Cents			
	$ 75,000.00	Allowance	1	$ 75,000.00
16.A.	For removal and relaying and/or replacement of Existing Water Mains, associated fittings, valves and services, as specified, the sum of			
	$ -	per inch-foot	12,000	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
16.B.	For removal and relaying and/or replacement of Existing Storm Drains, as specified, the sum of $ -	per inch-foot	20,000	$ -
16.C.	For removal and relaying and/or replacement of Existing Gas Mains and services, as specified, the sum of One Hundred Thousand Dollars and No Cents $ 100,000.00	Allowance	1	$ 100,000.00
16.D.	For removal and relaying and/or replacement of Existing Miscellaneous Utilities, as specified, the sum of Seventy Five Thousand Dollars and No Cents $ 75,000.00	Allowance	1	$ 75,000.00
16.E.	For furnishing and removal of 6-inch Water Main Line Stops, as specified, the sum of $ -	per each	1	$ -
16.F.	For furnishing and removal of 8-inch Water Main Line Stops, as specified, the sum of $ -	per each	18	$ -
16.G.	For furnishing and removal of 10-inch Water Main Line Stops, as specified, the sum of $ -	per each	1	$ -
17.	Uniformed Traffic Police Officers - Paid by Owner			
18.A.	For furnishing, installing, and removing Engineer's Field Office, as specified, the sum of $ -	per l.s.	1	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
18.B.	For maintaining Engineer's Field Office, as specified, the sum of $ -	per week	91	$ -
19.	For furnishing, installing, maintaining and removing Environmental Protection, as specified, the sum of $ -	per l.s.	2,830	$ -
20.	For furnishing, installing, maintaining and removing Trench Dewatering Equipment, as specified, the sum of $ -	per l.f.	11,220	$ -
21.	Temporary By-pass Pumping - Not Used			
22.A.	For furnishing and installing Highway Crossing, as specified, the sum of $ -	per l.s.	1	$ -
22.B.	For MassDOT Inspections, as specified, the sum of Ten Thousand Dollars and No Cents $ 10,000.00	Allowance	1	$ 10,000.00
23.A.	For furnishing and installing Pumping Station No. 1, as specified, the sum of $ -	per l.s.	1	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
23.B.	For furnishing and installing Pumping Station No. 2, as specified, the sum of $ -	per l.s.	1	$ -
23.C.	For furnishing and installing Pumping Station No. 3, as specified, the sum of $ -	per l.s.	1	$ -
23.D.	For Electric Company Connection/Service Fee, as specified, the sum of One Hundred Twenty Five Thousand Dollars and No Cents $ 125,000.00	Allowance	1	$ 125,000.00
23.E.	For Telephone Company Connection/Service Fee, as specified, the sum of Thirty Thousand Dollars and No Cents $ 30,000.00	Allowance	1	$ 30,000.00
23.F.	For Planting Operations, as specified, the sum of Thirty Thousand Dollars and No Cents $ 30,000.00	Allowance	1	$ 30,000.00
24.	For furnishing and installing Tracer Wire in State Roadways, All Depths, as specified, the sum of $ -	l.f.	15,000	$ -
TOTAL AMOUNT OF BID (SRF ELIGIBLE BID ITEMS) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF (Bid Items 1 through 24, inclusive).				**$ -**

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	ALTERNATIVES			
A-1A.	For furnishing and installing 4-inch Fiber Optic Conduits and Associated Fittings, All Depths, as specified, the sum of $ -	l.f.	3,590	$ -
A-1B.	For furnishing and installing Fiber Optic Handhole, All Depths, as specified, the sum of $ -	ea.	10	$ -
A-2.	For furnishing and installing Tracer Wire in Town Roadways All Depths, as specified, the sum of $ -	l.f.	28,100	$ -
	TOTAL AMOUNT OF BID (ALTERNATIVE BID ITEMS) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF (Bid Items A-1 through A-2., inclusive).			**$** -
	SRF INELIGIBLE BID ITEMS			
	Item B-1 - Replacement of Water Services			
B-1A.	For furnishing and installing 1-inch Polyvinyl Chloride Water Services and Associated Fittings from water main to property line as specified, the sum of $ -	per l.f.	2,040	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
B-1B.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	480	$ -
B-1C	For furnishing and placing Temporary Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	290	$ -
B-1D.	For furnishing and placing Permanent Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	100	$ -
	Item B-1 - Replacement of Water Services (Bid Items B-1A. through B-1D., inclusive)			**$ -**
Item B-2 - Replacement of Canal Road Water Main				
B-2A.	For furnishing and installing 8-inch DI water main and Associated Fittings, as specified, the sum of $ -	per l.f.	2,060	$ -
B-2B.	For furnishing and installing 1-inch Polyvinyl Chloride Water Services and Associated Fittings from water main to property line as specified, the sum of $ -	per l.f.	320	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
B-2C.	For furnishing and installing 6-inch Gate Valves and Boxes, as specified, the sum of $ -	per each	6	$ -
B-2D.	For furnishing and installing 8-inch Gate Valves and Boxes, as specified, the sum of $ -	per each	7	$ -
B-2E.	For furnishing and installing Fire Hydrants, as specified, the sum of $ -	per each	6	$ -
B-2F.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	560	$ -
B-2G.	For furnishing and placing Temporary Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	340	$ -
B-2H.	For furnishing and placing Permanent Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	120	$ -
	Item B-2 - Replacement of Canal Road Water Main (Bid Items B-2A. through B-2H., inclusive)			**$ -**

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
Item B-3 - Water Quality Improvements				
B-3A.	For Brewster Cross Road Water Quality Improvements, as specified, the sum of			
	$ -	per l.s.	1	$ -
B-3B.	For Locust Road Water Quality Improvements, as specified, the sum of			
	$ -	per l.s.	1	$ -
	Item B-2 - Water Quality Improvements (Bid Items B-3A. through B-3B., inclusive)			**$ -**

TOTAL AMOUNT OF BID (SRF INELIGIBLE BID ITEMS) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF (Bid Items B-1 through B-3, inclusive).

$ -

Note: Funding for the SRF Ineligible Bid Items is anticipated to be obtained at the Annual Town Meeting proposed to be held in May 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.

BASIS OF AWARD

BASIS OF AWARD = TOTAL AMOUNT SRF ELIGIBLE BID ITEMS BASED ON ENGINEER'S ESTIMATE OF QUANTITIES (Bid Items 1 through 24, inclusive) + TOTAL AMOUNT OF ALTERNATIVES BID ITEMS BASED ON ENGINEER'S ESTIMATE OF QUALTITIES (Bit Items A-1 throguh A-2, inclusive) + TOTAL AMOUNT OF SRF INELIGIBLE BID ITEMS BASED ON ENGINEER'S ESTIMATE OF QUANTITIES (Bid Items B-1 through B-3, inclusive).

$ -

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

PENAL SUM FORM

SECTION 00310

BID BOND

Any singular reference to Bidder, Surety, Owner or other party shall be considered plural where applicable.

BIDDER *(Name and Address)*:

SURETY *(Name, and Address of Principal Place of Business)*:

OWNER *(Name and Address)*:

BID
Bid Due Date:
Description *(Project Name— Include Location)*:

BOND
Bond Number:
Date:
Penal sum _____ $ _____
(Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER	**SURETY**
_____ (Seal)	_____ (Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (Attach Power of Attorney)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____
Signature	Signature
Title	Title

Note: Addresses are to be used for giving any required notice.
Provide execution by any additional parties, such as joint venturers, if necessary.

Note: The Bidder may submit their standard Bid Bond as long as it fully complies with the requirements of DOCUMENT C-430.

EJCDC ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

PENAL SUM FORM

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation shall be null and void if:

   3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or

   3.2 All Bids are rejected by Owner, or

   3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

END OF DOCUMENT

ATTACHMENT A

INSTRUMENTS PRODUCT SHEETS

DATA SHEET 416.1	MAGNETIC FLOW METER SPECIFICATION
DATA SHEET 853.1	LEVEL SWITCH (FLOAT TYPE) SPECIFICATION
DATA SHEET 873.1	SUBMERSIBLE WATER LEVEL SENSOR/TRANSMITTER SPECIFICATION
DATA SHEET 1452.1	PRESSURE SWITCH SPECIFICATION
DATA SHEET 1454.1	PRESSURE GAUGE SPECIFICATION
DATA SHEET 1457.1	PRESSURE ISOLATOR RING SPECIFICATION

MAGNETIC FLOW METER SPECIFICATION

DATA SHEET NO. 416.1

GENERAL

1.	Tag No.:	SEE TABLE
2.	Service:	SEE TABLE
3.	P & I D No.:	SEE TABLE
4.	Location:	SEE MECHANICAL DRAWINGS

CONNECTIONS

5.	Line Size:	SEE TABLE
6.	Line Material:	DUCTILE IRON
7.	Conn. Type:	FLANGED
8.	Conn. Material:	CARBON STEEL

PROCESS CONDITIONS

9.	Fluid:	SEE TABLE
10.	Maximum Flow:	SEE TABLE
11.	Max. Flow Velocity:	SEE TABLE
12.	Minimum Flow:	SEE TABLE
13.	Min. Flow Velocity:	SEE TABLE
14.	Operating Temp.:	40 TO 250 °F.
15.	Operating Pressure:	57 PSI

METER

16.	Meter Size:	SEE TABLE
17.	Tube Material:	304 STAINLESS
18.	Housing:	WELDED STEEL
19.	Liner Material:	INJECTION MOLDED HARD RUBBER OR EQUIVALENT
20.	Electrode Type:	FLUSH MOUNT
21.	Electrode Material:	316 STAINLESS OR EQUIVALENT
22.	Terminal Box:	DIE CAST ALUMINUM
23.	Enclosure Class:	NEMA 4X
24.	Power Supply:	120 VAC, 60 HZ
25.	Grounding Type:	STRAP AND RING

TRANSMITTER

26.	Type:	INTELLIGENT, MICROPROCESSOR BASED
27.	Mounting:	WALL MOUNTED
28.	Transmitter Range:	SEE TABLE BASED ON INSTRUMENT SPAN
29.	Enclosure Class:	NEMA 4X
30.	Power Supply:	120 VAC, 60 HZ
31.	Analog Output:	4 - 20 mADC
32.	Elect. Class:	SEE ELECTRICAL DESIGN FOR AREA CLASSIFICATION
33.	System Accuracy:	+/- 0.5% OF FLOW RATE AT VELOCITIES ABOVE 1 FOOT PER SECOND
34.	Sys. Repeatability:	+/- 0.1% OF FULL SCALE
35.	Empty Pipe Detect:	REQUIRED
36.	Local Display:	MULTI-LINE LC FOR MEASURED VARIABLE, DIAGNOSTICS PLUS BAR GRAPH AND KEY PAD
37.	Local Totalizer:	REQUIRED, 6 DIGIT, NON RESET
38.	Cable Length:	APPROX. 50 FEET PROVIDED BY METER MANUFACTURER

MISCELLANEOUS

39.	Manufacturer(s):	FOXBORO, E+H, KROHNE OR SIEMENS
40.	Model No.:	2000 SERIES, PROMAG W, ENVIROMAG OR MAG 5100

NOTES.

a. Provide grounding ring from meter manufacturer. Fabricated grounding rings from a third party shall not be accepted.
b. Provide meter manufacturers cable between the meter and the transmitter.
c. Wet calibrate all meters (at 3 points over the specified flow range) by gravimetric or volumetric methods that are traceable to NIST (National Institute Standard Testing).
d. Provide certificate of wet calibration to the engineer/owner prior to meter installation.
e. Provide, by the meter manufacturer, insitu calibration of all meters prior to system acceptance. Submit written calibration report from the manufacturer to the engineer.
f. PROVIDE 316 STAINLESS STEEL MOUNTING HARDWARE including all nuts and bolts connecting the meter to the process pipe.
g. Contractor to provide all power and signal cable in rigid conduit or liquid-tight conduit. See electrical specification for product specifications.
h. Contractor to provide grounding from ground rings to meter and meter to ground, using green size 10 AWG (6mm) ground wire. The Contractor shall install ground as directed by the meter manufacturer or to nearest water pipe. Contractor is responsible for all connections.
i. Remote communication must not interfere with the analog output signal. Use frequency shift keying (FSK) technique for communication.

TAG NO	SERVICE	LINE SIZE (in)	FLUID	MAX FLOW (gpm)	MAX VEL (fps)	Min FLOW (gpm)	Min VEL (fps)	METER SIZE (in)	P&I D
FE/FIT 0105	PUMP STATION 1 EFFLUENT	6	RWW	1100	12.48	160	1.82	6	01 DI-601
FE/FIT 0204	PUMP STATION 2 EFFLUENT	4	RWW	536	13.68	111	2.83	4	02 DI-601
FE/FIT 0304	PUMP STATION 3 EFFLUENT	4	RWW	305	13.84	54	2.45	4	03 DI-601

LEVEL SWITCH (FLOAT TYPE) SPECIFICATION

DATA SHEET NO. 853.1

GENERAL

1.	Tag Number:	SEE TABLE BELOW
2.	Service:	SEE TABLE BELOW
3.	P & I D No.:	SEE TABLE BELOW
4.	Location:	SEE ELECTRICAL DRAWINGS

FLOAT

5.	Dimensions:	APPROX. 6 INCH DIAMETER
6.	Material:	POLYPROPYLENE

SWITCH

7.	Type:	MICRO SWITCH STEEL BALL ACTIVATED
8.	Contact:	SPDT
9.	Rating:	5 AMPS AT 120 VAC
10.	Enclosure:	ENCAPSULATED
11.	Open/Close:	CLOSE ON INCREASING, OPEN ON DECREASING
12.	Mounting:	ADJUSTABLE CLAMP ON 1 INCH STAINLESS PIPE
13.	Elec. Class'tion:	SEE ELECTRICAL DRAWINGS

PROCESS CONDITIONS

14.	Operating Temp.:	40 TO 75 DEG. F.
15.	Operating Pressure:	ATMOSPHERIC

MISCELLANEOUS

16.	Interconn. Cable:	REQUIRED APPROX. 50 FEET
17.	Manufacturer(s):	COX OR KARI NO OR EQUAL
18.	Model No.(s):	OPTI-FLOAT OR KA SERIES NO OR EQUAL

NOTES

a. Provide 1-inch diameter SCH 40 316L SS pipe to mount the float switch(s).
b. Provide COX or KARI level switches as specified. Other manufacturers shall not be accepted based on performance.
c. Provide detailed instructions for proper installation of switches, enclosures and mounting hardware.
d. Provide 316 SS brackets and hardware to attach pipe to side of well or tank.
e. Provide a minimum of 3 brackets spaced a maximum of 10'-0" OC.
f. Provide all 316 SS mounting hardware to mount float switch(s) to 1-inch pipe. Mounting hardware shall allow for float level adjustment with hand tools.
g. Provide single sealed well/tank penetration for float switch(s) cables.
h. Provide 316 SS NEMA 4X or cast aluminum termination enclosure (based on area electrical classification). The enclosure shall provide termination for the float(s) and include isolation relays and intrinsic safety barriers.
i. Provide termination enclosure mounted on 316 SS UNISTRUT® supports for wall or floor mounting.

TAG NO.	SERVICE	P&ID
LSHH 0104	PUMP STATION 1 HIGH-HIGH LEVEL	01 DI-601
LSLL 0104	PUMP STATION 1 LOW-LOW LEVEL	01 DI-601
LSHH 0203	PUMP STATION 2 HIGH-HIGH LEVEL	02 DI-601
LSLL 0203	PUMP STATION 2 LOW-LOW LEVEL	02 DI-601
LSHH 0303	PUMP STATION 3 HIGH-HIGH LEVEL	03 DI-601
LSLL 0303	PUMP STATION 3 LOW-LOW LEVEL	03 DI-601

SUBMERSIBLE WATER-LEVEL SENSOR/TRANSMITTER SPECIFICATION

DATA SHEET NO. 873.1

GENERAL

1.	Tag Number:	SEE TABLE
2.	Service:	SEE TABLE
3.	P & I D No.:	SEE TABLE
4.	Location:	SEE TABLE

SENSOR AND TRANSMITTER

5.	Type:	HYDROSTATIC HEAD-PRESSURE TRANSDUCER
6.	Wetted Parts:	316 STAINLESS STEEL, VITON OR TITANIUM BASED ON CORROSIVE FLUID
7.	Diaphram:	316 STAINLESS STEEL OR HASTELLOY OR PLATINUM BASED ON CORROSIVE FLUID
8.	Analog Coms:	4 - 20 mADC / 10-30 VDC
9.	Digital Coms:	NONE REQUIRED.
10.	Cable:	PROVIDED BY SENSOR MANUFACTURE
11.	Cable Connection:	WATERTIGHT
12.	Cable Type:	POLYURETHANE
13.	Cable Length:	AS REQUIRED FOR INSTALLATION
14.	Pressure Range:	BASED ON TANK OR VESSEL DIMENSIONS W/ 200% OVER RANGE PROTECTION
15.	Oper. Temperature:	-20 TO 190 DEG. F.
16.	Zero Point Shift:	90% OF MEASURING RANGE

INDICATING DISPLAY

17.	Type:	INDICATING
18.	Display:	LCD
19.	Supply Voltage:	120 VAC
.20	Housing:	CAST ALUMINUM
21.	Calibration:	FIELD
22.	Enclosure:	IP66 NEMA 4X MINIMUM AND AS REQUIRED FOR ELECTRICAL AREA CLASSIFICATION.
23.	Elec. Class:	SEE ELECTRICAL

MISCELLANEOUS

24.	Manufacturer(s):	ENDRESS HAUSER (E+H) AMERICAN SENSOR TECHNOLOGIES (AST) OR APPROVED EQUAL

NOTES.

a. Provide lighting and surge protection
b. Provide manufacturers mounting hardware for transmitter and level transducer mounting. Submit mounting details with shop drawings.

TAG	SERVICE	P&ID
LE/LT 0104	PUMP STATION 1 LEVEL	01 DI-601
LE/LT 0203	PUMP STATION 2 LEVEL	02 DI-601
LE/LT 0303	PUMP STATION 3 LEVEL	03 DI-601

PRESSURE GAUGE SPECIFICATION

DATA SHEET NO. 1454.1

GENERAL

1.	Tag Number:	SEE TABLE
2.	Service:	SEE TABLE
3.	P & I D No.:	SEE TABLE
4.	Location:	SEE CONTRACT MECHANICAL PROCESS DRAWINGS.

GAUGE

5.	Type:	GEARLESS DIRECT-DRIVE NON-LIQUID FILLED
6.	Element:	HELICALLY WOUND BOURDON TUBE
7.	Element Material:	INCONEL X-750
8.	Range:	SEE TABLE
9.	Overpress. Limit:	FULL VACUUM AND/OR 150% OF MAX RANGE
10.	Accuracy:	± 0.5% AT MID SCALE
11.	Repeatability:	± 0.025% FULL SCALE
12.	Zero Adjustment:	EXTERNAL
13.	Span:	FACTORY SET
14.	Linearity:	FACTORY SET
15.	Shaft Attachment:	DIRECT SENSING COIL AND POINTER
16.	Shaft Bearing:	SYNTHETIC SAPPHIRE BOTH ENDS
17.	Fittings:	316 SS OR AS REQUIRED BY PROCESS
18.	Joints:	NICRO-BRAZED OR T.I.G. HELIARC WELDED
19.	Case Type:	SWIVEL FITTING WITH MOVEABLE FLANGE
20.	Case Material:	ABS PLASTIC
21.	Case Front:	REAR BLOWOUT
22.	Dial Diameter:	4-1/2 INCHES
23.	Socket Material:	316 STAINLESS STEEL
24.	Process Connection:	½ INCH NPT
25.	Lens:	ACRYLIC
26.	Mounting:	BACK SWIVEL FLANGE

PROCESS CONDITIONS

27.	Fluid:	SEE TABLE
28.	Operating Temp.:	SEE TABLE
29.	Operating Pressure:	SEE TABLE

MISCELLANEOUS

30.	Diaphragm:	PROVIDE EXTERNAL ISOLATION RING, PIPING AND VALVES, AS INDICATED ON THE CONTRACT MECHANICAL PROCESS DRAWINGS AND DETAILS. SEE DATA SHEET 1457.
31.	Snubber:	PROVIDE INTERNAL TO STEM
32.	Pulsation Damper:	INTERNAL TO STEM
33.	Manufacturer(s):	3D, PERMA-CAL OR EQUAL

TAG NO.	SERVICE	RANGE	FLUID	P & I D
PI 0101	PS1.P-1 DISCHARGE	0-100	RWW	01 DI-601
PI 0102	PS1.P-2 DISCHARGE		RWW	01 DI-601
PI 0103	PS1.P-3 DISCHARGE		RWW	01 DI-601
PI 0201	PS2.P-1 DISCHARGE		RWW	02 DI-601
PI 0202	PS2.P-2 DISCHARGE		RWW	02 DI-601
PI 0301	PS3.P-1 DISCHARGE		RWW	03 DI-601
PI 0302	PS3.P-2 DISCHARGE		RWW	03 DI-601

PRESSURE ISOLATOR RING SPECIFICATION

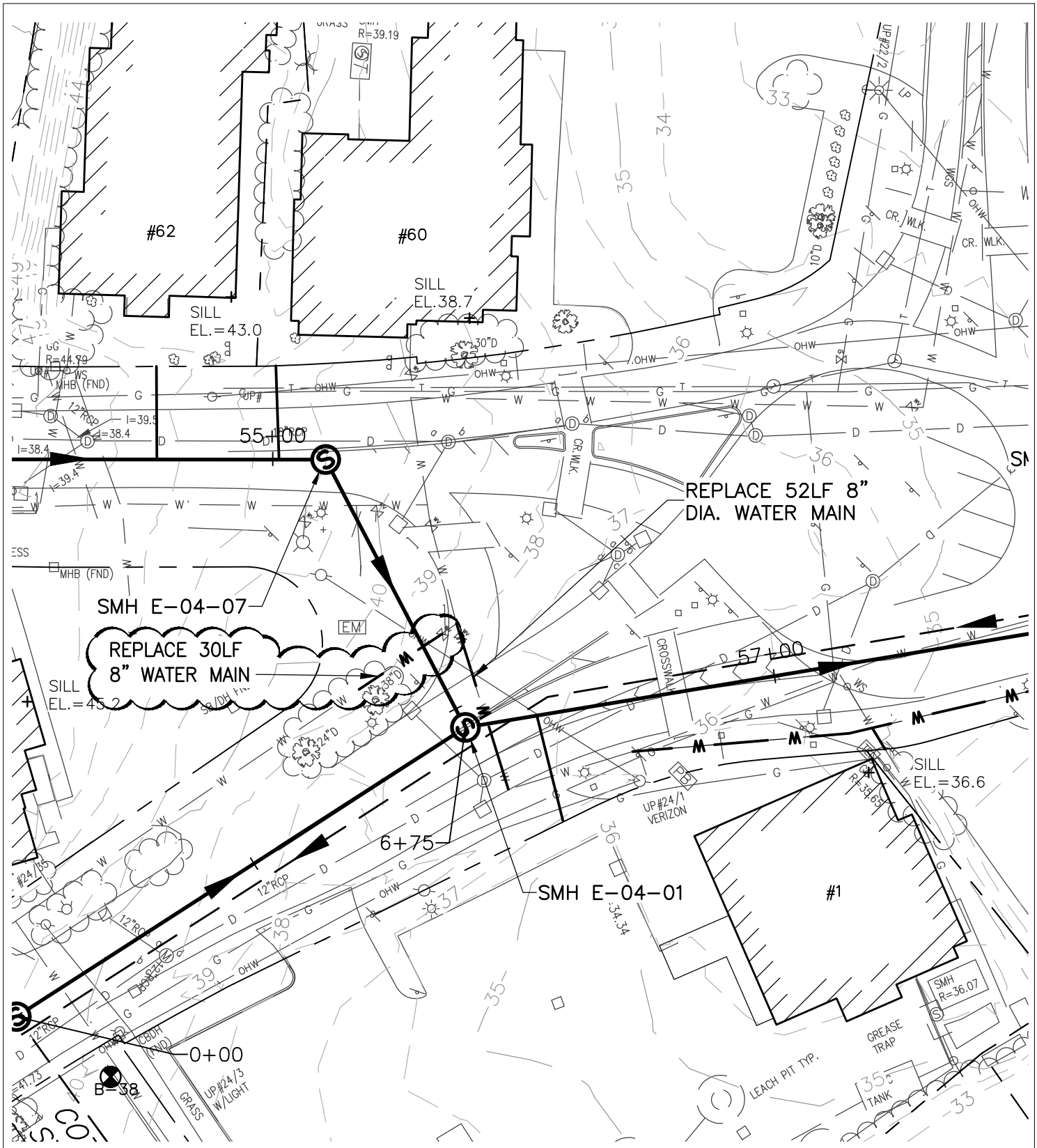
DATA SHEET NO. 1457.1

GENERAL

1.	Tag Number:	SEE DATA SHEET 1454
2.	Service:	SEE DATA SHEET 1454
3.	P & I D No.:	SEE DATA SHEET 1454
4.	Location:	SEE MECHANICAL DRAWINGS

A. Pressure Sensor Rings
   1. Manufacturers
      a. Onyx
      b. Or an acceptable equivalent product.
   2. 1-inch and Larger: Provide sensor/isolators that fit inside the bolt circle of 150-lb (Class 150).
   3. 3/4-inch and Smaller: Provide sensor/isolators full flange or threaded as specified and indicated. For chemical system provide full flange, threaded connections are not acceptable.
   4. Face to face length of the sensor: Conform to Specification MSS-SP67.
   5. Type: Flow through design with flexible sleeve around full circumference. The centersection shall have a cavity behind the sleeve filled with silicone fluid to transfer pressure to the gauge.
   6. Rigidly support all pressure instruments by a post at least 7/8-inch diameter welded to the isolator. On sensor rings with more than one instrument, provide all connections 1/2-inch NPT as a minimum. 1/4-inch NPT fittings are not acceptable.
   7. Provide sensor/isolator rings that do not have any fill plugs or valves that can be inadvertently removed with the resultant loss of fill fluid. Pressure sensor/isolators using valves are not acceptable.
   8. Provide liquid filled sensor/isolators permanently vacuum sealed at the factory with a modular seal consisting of a membrane and needle fitting to allow removal and replacement of pressure instruments without compromising the vacuum fill. Sensor/isolators using valves are not acceptable.
   9. Provide the needle fitting with both 1/4-inch NPTF threads and 1/2-inch NPTM threads.
   10. Provide the pressure sensor/isolator capable of operating under pressure with all pressure instruments removed with no loss of fill fluid and without the need for isolating valves.
   11. Attach pressure instruments to the isolator with a hand tightened lock ring.
   12. It shall be possible to remove or attach pressure instruments to the isolator without requiring the use of any tools.
   13. Permanently fill the pressure sensor with high viscosity silicone instrument oil to damp out surges or pressure spikes without the requirement for a separate snubber.
   14. Pressure rating: 200 psi minimum for all lines tested at 150 psi or less and 600 psi minimum per lines tested above 150 psi.
   15. Materials:
      a. Process water
         (1) Center – 316 stainless
         (2) End Plates – 316 stainless
         (3) Elastomer – EPDM
         (4) Fluid – silicone
         (5) Stinger – 316 stainless
         (6) Pipe – 316L stainless

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PLAN - CRANBERRY HIGHWAY

SCALE: 1"=40'

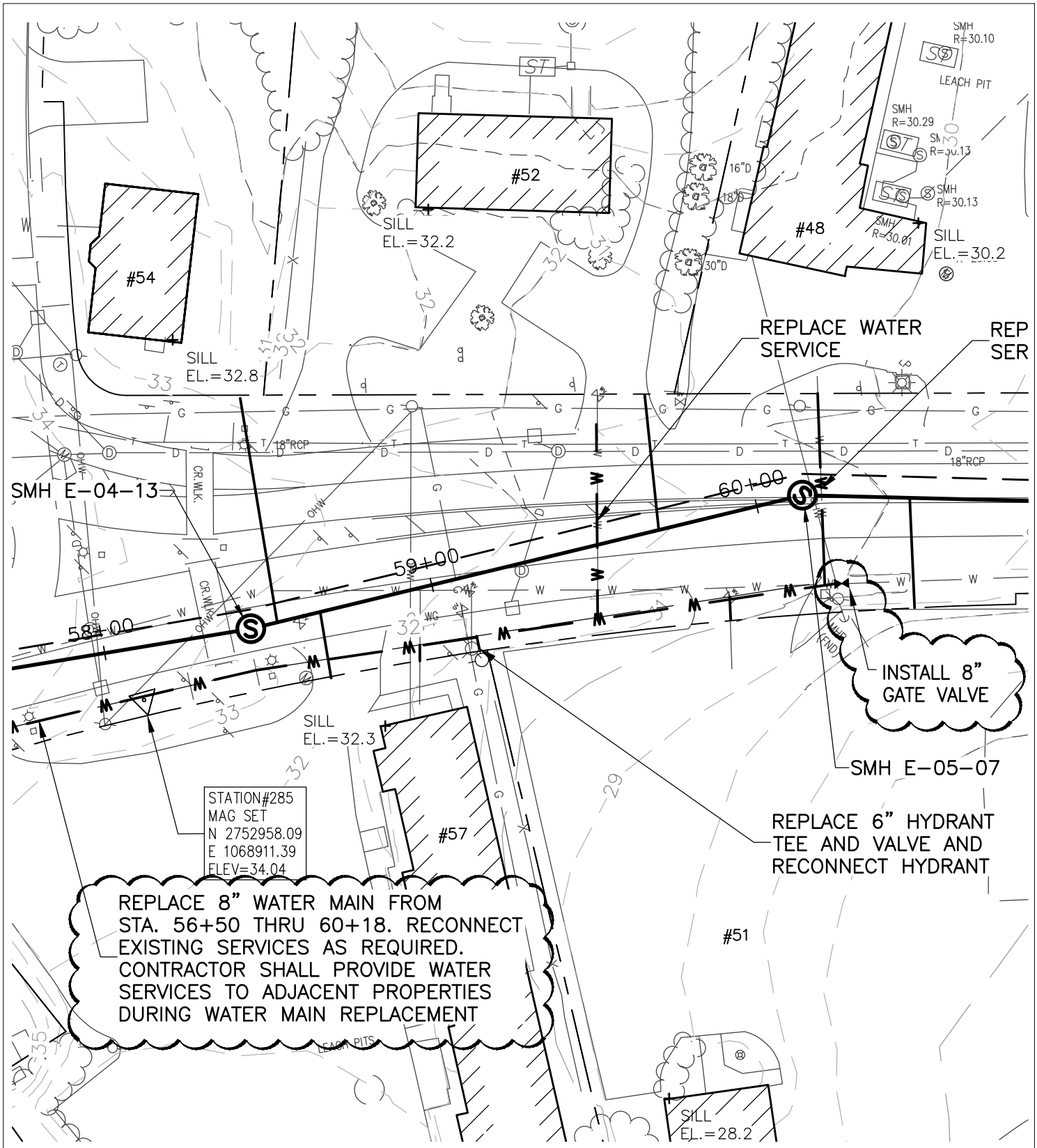
Water Dept. Modifications
Sheets 03 C-112

PLOT DATE: Thursday, March 5, 2020 10:57:18 AM

Downtown Area Collection System and Pump Stations
Town of Orleans, MA
Contract No. 2019-02

AECOM

Addendum 4



PLAN - CRANBERRY HIGHWAY

SCALE: 1"=40'

Water Dept. Modifications
Sheets 03 C-113

PLOT DATE: Thursday, March 5, 2020 10:58:11 AM

Downtown Area Collection System and Pump Stations
Town of Orleans, MA
Contract No. 2019-02

AECOM

Addendum 4

March 10, 2020

ADDENDUM NO. 5

TO

DOCUMENTS AND SPECIFICATIONS

FOR

Downtown Area Collection System and Pumping Stations

Contract No. 2019-02 and SRF No. 4486

Town of Orleans, MA

Department of Public Works & Natural Resources

This Addendum No. 5 forms a part of the Contract Documents and modifies the Bidding Documents dated January 2020 as noted below. Acknowledge receipt of this Addendum in the space provided in SECTION 00410, FORM OF GENERAL BID. Failure to do so may subject the Bidder to disqualification.

This Addendum consists of 2 pages and 0 pages of attachments for a total of 2 pages.

ATTACHMENTS

None

CHANGES TO BE MADE TO THE CONTRACT SPECIFICATIONS

1. SECTION 00100, ADVERTISEMENT FOR BIDS

   A. Page 00100-1, Paragraph 3., first subparagraph, delete the words "…until 2:00 p.m. prevailing time, on March 11, 2020 at which time and place…" and replace with the words "…until 11:00 a.m. prevailing time, on March 18, 2020 at which time and place…".

CHANGES TO BE MADE TO THE CONTRACT DRAWINGS

None

CHANGES TO BE MADE TO THE CONTRACT ATTACHMENTS

None

END OF ADDENDUM NO. 5

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March 12, 2020

ADDENDUM NO. 6

TO

DOCUMENTS AND SPECIFICATIONS

FOR

Downtown Area Collection System and Pumping Stations

Contract No. 2019-02 and SRF No. 4486

Town of Orleans, MA

Department of Public Works & Natural Resources

This Addendum No. 6 forms a part of the Contract Documents and modifies the Bidding Documents dated January 2020 as noted below. Acknowledge receipt of this Addendum in the space provided in SECTION 00410, FORM OF GENERAL BID. Failure to do so may subject the Bidder to disqualification.

This Addendum consists of 2 pages and 0 pages of attachments for a total of 2 pages.

ATTACHMENTS

None

CHANGES TO BE MADE TO THE CONTRACT SPECIFICATIONS

1. SECTION 11306, SUBMERSIBLE SOLIDS HANDLING PUMPS AND APPURTENANCES

   A. Page 11306-7, ARTICLE 2.04 – PUMP CONSTRUCTION, Paragraph E. delete subparagraph 3.b. in its entirety and replace with the following new subparagraph:

      b. Impellers shall be of wear resistant materials as specified above.

2. SECTION 13300, INSTRUMENTATION AND CONTROL SYSTEM – GENERAL

   A. Page 13300-5, ARTICLE 1.08 – WARRANTY, delete Paragraph B. in its entirety and replace with the following new paragraph:

      B. Equipment Manufacturer – Not Used

CHANGES TO BE MADE TO THE CONTRACT DRAWINGS

1. DRAWING 02 C-401, PUMP STATION NO. 2 SITE PLAN

   A. Walkway Section A-A, add the following notes;

      Notes:

      1. Color shall be selected by Engineer from the Aerospace Material Specification - Standard 595A color index https://federalstandardcolor.com/
      2. The Sandstone Colored Concrete Access Drive Section shall be the same as the Walkway Section except for the width.

CHANGES TO BE MADE TO THE CONTRACT ATTACHMENTS

None

END OF ADDENDUM NO. 6

March 14, 2020

ADDENDUM NO. 7

TO

DOCUMENTS AND SPECIFICATIONS

FOR

Downtown Area Collection System and Pumping Stations

Contract No. 2019-02 and SRF No. 4486

Town of Orleans, MA

Department of Public Works & Natural Resources

This Addendum No. 7 forms a part of the Contract Documents and modifies the Bidding Documents dated January 2020 as noted below. Acknowledge receipt of this Addendum in the space provided in SECTION 00410, FORM OF GENERAL BID. Failure to do so may subject the Bidder to disqualification.

This Addendum consists of 2 pages and 16 pages of attachments for a total of 18 pages.

ATTACHMENTS

None

CHANGES TO BE MADE TO THE CONTRACT SPECIFICATIONS

1. SECTION 00410, FORM OF GENERAL BID

   A. Delete "Orleans_MA-2019-02-Bid Form_Add_4-03-06-20" in its entirety and replace with the attached new "Orleans_MA-2019-02-Bid Form_Add_7-03-16-20" in both hard copy and Microsoft Excel format.

2. SECTION 01025, MEASUREMENT AND PAYMENT

   A. Page 01025-10, ITEM 15 – PAVEMENT RESTORATION, Paragraph A., remove the words "infra-red heat treatment of bituminous concrete joints," in their entirety.

   B. Page 01025-10, ITEM 15 – PAVEMENT RESTORATION, Paragraph B., add the following new subparagraph:

      6. Payment limits for pavement restoration specified above supersede the MassDEP Policy Memorandum CG-8.

3. SECTION 01030, SPECIAL REQUIREMENTS

   A. Page 01030-5, ARTICLE 1.11 - SCOPE OF WORK AND SEQUENCE OF CONSTRUCTION, Paragraph 9, subparagraph a. (3), delete the last sentence of the subparagraph and replace with the following new sentence:

      Permanent trench pavement shall occur between 90 to 180 days after pipeline installation subject to OWNER and MassDOT approval.

B. Page 01030-5, ARTICLE 1.11 - SCOPE OF WORK AND SEQUENCE OF CONSTRUCTION, Paragraph 9, subparagraph a. (3), delete the last sentence of the subparagraph and replace with the following new sentence:

   Mill and overlay shall be occur following the completion of the permanent trench pavement subject to OWNER and MassDOT approval.

C. Page 01030-5, ARTICLE 1.11 - SCOPE OF WORK AND SEQUENCE OF CONSTRUCTION, Paragraph 9, subparagraph b. (3), delete the last sentence of the subparagraph and replace with the following new sentence:

   Permanent trench pavement shall occur between 90 to 180 days after pipeline installation subject to OWNER approval.

D. Page 01030-5, ARTICLE 1.11 - SCOPE OF WORK AND SEQUENCE OF CONSTRUCTION, Paragraph 9, subparagraph b. (4), delete the last sentence of the subparagraph and replace with the following new sentence:

   Mill and overlay shall be occur following the completion of the permanent trench pavement subject to OWNER approval.

CHANGES TO BE MADE TO THE CONTRACT DRAWINGS

None.

CHANGES TO BE MADE TO THE CONTRACT ATTACHMENTS

None

END OF ADDENDUM NO. 7

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS			
1.	For Mobilization/Demobilization, as specified (maximum of five (5) percent of System Expansion bid), the sum of $ -	l.s.	1	$ -
2.A.	For furnishing and installing 1-1/2-inch through 2-inch, inclusive, Polyvinyl Chloride/High Density Polyethylene Low Pressure Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	2,030	$ -
2.B.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Less Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	7,000	$ -
2.C.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Greater Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	13,750	$ -
2.D.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,950	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.E.	For furnishing and installing 12-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	2,410	$ -
2.F.	For furnishing and installing 18-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,900	$ -
2.G.	For furnishing and installing 6-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	3,060	$ -
2.H.	For furnishing and installing 8-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	710	$ -
2.I.	For furnishing and installing 8-inch PVC Effluent Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	3,590	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.J.	For furnishing and installing 1-1/4-inch Polyvinyl Chloride Low-Pressure Sewer Service Connections and Associated Fittings from main line to property line, All Depths, as specified, the sum of $ -	per l.f.	600	$ -
2.K.	For furnishing and installing 6-inch Polyvinyl Chloride Service Connections and Associated Fittings from main line to property line as specified, the sum of $ -	per l.f.	6,100	$ -
2.L.	For furnishing and installing LPS Wyes, All Depths, as specified, the sum of $ -	per each	21	$ -
2.M.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	109	$ -
2.N.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	12	$ -
2.O.	For furnishing and installing 12-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	11	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.P.	For furnishing and installing 18-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	18	$ -
2.Q.	For furnishing and installing Low Pressure Sewer Main Line Valves, All Sizes and Depths, as specified, the sum of $ -	per each	4	$ -
3.A.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Less Than 10 feet in Depth, the sum of $ -	per each	24	$ -
3.B.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Greater Than 10 feet in Depth, the sum of $ -	per each	102	$ -
3.C.	For furnishing and installing 5-foot Diameter Precast Concrete Sewer Manholes, All Depths, as specified, the sum of $ -	per each	9	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
3.D.	For furnishing and installing 6-foot Diameter Precast Concrete Low Pressure Sewer Terminal Flushing Manholes, All Depths, as specified, the sum of $ -	per each	5	$ -
3.E.	For furnishing and installing 6-foot Diameter Precast Concrete Effluent Force Main In-Line Flushing Manholes, All Depths, as specified, the sum of $ -	per each	1	$ -
3.F.	For furnishing and installing 6-foot Diameter Precast Concrete Leaching Catch Basins with Grates, All Depths, as specified, the sum of $ -	per each	4	$ -
4.A.	For furnishing and installing Standard Manhole Frames and Covers, as specified, the sum of $ -	per each	108	$ -
4.B.	For furnishing and installing Bolted and Gasketed Manhole Frames and Covers, as specified, the sum of $ -	per each	37	$ -
5.	For furnishing and installing Interior Manhole Drop Connections, as specified, the sum of $ -	per v.f.	80	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
6.	For furnishing and installing chimneys, as specified, the sum of $ -	per v.f.	490	$ -
7.	For furnishing and placing miscellaneous cement concrete, as specified, the sum of $ -	per c.y.	440	$ -
8.	For Rock and Boulder Excavation including Replacement with Suitable Fill Material, as specified, the sum of * $ - * Minimum Bid = $80/c.y.	per c.y.	550	$ -
9.A.	For Replacement of Unsuitable Material Below Trench Grade and/or Subgrade, as specified, the sum of $ -	per c.y.	820	$ -
9.B.	For Replacement of Unsuitable Material Above Trench Grade, as specified, the sum of $ -	per c.y.	1,630	$ -
10.	For Experimental Excavation, as specified, the sum of $ -	per c.y.	440	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
11	Fill for embankments – Not Used			
12.	Sheeting and/or shoring ordered left in place – Not Used			
13.	For performing Soil Compaction Tests, as specified, the sum of $ -	per each	150	$ -
14.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	10,740	$ -
15.A.	For furnishing and placing 3-inch Temporary Bituminous Concrete Trench Pavement (base course), as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	5,320	$ -
15.B.	For furnishing and placing 7-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in State Roadways, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	4,060	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.C.	For milling and furnishing and placing 2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in State Roadways, as specified, the sum of *			
	$ -	per ton	6,050	$ -
	* Minimum Bid = $80/ton			
15.D.	For furnishing and placing 4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	480	$ -
	* Minimum Bid = $80/ton			
15.E.	For furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (base course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	490	$ -
	* Minimum Bid = $80/ton			
15.F.	For furnishing and placing Dense Graded Gravel, as specified, the sum of			
	$ -	per c.y.	350	$ -
15.G.	For furnishing and placing 4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	4,460	$ -
	* Minimum Bid = $80/ton			

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.H.	For milling and furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	7,050	$ -
	* Minimum Bid = $80/ton			
15.I.	For Miscellaneous Restoration of State and Town Roadways, as specified, the sum of *			
	$ -	per ton	550	$ -
	* Minimum Bid = $80/ton			
15.J.	For furnishing and placing Miscellaneous Bituminous Concrete Pavement, as specified, the sum of *			
	$ -	per ton	660	$ -
	* Minimum Bid = $80/ton			
15.K.	For repair and/or replacement of the Vehicle Loop Detectors, as specified, the sum of			
	$ -	per each	20	$ -
15.L.	For repainting of Traffic Markings - Lines, Symbols and Wording, as specified, the sum of			
	Seventy Five Thousand Dollars and No Cents $ 75,000.00	Allowance	1	$ 75,000.00
16.A.	For removal and relaying and/or replacement of Existing Water Mains, associated fittings, valves and services, as specified, the sum of			
	$ -	per inch-foot	12,000	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
16.B.	For removal and relaying and/or replacement of Existing Storm Drains, as specified, the sum of $ -	per inch-foot	20,000	$ -
16.C.	For removal and relaying and/or replacement of Existing Gas Mains and services, as specified, the sum of One Hundred Thousand Dollars and No Cents $ 100,000.00	Allowance	1	$ 100,000.00
16.D.	For removal and relaying and/or replacement of Existing Miscellaneous Utilities, as specified, the sum of Seventy Five Thousand Dollars and No Cents $ 75,000.00	Allowance	1	$ 75,000.00
16.E.	For furnishing and removal of 6-inch Water Main Line Stops, as specified, the sum of $ -	per each	1	$ -
16.F.	For furnishing and removal of 8-inch Water Main Line Stops, as specified, the sum of $ -	per each	18	$ -
16.G.	For furnishing and removal of 10-inch Water Main Line Stops, as specified, the sum of $ -	per each	1	$ -
17.	Uniformed Traffic Police Officers - Paid by Owner			
18.A.	For furnishing, installing, and removing Engineer's Field Office, as specified, the sum of $ -	per l.s.	1	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
18.B.	For maintaining Engineer's Field Office, as specified, the sum of $ -	per week	91	$ -
19.	For furnishing, installing, maintaining and removing Environmental Protection, as specified, the sum of $ -	per l.s.	2,830	$ -
20.	For furnishing, installing, maintaining and removing Trench Dewatering Equipment, as specified, the sum of $ -	per l.f.	11,220	$ -
21.	Temporary By-pass Pumping - Not Used			
22.A.	For furnishing and installing Highway Crossing, as specified, the sum of $ -	per l.s.	1	$ -
22.B.	For MassDOT Inspections, as specified, the sum of Ten Thousand Dollars and No Cents $ 10,000.00	Allowance	1	$ 10,000.00
23.A.	For furnishing and installing Pumping Station No. 1, as specified, the sum of $ -	per l.s.	1	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
23.B.	For furnishing and installing Pumping Station No. 2, as specified, the sum of $ -	per l.s.	1	$ -
23.C.	For furnishing and installing Pumping Station No. 3, as specified, the sum of $ -	per l.s.	1	$ -
23.D.	For Electric Company Connection/Service Fee, as specified, the sum of One Hundred Twenty Five Thousand Dollars and No Cents $ 125,000.00	Allowance	1	$ 125,000.00
23.E.	For Telephone Company Connection/Service Fee, as specified, the sum of Thirty Thousand Dollars and No Cents $ 30,000.00	Allowance	1	$ 30,000.00
23.F.	For Planting Operations, as specified, the sum of Thirty Thousand Dollars and No Cents $ 30,000.00	Allowance	1	$ 30,000.00
24.	For furnishing and installing Tracer Wire in State Roadways, All Depths, as specified, the sum of $ -	l.f.	15,000	$ -
TOTAL AMOUNT OF BID (SRF ELIGIBLE BID ITEMS) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF (Bid Items 1 through 24, inclusive).				**$ -**

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	ALTERNATIVES			
A-1A.	For furnishing and installing 4-inch Fiber Optic Conduits and Associated Fittings, All Depths, as specified, the sum of $ -	l.f.	3,590	$ -
A-1B.	For furnishing and installing Fiber Optic Handhole, All Depths, as specified, the sum of $ -	ea.	10	$ -
A-2.	For furnishing and installing Tracer Wire in Town Roadways All Depths, as specified, the sum of $ -	l.f.	28,100	$ -
	TOTAL AMOUNT OF BID (ALTERNATIVE BID ITEMS) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF (Bid Items A-1 through A-2., inclusive).			**$** -
	SRF INELIGIBLE BID ITEMS			
	Item B-1 - Replacement of Water Services			
B-1A.	For furnishing and installing 1-inch Polyvinyl Chloride Water Services and Associated Fittings from water main to property line as specified, the sum of $ -	per l.f.	2,040	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
B-1B.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	480	$ -
B-1C	For furnishing and placing Temporary Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	290	$ -
B-1D.	For furnishing and placing Permanent Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	100	$ -
	Item B-1 - Replacement of Water Services (Bid Items B-1A. through B-1D., inclusive)			**$ -**
Item B-2 - Replacement of Canal Road Water Main				
B-2A.	For furnishing and installing 8-inch DI water main and Associated Fittings, as specified, the sum of $ -	per l.f.	2,060	$ -
B-2B.	For furnishing and installing 1-inch Polyvinyl Chloride Water Services and Associated Fittings from water main to property line as specified, the sum of $ -	per l.f.	320	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
B-2C.	For furnishing and installing 6-inch Gate Valves and Boxes, as specified, the sum of $ -	per each	6	$ -
B-2D.	For furnishing and installing 8-inch Gate Valves and Boxes, as specified, the sum of $ -	per each	7	$ -
B-2E.	For furnishing and installing Fire Hydrants, as specified, the sum of $ -	per each	6	$ -
B-2F.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	560	$ -
B-2G.	For furnishing and placing Temporary Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	340	$ -
B-2H.	For furnishing and placing Permanent Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	120	$ -
	Item B-2 - Replacement of Canal Road Water Main (Bid Items B-2A. through B-2H., inclusive)			**$ -**

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
Item B-3 - Water Quality Improvements				
B-3A.	For Brewster Cross Road Water Quality Improvements, as specified, the sum of			
	$ -	per l.s.	1	$ -
B-3B.	For Locust Road Water Quality Improvements, as specified, the sum of			
	$ -	per l.s.	1	$ -
	Item B-2 - Water Quality Improvements (Bid Items B-3A. through B-3B., inclusive)			**$ -**

TOTAL AMOUNT OF BID (SRF INELIGIBLE BID ITEMS) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF (Bid Items B-1 through B-3, inclusive).

$ -

Note: Funding for the SRF Ineligible Bid Items is anticipated to be obtained at the Annual Town Meeting proposed to be held in May 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.

BASIS OF AWARD

BASIS OF AWARD = TOTAL AMOUNT SRF ELIGIBLE BID ITEMS BASED ON ENGINEER'S ESTIMATE OF QUANTITIES (Bid Items 1 through 24, inclusive) + TOTAL AMOUNT OF ALTERNATIVES BID ITEMS BASED ON ENGINEER'S ESTIMATE OF QUALTITIES (Bit Items A-1 throguh A-2, inclusive) + TOTAL AMOUNT OF SRF INELIGIBLE BID ITEMS BASED ON ENGINEER'S ESTIMATE OF QUANTITIES (Bid Items B-1 through B-3, inclusive).

$ -

March 17, 2020

ADDENDUM NO. 8

TO

DOCUMENTS AND SPECIFICATIONS

FOR

Downtown Area Collection System and Pumping Stations

Contract No. 2019-02 and SRF No. 4486

Town of Orleans, MA

Department of Public Works & Natural Resources

This Addendum No. 8 forms a part of the Contract Documents and modifies the Bidding Documents dated January 2020 as noted below. Acknowledge receipt of this Addendum in the space provided in SECTION 00410, FORM OF GENERAL BID. Failure to do so may subject the Bidder to disqualification.

This Addendum consists of 6 pages and 16 pages of attachments for a total of 22 pages.

ATTACHMENTS

None

CHANGES TO BE MADE TO THE CONTRACT SPECIFICATIONS

1. SECTION 00100, ADVERTISEMENT FOR BIDS

   A. Page 00100-1, Paragraph 3., first subparagraph, delete the words "…until 11:00 a.m. prevailing time, on March 18, 2020 at which time and place…" and replace with the words "…until 11:00 a.m. prevailing time, on April 1, 2020 at which time and place…".

2. SECTION 00410, FORM OF GENERAL BID

   A. Delete "Orleans_MA-2019-02-Bid Form_Add_4-03-14-20" in its entirety and replace with the attached new "Orleans_MA-2019-02-Bid Form_Add_8-03-17-20" in both hard copy and Microsoft Excel format.

3. SECTION 01025, MEASUREMENT AND PAYMENT

   A. Page 01025-10, ITEM 15 – PAVEMENT RESTORATION, Paragraph B., delete the paragraph in its entirety and replace with the following new paragraph:

      B. Measurement. Measurement for pavement restoration shall be as follows:

         1. Temporary Bituminous Concrete Trench Pavement. – Not Used

2. Permanent Bituminous Concrete Trench Pavement

    a. Measurement for Permanent Bituminous Concrete Trench Pavement shall be based on the horizontal measured length of main line trench defined as the length of roadway disturbed by the main line Work from centerline of manhole to centerline of manhole. Measurement shall be by the linear foot with no deductions made for manholes, fittings or valves.

    b. Measurement for Permanent Bituminous Concrete Trench Pavement shall be based on the horizontal measured length of service trench defined as the length of roadway surface disturbed by the service line Work less three (3) feet from the centerline of the main sewer or water pipeline trench. Measurement shall be by the linear foot with no deductions made for fittings or valves.

    c. Measurement for Permanent Bituminous Concrete Trench Pavement for trenches with more than one (1) pipe laid in the same trench shall be treated as a common trench, unless otherwise approved by the Engineer.

3. Permanent Bituminous Concrete Full Width Overlay Pavement. Measurement for Permanent Bituminous Concrete Full Width Overlay Pavement with or without milling will be made based on either: (a) Certified weight slips delivered daily to the Engineer or (b) the actual length and width of roadway overlaid as approved by the Engineer.

4. Dense Graded Gravel

    a. Measurement for dense graded gravel shall be defined as the length of roadway surface disturbed by the width of the roadway. Measurement shall be by the linear foot with no deductions made for manholes, fittings or valves.

    b. Measurement for Permanent Bituminous Concrete Trench Pavement for trenches with more than one (1) pipe laid in the same trench shall be treated as a common trench, unless otherwise approved by the Engineer.

5. Miscellaneous Bituminous Concrete. Measurement for Miscellaneous Bituminous Concrete placed where directed by the Engineer shall be by the ton based on certified weight slips delivered daily to the Engineer.

6. Replacement of Vehicle Loop Detectors. Measurement for Replacement of Vehicle Loop Detectors shall be based on each location replaced as approved by the Engineer and MassDOT. Each location paid for shall be for the vehicle loop detector replaced following Permanent Bituminous Concrete Trench Pavement and replaced following Permanent Bituminous Concrete Full Width Overlay Pavement.

7. Repainting of Traffic Markings. Refer to SECTION 01020, ALLOWANCES.

B. Page 01025-10, ITEM 15 – PAVEMENT RESTORATION, Paragraph C., delete the paragraph in its entirety and replace with the following new paragraph:

C. Payment

1. Temporary Bituminous Concrete Trench Pavement – Not Used

2. Permanent Bituminous Concrete Trench Pavement. Payment for Permanent Bituminous Concrete Trench Pavement whether placed by machine or by hand listed in DOCUMENT 00410, FORM OF GENERAL BID will be made at the unit price bid per linear foot under the applicable divisions of this Bid Item.

3. Permanent Bituminous Concrete Full Width Pavement. Payment for Permanent Bituminous Concrete Full Width Pavement including milling, if applicable, listed in DOCUMENT 00410, FORM OF GENERAL BID will be made at the unit price bid per ton under the applicable divisions of this Bid Item.

    1. The factor of 0.055 tons per square yard per inch of thickness shall be used for weight-volume conversions for bituminous concrete.

    2. Certified weight slips for all bituminous concrete delivered to the site(s) and certified volume slips for all controlled density fill delivered to the site(s) shall be submitted to the Engineer on a daily basis.

3. Payment for furnishing and placing permanent bituminous concrete pavement shall be made at the unit price bid per ton computed using one of the following methods:

    a. Method 1 (Measured in Place): The Engineer shall multiply the pavement area by the specified pavement thickness by the factor to obtain the tonnage of bituminous concrete.

    b. Method 2 (Delivered): Certified weight slips shall be used. Any bituminous concrete placed outside the payment limits, unless approved by the Engineer, shall be deducted (using Method 1) from the total tonnage obtained from the certified weight slips.

    c. Payment for furnishing and placing temporary and permanent bituminous concrete will be made based on the number of tons obtained using either Method 1 or Method 2, whichever is less.

4. Miscellaneous Bituminous Concrete. Payment for Miscellaneous Bituminous Concrete whether placed by machine or by hand, for leveling of existing roadways, driveway aprons, sidewalks, repairs to roadways used for detours, and other areas outside the trench limits listed in DOCUMENT 00410, FORM OF GENERAL BID will be made at the unit price bid per ton.

5. Dense Graded Gravel. Payment for furnishing and placing dense graded gravel listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid per cubic yard under this Bid Item.

6. Vehicle Loop Detectors. Payment for replacement of vehicle loop detectors listed in DOCUMENT 00410, FORM OF GENERAL BID shall be at the unit price bid per each location under this Bid Item.

7. Repainting of Traffic Markings. Refer to SECTION 01020, ALLOWANCES.

8. Price Adjustment - Liquid Asphalt, Diesel, Gasoline and Portland Cement

    a. The intent of this provision is to insure adequate and fair compensation for unpredictable and fluctuating costs which, from time to time, occur in the prices of Liquid Asphalt, Diesel Fuel, Gasoline and Portland Cement. The price adjustment provisions are made part of the Contract to assure more realistic bidding and encourage competition. Price Adjustments will be based on the variance in price, for the material component only, between the Base Price and the Period Price. They shall not include transportation or other charges. Price Adjustments will occur on a monthly basis for Liquid Asphalt and at the end of the Project for Diesel Fuel, Gasoline and Portland Cement.

    b. Base Price - The Base Price of liquid asphalt on a project is a fixed price determined by the MassDOT at the time of the bid using the same method as the determination of the Period Price detailed below. The Base Price shall be used in all bids.

        The December 2019 base prices are as follows: diesel fuel at $2.390 per gallon and gasoline at $2.060 per gallon. The January 2020 base prices are as follows: liquid asphalt at $535.00 per ton and Portland cement at $130.26 per ton. MassDOT posts the Price Adjustments on their Highway Division's website at https://www.mass.gov/service-details/2019-massdot-contract-price-adjustments under the following link sequences: (1) Doing Business With Us; (2) Construction; and (3) Price Adjustments.

        1) Hot Mix Asphalt

            a) Period Price - The Period Price is the price of liquid asphalt for each monthly period as determined by the MassDOT using the average selling price per standard ton of PG64-28 paving grade (primary binder classification) asphalt, FOB manufacturer's terminal, as listed under the "East Coast Market - New England, Boston, Massachusetts area" section of the Poten & Partners, Inc. "Asphalt Weekly Monitor". This average selling price is listed in the issue having a publication date of the second Friday of the month and will be posted as the Period Price for that month. The MassDOT will post this Period Price on its website at http://www.mhd.state.ma.us/ within two (2) business days following its receipt of the relevant issue of the "Asphalt Weekly Monitor". Poten and Partners has granted the MassDOT the right to publish this specific asphalt price information sourced from the Asphalt Weekly Monitor. This method of period price determination was formerly called the New Asphalt Period Price Method. Separate website postings using both the New Asphalt Period Price Method and the Old Asphalt Period Price Method were discontinued after June 2013.

b) Price Adjustment Determination, Calculation and Payment - Price Adjustments, as herein provided, either upwards or downwards, will be made after the work has been performed using the monthly period price for the month during which the work was performed. Price Adjustments will be paid only if the variance from the Base Price is 5 percent or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5 percent from either upward or downward adjustments. The Price Adjustment applies only to the actual virgin liquid asphalt content in the mixture placed on the job in accordance with the Standard Specifications for Highways and Bridges, Division III, Section M3.11.03. No adjustment will be paid for work done beyond the completion date. Price Adjustments for a positive price adjustment (a payment) and a negative price adjustment (a deduction) will be calculated using the following equation:

c) Price Adjustment = Tons of HMA Placed x Liquid Asphalt Content % x RAP Factor x (Period Price - Base Price).

2) Diesel Fuel` and Gasoline

a) Price period - The Period Price will be the average of prices charged to the State, including State Tax for the bulk purchases made during each month.

b) Price Adjustment Determination, Calculation and Payment - Price Adjustments, as herein provided, either upwards or downwards, will be made after the work has been performed using the monthly period price for the month during which the work was performed. This adjustment will be based on fuel usage factors for various items of work developed by the Highway Research Board in Circular 158, dated July 1974. These factors will be multiplied by the quantities of work done in each item during each monthly period and further multiplied by the variance in price from the Base Price to the Period Price. The Base Price of Diesel Fuel and Gasoline will be the price as indicated in the Department's web site (www.MassDOT.state.ma.us) for the month in which the contract was bid, which includes State Tax. This adjustment will be affected only if the variance from the Base Price is 5 percent or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5 percent from either upward or downward adjustments. Any adjustment (increase or decrease) to estimated quantities made to each item at the time of final payment will have the fuel price adjustment figured at the average period price for the entire term of the project for the difference of quantity. No adjustment will be paid for work done beyond the completion date. The fuel price adjustment will apply only to the following items of work at the fuel factors shown:

SRF Eligible Bid Items Covered	Diesel Fuel	Gasoline
2. Sewer and Storm Drainage Pipelines and Associated Fittings	X	X
3. Precast Concrete Manholes and Structures	X	X
8. Rock and/or Boulder Excavation	X	X
9. Replacement of Unsuitable Material	X	X
10. Experimental Excavation	X	X
14. Road Gravel	X	X
15. Pavement Restoration	X	Does Not Apply

9. No additional payment will be made beyond the payment limits noted or for maintenance or repair of trenches.

10. Payment for joint sealant and/or tack coat shall be included under the applicable division of this Bid Item for bituminous concrete Work.

11. Payment for adjusting frames and covers, valve boxes and all other castings prior to placement of permanent bituminous concrete pavement shall be included under the applicable division of this Bid Item for bituminous concrete Work.

12. Payment for reshaping of roadways and/or road shoulders, roadway reclamation, regrading and compaction of roadway base course materials and or providing leveling course over settled trenches shall be included under the applicable division of this Bid Item for bituminous concrete Work.

4. SECTION 01030, SPECIAL REQUIREMENTS

A. Page 01030-5, ARTICLE 1.11 - SCOPE OF WORK AND SEQUENCE OF CONSTRUCTION, Paragraph F, subparagraph 2.c., delete the subparagraph in its entirety and replace with the following new subparagraph:

c. The Contractor is required to place Permanent Bituminous Concrete Trench Pavement each and every Friday. If Permanent Bituminous Concrete Pavement is not available, the Contractor shall place Hot Mix Pavement at no additional cost to the Owner and shall replace the Hot Mix Pavement once Permanent Bituminous Concrete Pavement is available.

B. Page 01030-5, ARTICLE 1.11 - SCOPE OF WORK AND SEQUENCE OF CONSTRUCTION, Paragraph F, subparagraph 2.b., delete the subparagraph in its entirety and replace with the following new subparagraph:

b. The Contractor is required to place Permanent Bituminous Concrete Trench Pavement each and every Friday.

C. Page 01030-5, ARTICLE 1.11 - SCOPE OF WORK AND SEQUENCE OF CONSTRUCTION, Paragraph F, subparagraph 3., delete the words "…infrastructure and temporary pavement restoration, the vehicle…" and replace with the words "…infrastructure and Permanent Bituminous Concrete Trench Pavement and/or Permanent Bituminous Concrete Full Width Pavement, the vehicle…".

D. Page 01030-5, ARTICLE 1.11 - SCOPE OF WORK AND SEQUENCE OF CONSTRUCTION, Paragraph F, subparagraph 7., delete the words "…compact and place temporary paving on the trenches at the end of each working day. However, in order to minimize the construction…" and replace with the words "…compact and place Permanent Bituminous Concrete Trench Pavement on the trenches at the end of each and every Friday. In addition, the Contractor is required to make all roadways passable at the end of each and every workday utilizing utilized Millings and/or Compacted Gravel (at no additional cost to the Owner), However, in order to minimize the construction …".

E. Page 01030-5, ARTICLE 1.11 - SCOPE OF WORK AND SEQUENCE OF CONSTRUCTION,

1. Paragraph F, subparagraph 9.a.(2), delete the subparagraph in its entirety and replace with the following new subparagraph:

(2) Temporary Trench Pavement – Not Used.

2. Paragraph F, subparagraph 9.a., delete the words "subparagraph in its entirety and replace with the following new subparagraph:

Permanent Bituminous Concrete Trench Pavement and Permanent Bituminous Concrete Full Width Pavement of State Roadways shall occur in the following locations:

3. Paragraph F, subparagraph 9.b.(2), delete the subparagraph in its entirety and replace with the following new subparagraph:

(2) Temporary Trench Pavement – Not Used.

4. Paragraph F, subparagraph 9.b., delete the words "subparagraph in its entirety and replace with the following new subparagraph:

Permanent Bituminous Concrete Trench Pavement and Permanent Bituminous Concrete Full Width Pavement of Local Roadways shall occur in the following locations:

5. Paragraph F, subparagraph 9.d.(2), delete the subparagraph in its entirety and replace with the following new subparagraph:

   (2) Temporary Trench Pavement – Not Used.

6. Paragraph F, subparagraph 9.d., delete the words "subparagraph in its entirety and replace with the following new subparagraph:

   Permanent Bituminous Concrete Trench Pavement and Permanent Bituminous Concrete Full Width Pavement of Local Roadways shall occur in all other locations not specified.

CHANGES TO BE MADE TO THE CONTRACT DRAWINGS

None.

CHANGES TO BE MADE TO THE CONTRACT ATTACHMENTS

None

END OF ADDENDUM NO. 8

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS			
1.	For Mobilization/Demobilization, as specified (maximum of five (5) percent of System Expansion bid), the sum of $ -	l.s.	1	$ -
2.A.	For furnishing and installing 1-1/2-inch through 2-inch, inclusive, Polyvinyl Chloride/High Density Polyethylene Low Pressure Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	2,030	$ -
2.B.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Less Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	7,000	$ -
2.C.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Greater Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	13,750	$ -
2.D.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,950	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.E.	For furnishing and installing 12-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	2,410	$ -
2.F.	For furnishing and installing 18-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,900	$ -
2.G.	For furnishing and installing 6-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	3,060	$ -
2.H.	For furnishing and installing 8-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	710	$ -
2.I.	For furnishing and installing 8-inch PVC Effluent Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	3,590	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.J.	For furnishing and installing 1-1/4-inch Polyvinyl Chloride Low-Pressure Sewer Service Connections and Associated Fittings from main line to property line, All Depths, as specified, the sum of $ -	per l.f.	600	$ -
2.K.	For furnishing and installing 6-inch Polyvinyl Chloride Service Connections and Associated Fittings from main line to property line as specified, the sum of $ -	per l.f.	6,100	$ -
2.L.	For furnishing and installing LPS Wyes, All Depths, as specified, the sum of $ -	per each	21	$ -
2.M.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	109	$ -
2.N.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	12	$ -
2.O.	For furnishing and installing 12-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	11	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.P.	For furnishing and installing 18-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	18	$ -
2.Q.	For furnishing and installing Low Pressure Sewer Main Line Valves, All Sizes and Depths, as specified, the sum of $ -	per each	4	$ -
3.A.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Less Than 10 feet in Depth, the sum of $ -	per each	24	$ -
3.B.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Greater Than 10 feet in Depth, the sum of $ -	per each	102	$ -
3.C.	For furnishing and installing 5-foot Diameter Precast Concrete Sewer Manholes, All Depths, as specified, the sum of $ -	per each	9	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
3.D.	For furnishing and installing 6-foot Diameter Precast Concrete Low Pressure Sewer Terminal Flushing Manholes, All Depths, as specified, the sum of $ -	per each	5	$ -
3.E.	For furnishing and installing 6-foot Diameter Precast Concrete Effluent Force Main In-Line Flushing Manholes, All Depths, as specified, the sum of $ -	per each	1	$ -
3.F.	For furnishing and installing 6-foot Diameter Precast Concrete Leaching Catch Basins with Grates, All Depths, as specified, the sum of $ -	per each	4	$ -
4.A.	For furnishing and installing Standard Manhole Frames and Covers, as specified, the sum of $ -	per each	108	$ -
4.B.	For furnishing and installing Bolted and Gasketed Manhole Frames and Covers, as specified, the sum of $ -	per each	37	$ -
5.	For furnishing and installing Interior Manhole Drop Connections, as specified, the sum of $ -	per v.f.	80	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
6.	For furnishing and installing chimneys, as specified, the sum of $ -	per v.f.	490	$ -
7.	For furnishing and placing miscellaneous cement concrete, as specified, the sum of $ -	per c.y.	440	$ -
8.	For Rock and Boulder Excavation including Replacement with Suitable Fill Material, as specified, the sum of * $ - * Minimum Bid = $80/c.y.	per c.y.	550	$ -
9.A.	For Replacement of Unsuitable Material Below Trench Grade and/or Subgrade, as specified, the sum of $ -	per c.y.	820	$ -
9.B.	For Replacement of Unsuitable Material Above Trench Grade, as specified, the sum of $ -	per c.y.	1,630	$ -
10.	For Experimental Excavation, as specified, the sum of $ -	per c.y.	440	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
11	Fill for embankments – Not Used			
12.	Sheeting and/or shoring ordered left in place – Not Used			
13.	For performing Soil Compaction Tests, as specified, the sum of $ -	per each	150	$ -
14.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	10,740	$ -
15.A.	For furnishing and placing 3-inch Temporary Bituminous Concrete Trench Pavement (base course) - Not Used			
15.B.	For furnishing and placing 7-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in State Roadways, as specified, the sum of $ -	per l.f.	9,000	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.C.	For milling and furnishing and placing 2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in State Roadways, as specified, the sum of *			
	$ -	per ton	4,440	$ -
	* Minimum Bid = $80/ton			
15.D.	For furnishing and placing 4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	440	$ -
	* Minimum Bid = $80/ton			
15.E.	For furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (base course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	430	$ -
	* Minimum Bid = $80/ton			
15.F.	For furnishing and placing Dense Graded Gravel, as specified, the sum of			
	$ -	per c.y.	360	$ -
15.G.	For furnishing and placing 4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways, as specified, the sum of			
	$ -	per l.f.	25,000	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.H.	For milling and furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	4,900	$ -
	* Minimum Bid = $80/ton			
15.I.	For Miscellaneous Restoration of State and Town Roadways, as specified, the sum of *			
	$ -	per ton	550	$ -
	* Minimum Bid = $80/ton			
15.J.	For furnishing and placing Miscellaneous Bituminous Concrete Pavement, as specified, the sum of *			
	$ -	per ton	440	$ -
	* Minimum Bid = $80/ton			
15.K.	For repair and/or replacement of the Vehicle Loop Detectors, as specified, the sum of			
	$ -	per each	20	$ -
15.L.	For repainting of Traffic Markings - Lines, Symbols and Wording, as specified, the sum of			
	Seventy Five Thousand Dollars and No Cents			
	$ 75,000.00	Allowance	1	$ -
16.A.	For removal and relaying and/or replacement of Existing Water Mains, associated fittings, valves and services, as specified, the sum of			
	$ -	per inch-foot	12,000	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
16.B.	For removal and relaying and/or replacement of Existing Storm Drains, as specified, the sum of $ -	per inch-foot	20,000	$ -
16.C.	For removal and relaying and/or replacement of Existing Gas Mains and services, as specified, the sum of One Hundred Thousand Dollars and No Cents $ 100,000.00	Allowance	1	$ -
16.D.	For removal and relaying and/or replacement of Existing Miscellaneous Utilities, as specified, the sum of Seventy Five Thousand Dollars and No Cents $ 75,000.00	Allowance	1	$ -
16.E.	For furnishing and removal of 6-inch Water Main Line Stops, as specified, the sum of $ -	per each	1	$ -
16.F.	For furnishing and removal of 8-inch Water Main Line Stops, as specified, the sum of $ -	per each	18	$ -
16.G.	For furnishing and removal of 10-inch Water Main Line Stops, as specified, the sum of $ -	per each	1	$ -
17.	Uniformed Traffic Police Officers - Paid by Owner			
18.A.	For furnishing, installing, and removing Engineer's Field Office, as specified, the sum of $ -	per l.s.	1	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
18.B.	For maintaining Engineer's Field Office, as specified, the sum of $ -	per week	91	$ -
19.	For furnishing, installing, maintaining and removing Environmental Protection, as specified, the sum of $ -	per l.s.	2,830	$ -
20.	For furnishing, installing, maintaining and removing Trench Dewatering Equipment, as specified, the sum of $ -	per l.f.	11,220	$ -
21.	Temporary By-pass Pumping - Not Used			
22.A.	For furnishing and installing Highway Crossing, as specified, the sum of $ -	per l.s.	1	$ -
22.B.	For MassDOT Inspections, as specified, the sum of Ten Thousand Dollars and No Cents $ 10,000.00	Allowance	1	$ -
23.A.	For furnishing and installing Pumping Station No. 1, as specified, the sum of $ -	per l.s.	1	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
23.B.	For furnishing and installing Pumping Station No. 2, as specified, the sum of $ -	per l.s.	1	$ -
23.C.	For furnishing and installing Pumping Station No. 3, as specified, the sum of $ -	per l.s.	1	$ -
23.D.	For Electric Company Connection/Service Fee, as specified, the sum of One Hundred Twenty Five Thousand Dollars and No Cents $ 125,000.00	Allowance	1	$ -
23.E.	For Telephone Company Connection/Service Fee, as specified, the sum of Thirty Thousand Dollars and No Cents $ 30,000.00	Allowance	1	$ -
23.F.	For Planting Operations, as specified, the sum of Thirty Thousand Dollars and No Cents $ 30,000.00	Allowance	1	$ -
24.	For furnishing and installing Tracer Wire in State Roadways, All Depths, as specified, the sum of $ -	l.f.	15,000	$ -
TOTAL AMOUNT OF BID (SRF ELIGIBLE BID ITEMS) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF (Bid Items 1 through 24, inclusive).				**$ -**

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	ALTERNATIVES			
A-1A.	For furnishing and installing 4-inch Fiber Optic Conduits and Associated Fittings, All Depths, as specified, the sum of $ -	l.f.	3,590	$ -
A-1B.	For furnishing and installing Fiber Optic Handhole, All Depths, as specified, the sum of $ -	ea.	10	$ -
A-2.	For furnishing and installing Tracer Wire in Town Roadways All Depths, as specified, the sum of $ -	l.f.	28,100	$ -
	TOTAL AMOUNT OF BID (ALTERNATIVE BID ITEMS) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF (Bid Items A-1 through A-2., inclusive).			**$ -**
	SRF INELIGIBLE BID ITEMS			
	Item B-1 - Replacement of Water Services			
B-1A.	For furnishing and installing 1-inch Polyvinyl Chloride Water Services and Associated Fittings from water main to property line as specified, the sum of $ -	per l.f.	2,040	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
B-1B.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	480	$ -
B-1C	For furnishing and placing Temporary Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	290	$ -
B-1D.	For furnishing and placing Permanent Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	100	$ -
	Item B-1 - Replacement of Water Services (Bid Items B-1A. through B-1D., inclusive)			**$ -**
Item B-2 - Replacement of Canal Road Water Main				
B-2A.	For furnishing and installing 8-inch DI water main and Associated Fittings, as specified, the sum of $ -	per l.f.	2,060	$ -
B-2B.	For furnishing and installing 1-inch Polyvinyl Chloride Water Services and Associated Fittings from water main to property line as specified, the sum of $ -	per l.f.	320	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
B-2C.	For furnishing and installing 6-inch Gate Valves and Boxes, as specified, the sum of $ -	per each	6	$ -
B-2D.	For furnishing and installing 8-inch Gate Valves and Boxes, as specified, the sum of $ -	per each	7	$ -
B-2E.	For furnishing and installing Fire Hydrants, as specified, the sum of $ -	per each	6	$ -
B-2F.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	560	$ -
B-2G.	For furnishing and placing Temporary Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	340	$ -
B-2H.	For furnishing and placing Permanent Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	120	$ -
	Item B-2 - Replacement of Canal Road Water Main (Bid Items B-2A. through B-2H., inclusive)			**$ -**

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
Item B-3 - Water Quality Improvements				
B-3A.	For Brewster Cross Road Water Quality Improvements, as specified, the sum of			
	$ -	per l.s.	1	$ -
B-3B.	For Locust Road Water Quality Improvements, as specified, the sum of			
	$ -	per l.s.	1	$ -
	Item B-2 - Water Quality Improvements (Bid Items B-3A. through B-3B., inclusive)			**$ -**

TOTAL AMOUNT OF BID (SRF INELIGIBLE BID ITEMS) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF (Bid Items B-1 through B-3, inclusive).

$ -

Note: **Funding for the SRF Ineligible Bid Items is anticipated to be obtained at the Annual Town Meeting proposed to be held in May 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

BASIS OF AWARD

BASIS OF AWARD = TOTAL AMOUNT SRF ELIGIBLE BID ITEMS BASED ON ENGINEER'S ESTIMATE OF QUANTITIES (Bid Items 1 through 24, inclusive) + TOTAL AMOUNT OF ALTERNATIVES BID ITEMS BASED ON ENGINEER'S ESTIMATE OF QUALTITIES (Bit Items A-1 throguh A-2, inclusive) + TOTAL AMOUNT OF SRF INELIGIBLE BID ITEMS BASED ON ENGINEER'S ESTIMATE OF QUANTITIES (Bid Items B-1 through B-3, inclusive).

$ -

March 24, 2020

ADDENDUM NO. 9

TO

DOCUMENTS AND SPECIFICATIONS

FOR

Downtown Area Collection System and Pumping Stations

Contract No. 2019-02 and SRF No. 4486

Town of Orleans, MA

Department of Public Works & Natural Resources

This Addendum No. 9 forms a part of the Contract Documents and modifies the Bidding Documents dated January 2020 as noted below. Acknowledge receipt of this Addendum in the space provided in SECTION 00410, FORM OF GENERAL BID. Failure to do so may subject the Bidder to disqualification.

This Addendum consists of 4 pages and 62 pages of attachments for a total of 66 pages.

ATTACHMENTS

1. Orleans_MA-2019-02-Bid Form_Add_9-03-24-20
2. SECTION 01025, MEASUREMENT AND PAYMENT

CHANGES TO BE MADE TO THE CONTRACT SPECIFICATIONS

1. GENERAL
   A. General Bid Opening – April 22, 2020 at 2:00 p.m.
   B. The Bid Form in Excel Format can be downloaded from the Tighe & Bond website. May need to click on "pre-qualified" to access the Forms. Once obtain and in most cases a yellow bar will appear on the top of the screen labeled as "Security Warning". If this occurs, you must select the "Enable Content" button in order to properly utilize the file.
2. SECTION 00100, ADVERTISEMENT FOR BIDS
   A. Page 00100-1, Paragraph 3., first subparagraph, delete the words "…until 11:00 a.m. prevailing time, on April 1, 2020 at which time and place…" and replace with the words "…until 2:00 p.m. prevailing time, on April 22, 2020 at which time and place…".

3. ADDENDUM NO. 1

   A. CHANGES TO BE MADE TO THE CONTRACT DRAWINGS, Item 6, delete the words “02-C-401” and replace with the words “01 C-104”.

4. SECTION 00410, FORM OF GENERAL BID

   A. Delete “Orleans_MA-2019-02-Bid Form_Add_8-03-17-20” in its entirety and replace with the attached new “Orleans_MA-2019-02-Bid Form_Add_9-03-24-20” in both hard copy and Microsoft Excel format.

5. SECTION 00520, ATTACHMENT A - ADDITIONAL FORMS TO BE SUBMITTED WITH THE BID, PART A - INSURANCE REQUIREMENTS FOR INCLUSION IN ALL SPECIFICATIONS AND CONTRACTS

   A. Page 00520A-3, delete Item 2) in its entirety and replace with the following new item:

      2) X - "Broad Form" Comprehensive General Liability including, but not limited to, Bodily Injury, Personal Injury and Property Damage Liability, Full Contractual Liability and liability arising from Explosion, Collapse and Underground Damage and all other applicable insurance necessary to carry out the contractual obligation to proceed under the contract. Provide a minimum limit of liability of $5,000,000.00 utilizing: (a) a standalone certificate or (b) a minimum $2,000,000.00 General Liability Policy combined with Umbrella Policy.

   B. Page 00520A-3, delete Item 4) in its entirety and replace with the following new item:

      4) X - Builder's Risk - Amount of the General Contractor’s Contract

   C. Page 00520A-3, delete Item 5) in its entirety and replace with the following new item:

      5) ___ - Professional Liability/ Errors and Omissions - Not Required.

6. SECTION 01020, ALLOWANCES

   A. Page 01020-2, ARTICLE 1.05 - ALLOWANCES FOR PRODUCTS, delete Paragraph C. in its entirety and replace with the following new paragraph:

      C. The scheduled allowances are as follows:

SCHEDULED ALLOWANCES - SRF ELIGIBLE BID ITEMS - BASE BID

Item Number	Description	Amount	Bid Item
1	Traffic Markings	$25,000	15.L.
2	Removal and Relaying and/or Replacement of Existing Gas Mains and Services	$50,000	16.C.
3	Removal and Relaying and/or Replacement of Existing Miscellaneous Utilities	$50,000	16.D.
4	MassDOT Inspections	$10,000	22.B.
5	Electric Company Connection/Service Fee	$100,000	23.D.
6	Telephone Company Connection/Service Fee	$20,000	23.E.
7	Planting Operations	$20,000	23.F.

SCHEDULED ALLOWANCES - SRF ELIGIBLE BID ITEMS – ALTERNATIVES
Item A-1- Pavement Restoration in Town Roadways

Item Number	Description	Amount	Bid Item
1	Traffic Markings	$25,000	15.L.

SCHEDULED ALLOWANCES - SRF ELIGIBLE BID ITEMS – ALTERNATIVES
Item A-2 - Pumping Station No. 3 Tributary Area

Item Number	Description	Amount	Bid Item
1	Traffic Markings	$25,000	15.L.
2	Removal and Relaying and/or Replacement of Existing Gas Mains and Services	$50,000	16.C.
3	Removal and Relaying and/or Replacement of Existing Miscellaneous Utilities	$25,000	16.D.
4	Electric Company Connection/Service Fee	$25,000	23.D.
5	Telephone Company Connection/Service Fee	$10,000	23.E.
6	Planting Operations	$10,000	23.F.

7. SECTION 01025, MEASUREMENT AND PAYMENT

   A. Delete the section in its entirety and replace with the new section as attached.

CHANGES TO BE MADE TO THE CONTRACT DRAWINGS

None.

CHANGES TO BE MADE TO THE CONTRACT ATTACHMENTS

None

END OF ADDENDUM NO. 9

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Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - BASE BID			
1.	For Mobilization/Demobilization, as specified (maximum of five (5) percent of System Expansion bid), the sum of $ -	l.s.	1	$ -
2.A.	For furnishing and installing 1-1/2-inch through 2-inch, inclusive, Polyvinyl Chloride/High Density Polyethylene Low Pressure Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	930	$ -
2.B.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Less Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	3,930	$ -
2.C.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Greater Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	5,310	$ -
2.D.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	930	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.E.	For furnishing and installing 12-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	2,410	$ -
2.F.	For furnishing and installing 18-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,900	$ -
2.G.	For furnishing and installing 6-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	450	$ -
2.H.	For furnishing and installing 8-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	710	$ -
2.I.	For furnishing and installing 8-inch PVC Effluent Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	3,590	$ -
2.J.	For furnishing and installing 1-1/4-inch Polyvinyl Chloride Low-Pressure Sewer Service Connections and Associated Fittings from main line to property line, All Depths, as specified, the sum of $ -	per l.f.	170	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.K.	For furnishing and installing 6-inch Polyvinyl Chloride Service Connections and Associated Fittings from main line to property line as specified, the sum of $ -	per l.f.	3,270	$ -
2.L.	For furnishing and installing LPS Wyes, All Depths, as specified, the sum of $ -	per each	8	$ -
2.M.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	95	$ -
2.N.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	11	$ -
2.O.	For furnishing and installing 12-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	11	$ -
2.P.	For furnishing and installing 18-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	18	$ -
2.Q.	For furnishing and installing Low Pressure Sewer Main Line Valves, All Sizes and Depths, as specified, the sum of $ -	per each	2	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
3.A.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Less Than 10 feet in Depth, the sum of $ -	per each	11	$ -
3.B.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Greater Than 10 feet in Depth, the sum of $ -	per each	50	$ -
3.C.	For furnishing and installing 5-foot Diameter Precast Concrete Sewer Manholes, All Depths, as specified, the sum of $ -	per each	7	$ -
3.D.	For furnishing and installing 6-foot Diameter Precast Concrete Low Pressure Sewer Terminal Flushing Manholes, All Depths, as specified, the sum of $ -	per each	2	$ -
3.E.	For furnishing and installing 6-foot Diameter Precast Concrete Effluent Force Main In-Line Flushing Manholes, All Depths, as specified, the sum of $ -	per each	1	$ -
3.F.	For furnishing and installing 6-foot Diameter Precast Concrete Leaching Catch Basins with Grates, All Depths, as specified, the sum of $ -	per each	4	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
4.A.	For furnishing and installing Standard Manhole Frames and Covers, as specified, the sum of $ -	per each	72	$ -
4.B.	For furnishing and installing Bolted and Gasketed Manhole Frames and Covers, as specified, the sum o $ -	per each	3	$ -
5.	For furnishing and installing Interior Manhole Drop Connections, as specified, the sum of $ -	per v.f.	60	$ -
6.	For furnishing and installing chimneys, as specified, the sum of $ -	per v.f.	150	$ -
7.	For furnishing and placing miscellaneous cement concrete, as specified, the sum o $ -	per c.y.	240	$ -
8.	For Rock and Boulder Excavation including Replacement with Suitable Fill Material, as specified, the sum of $ - * Minimum Bid = $80/c.y.	per c.y.	300	$ -
9.A.	For Replacement of Unsuitable Material Below Trench Grade and/or Subgrade, as specified, the sum o $ -	per c.y.	420	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
9.B.	For Replacement of Unsuitable Material Above Trench Grade, as specified, the sum o			
	$ -	per c.y.	840	$ -
10.	For Experimental Excavation, as specified, the sum of			
	$ -	per c.y.	240	$ -
11	Fill for embankments – Not Used			
12.	Sheeting and/or shoring ordered left in place – Not Usec			
13.	For performing Soil Compaction Tests, as specified, the sum of			
	$ -	per each	80	$ -
14.	For furnishing and placing Road Gravel Material, as specified, the sum of			
	$ -	per c.y.	5,580	$ -
15.A.	3-inch Temporary Bituminous Concrete Trench Pavement (base course) - Not Usec			
15.B.	For furnishing and placing 7-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in State Roadways, as specified, the sum of *			
	$ -	per l.f.	5,320	$ -

* Minimum Bid = $80/ton

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.C.	For milling and furnishing and placing 2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in State Roadways, as specified, the sum of *			
	$ -	per ton	2,470	$ -
	* Minimum Bid = $80/ton			
15.D.	Not Used			
15.E.	1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (base course) in Town Roadways - Not Used			
15.F.	For furnishing and placing Dense Graded Gravel, as specified, the sum of			
	$ -	per c.y.	350	$ -
15.G.	For furnishing and placing 4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	4,460	$ -
	* Minimum Bid = $80/ton			
15.H.	1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways - Not Used			
15.I.	For Miscellaneous Restoration of State and Town Roadways, as specified, the sum of *			
	$ -	per ton	360	$ -
	* Minimum Bid = $80/ton			

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.J.	For furnishing and placing Miscellaneous Bituminous Concrete Pavement, as specified, the sum of $ - * Minimum Bid = $80/ton	per ton	230	$ -
15.K.	For repair and/or replacement of the Vehicle Loop Detectors, as specified, the sum o $ -	per each	10	$ -
15.L.	For repainting of Traffic Markings - Lines, Symbols and Wording, as specified, the sum of Twenty Five Thousand Dollars and No Cents $ 25,000.00	Allowance	1	$ 25,000.00
16.A.	For removal and relaying and/or replacement of Existing Water Mains, associated fittings, valves and services, as specified, the sum of $ -	per inch-foot	6,000	$ -
16.B.	For removal and relaying and/or replacement of Existing Storm Drains, as specified, the sum o $ -	per inch-foot	10,000	$ -
16.C.	For removal and relaying and/or replacement of Existing Gas Mains and services, as specified, the sum o Fifty Thousand Dollars and No Cents $ 50,000.00	Allowance	1	$ 50,000.00
16.D.	For removal and relaying and/or replacement of Existing Miscellaneous Utilities, as specified, the sum o Fifty Thousand Dollars and No Cents $ 50,000.00	Allowance	1	$ 50,000.00

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
16.E.	For furnishing and removal of 6-inch Water Main Line Stops, as specified, the sum of $ -	per each	1	$ -
16.F.	For furnishing and removal of 8-inch Water Main Line Stops, as specified, the sum of $ -	per each	11	$ -
16.G.	10-inch Water Main Line Stops - Not Used			
17.	Uniformed Traffic Police Officers - Paid by Owner			
18.A.	For furnishing, installing, and removing Engineer's Field Office, as specified, the sum of $ -	per l.s.	1	$ -
18.B.	For maintaining Engineer's Field Office, as specified, the sum of $ -	per week	49	$ -
19.	Environmental Protection - Not Used			
20.	Trench Dewatering System - Not Used			
21.	Temporary By-pass Pumping - Not Used			

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
22.A.	For furnishing and installing Highway Crossing via Horizontal Directional Drilling, as specified, the sum of $ -	per l.s.	1	$ -
22.B.	For MassDOT Inspections, as specified, the sum of Ten Thousand Dollars and No Cents $ 10,000.00	Allowance	1	$ 10,000.00
23.A.	For furnishing and installing Pumping Station No. 1, as specified, the sum of $ -	per l.s.	1	$ -
23.B.	For furnishing and installing Pumping Station No. 2, as specified, the sum of $ -	per l.s.	1	$ -
23.C.	Pumping Station No. 3 - Not Used			
23.D.	For Electric Company Connection/Service Fee, as specified, the sum of One Hundred Thousand Dollars and No Cents $ 100,000.00	Allowance	1	$ 100,000.00
23.E.	For Telephone Company Connection/Service Fee, as specified, the sum of Twenty Thousand Dollars and No Cents $ 20,000.00	Allowance	1	$ 20,000.00

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
23.F.	For Planting Operations, as specified, the sum of Twenty Thousand Dollars and No Cents $ 20,000.00	Allowance	1	$ 20,000.00
24.	For furnishing and installing Tracer Wire in State Roadways, All Depths, as specified, the sum of $ -	l.f.	15,000	$ -

TOTAL AMOUNT OF BID (SRF ELIGIBLE BID ITEMS - BASE BID) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF (Bid Items 1 through 24, inclusive)

$ -

SRF ELIGIBLE BID ITEMS - ALTERNATIVES

A-1.	Pavement Restoration in Town Roadways	$ -
A-2.	Pumping Station No. 3 Tributary Area	$ -
A-3.	Fiber Optic Conduits, Associated Fittings and Handholes	$ -
A-4.	Tracer Wire in Town Roadways	$ -
A-5.	Highway Crossing Using Jacking	$ -

Company's Name	Date
Company's Address	**Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.**

Item	Description	Unit of Measure	Quantity	Extended Total

BASIS OF AWARD

BASIS OF AWARD - The OWNER's goal is to accomplish the work identified in SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) plus as many of the SRF ELIGIBLE BID ITEMS - ALTERNATIVES as its funding constraints will allow. The BASIS OF AWARD, therefore, is the lowest bid for the sum of SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) plus the cost of the greatest number of SRF ELIGIBLE BID ITEMS - ALTERNATIVES not exceeding its fudning constraints. The SRF ELIGIBLE BID ITEMS - ALTERNATIVES are listed in the order of their priority for award. Bidders must provide a bid figure for each alternative required regardless of the cost. Additional Funding may be obtained at the Annual Town Meeting proposed to be held in June 2020.

TOTAL AMOUNT OF BASE BID BASED ON ENGINEER'S ESTIMATE OF QUANTITIES: SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive)	**$ -**
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Item A-1.)	**$ -**
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Items A-1 through A-2., inclusive.)	**$ -**
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Items A-1 through A-3., inclusive.)	**$ -**
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Items A-1 through A-4., inclusive.)	**$ -**
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Items A-1 through A-5., inclusive.)	**$ -**

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF INELIGIBLE BID ITEMS			
B-1.	Replacement of Water Services			
		$		-
B-2.	Replacement of Canal Road Water Main			
		$		-
B-3.	Water Quality Improvements			
		$		-

Note: **Funding for the SRF Ineligible Bid Items is anticipated to be obtained at the Annual Town Meeting proposed to be held in May 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
	Item A-1- Pavement Restoration in Town Roadways			
1.	For Mobilization/Demobilization, as specified (maximum of five (5) percent of System Expansion bid), the sum of $ -	l.s.	1	$ -
2.	Sewer Pipelines and Associated Fittings - Not Used			
2Q.	For furnishing and installing Low Pressure Sewer Main Line Wyes, Tees and/or Reducers, All Sizes and Depths, as specified, the sum of	per each	-	$ -
3.	Precast Concrete Manholes and Structures - Not Used			
4.	Manhole Frames, Covers and Grates - Not Used			
5.	Interior Manhole Drop Connections - Not Used			
6.	Chimneys - Not Used			
7.	Miscellaneous Cement Concrete - Not Used			
8.	Rock and Boulder Excavation - Not Used			
9.	Replacement of Unsuitable Material - Not Used			
10.	Experimental Excavation - Not Used			

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
11.	Fill for embankments – Not Used			
12.	Sheeting and/or shoring ordered left in place – Not Used			
13.	For performing Soil Compaction Tests, as specified, the sum of			
14.	For furnishing and placing Road Gravel Material, as specified, the sum of			
15.A.	3-inch Temporary Bituminous Concrete Trench Pavement - (base course) - Not Used			
15.B.	7-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in State Roadways - Not Used			
15.C.	2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in State Roadways - Not Used			
15.D.	Not Used			
15.E.	For furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (base course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	430	$ -
	* Minimum Bid = $80/ton			
15.F.	Dense Graded Gravel - Not Used			
15.G.	4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways - Not Used			

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.H.	For milling and furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	4,900	$ -
	* Minimum Bid = $80/ton			
15.I.	For Miscellaneous Restoration of Town Roadways, as specified, the sum of *			
	$ -	per ton	50	$ -
	* Minimum Bid = $80/ton			
15.J.	For furnishing and placing Miscellaneous Bituminous Concrete Pavement, as specified, the sum of *			
	$ -	per ton	240	$ -
	* Minimum Bid = $80/ton			
15.K.	For repair and/or replacement of the Vehicle Loop Detectors, as specified, the sum of			
	$ -	per each	20	$ -
15.L.	For repainting of Traffic Markings - Lines, Symbols and Wording, as specified, the sum of			
	Twenty Five Thousand Dollars and No Cents			
	$ 25,000.00	Allowance	1	$ -
16.	Remove and Relaying and/or Replace Existing Utilities - Not Used			
17.	Uniformed Traffic Police Officers - Paid by Owner			
18..	Engineer's Field Office - Not Used			
19.	Environmental Protection - Not Used			

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
20.	Trench Dewatering Equipment - Not Used			
21.	Temporary By-pass Pumping - Not Used			
22.	Highway Crossing - Not Used			
23.	Pumping Station s- Not Used			
24.	Tracer Wire in State Roadways - Not Used			
	Item A-1 - Pavement Restoration in Town Roadways (Bid Item 1. through 24., inclusive)	**$**		-

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
	Item A-2 - Pumping Station No. 3 Tributary Area			
1.	For Mobilization/Demobilization, as specified (maximum of five (5) percent of System Expansion bid), the sum of $ -	l.s.	1	$ -
2.A.	For furnishing and installing 1-1/2-inch through 2-inch, inclusive, Polyvinyl Chloride/High Density Polyethylene Low Pressure Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,100	$ -
2.B.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Less Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	3,070	$ -
2.C.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Greater Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	8,440	$ -
2.D.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,020	$ -
2.E.	12-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths - Not Used			
2.F.	18-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths - Not Used			

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.G.	For furnishing and installing 6-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	2,610	$ -
2.H.	8-inch PVC Force Main and Associated Fittings, All Depths - Not Used			
2.I.	8-inch PVC Effluent Force Main and Associated Fittings, All Depths - Not Used			
2.J.	For furnishing and installing 1-1/4-inch Polyvinyl Chloride Low-Pressure Sewer Service Connections and Associated Fittings from main line to property line, All Depths, as specified, the sum of $ -	per l.f.	430	$ -
2.K.	For furnishing and installing 6-inch Polyvinyl Chloride Service Connections and Associated Fittings from main line to property line as specified, the sum of $ -	per l.f.	2,830	$ -
2.L.	For furnishing and installing LPS Wyes, All Depths, as specified, the sum of $ -	per each	13	$ -
2.M.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	95	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.N.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	1	$ -
2.O.	12-inch Polyvinyl Chloride Sewer Wyes, All Depths - Not Used			
2.P.	18-inch Polyvinyl Chloride Sewer Wyes, All Depths - Not Used			
2.Q.	For furnishing and installing Low Pressure Sewer Main Line Valves, All Sizes and Depths, as specified, the sum of $ -	per each	2	$ -
3.A.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Less Than 10 feet in Depth, the sum of $ -	per each	13	$ -
3.B.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Greater Than 10 feet in Depth, the sum of $ -	per each	52	$ -
3.C.	For furnishing and installing 5-foot Diameter Precast Concrete Sewer Manholes, All Depths, as specified, the sum of $ -	per each	2	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
3.D.	For furnishing and installing 6-foot Diameter Precast Concrete Low Pressure Sewer Terminal Flushing Manholes, All Depths, as specified, the sum of $ -	per each	3	$ -
3.E.	6-foot Diameter Precast Concrete Effluent Force Main In-Line Flushing Manholes, All Depths - Not Used			
3.F.	6-foot Diameter Precast Concrete Leaching Catch Basins with Grates, All Depths - Not Used			
4.A.	For furnishing and installing Standard Manhole Frames and Covers, as specified, the sum of $ -	per each	36	$ -
4.B.	For furnishing and installing Bolted and Gasketed Manhole Frames and Covers, as specified, the sum of $ -	per each	34	$ -
5.	For furnishing and installing Interior Manhole Drop Connections, as specified, the sum of $ -	per v.f.	20	$ -
6.	For furnishing and installing chimneys, as specified, the sum of $ -	per v.f.	340	$ -
7.	For furnishing and placing miscellaneous cement concrete, as specified, the sum of $ -	per c.y.	200	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
8.	For Rock and Boulder Excavation including Replacement with Suitable Fill Material, as specified, the sum of *			
	$ -	per c.y.	250	$ -
	* Minimum Bid = $80/c.y.			
9.A.	For Replacement of Unsuitable Material Below Trench Grade and/or Subgrade, as specified, the sum of			
	$ -	per c.y.	400	$ -
9.B.	For Replacement of Unsuitable Material Above Trench Grade, as specified, the sum of			
	$ -	per c.y.	790	$ -
10.	For Experimental Excavation, as specified, the sum of			
	$ -	per c.y.	200	$ -
11	Fill for embankments – Not Used			
12.	Sheeting and/or shoring ordered left in place – Not Used			
13.	For performing Soil Compaction Tests, as specified, the sum of			
	$ -	per each	70	$ -
14.	For furnishing and placing Road Gravel Material, as specified, the sum of			
	$ -	per c.y.	5,160	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.A.	3-inch Temporary Bituminous Concrete Trench Pavement (base course) - Not Used			
15.B.	For furnishing and placing 7-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in State Roadways, as specified, the sum of *			
	$ -	per l.f.	3,680	$ -
	* Minimum Bid = $80/ton			
15.C.	For milling and furnishing and placing 2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in State Roadways, as specified, the sum of *			
	$ -	per ton	1,970	$ -
	* Minimum Bid = $80/ton			
15.D.	Not Used			
15.E.	1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (base course) in Town Roadways - Not Used			
15.F.	For furnishing and placing Dense Graded Gravel, as specified, the sum of			
	$ -	per c.y.	350	$ -
15.G.	For furnishing and placing 4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	4,460	$ -
	* Minimum Bid = $80/ton			
15.H.	1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways - Not Used			

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.I.	For Miscellaneous Restoration of State and Town Roadways, as specified, the sum of *			
	$ -	per ton	190	$ -
	* Minimum Bid = $80/ton			
15.J.	For furnishing and placing Miscellaneous Bituminous Concrete Pavement, as specified, the sum of *			
	$ -	per ton	210	$ -
	* Minimum Bid = $80/ton			
15.K.	For repair and/or replacement of the Vehicle Loop Detectors, as specified, the sum of			
	$ -	per each	10	$ -
15.L.	For repainting of Traffic Markings - Lines, Symbols and Wording, as specified, the sum of			
	Twenty Five Thousand Dollars and No Cents			
	$ 25,000.00	Allowance	1	$ -
16.A.	For removal and relaying and/or replacement of Existing Water Mains, associated fittings, valves and services, as specified, the sum of			
	$ -	per inch-foot	6,000	$ -
16.B.	For removal and relaying and/or replacement of Existing Storm Drains, as specified, the sum of			
	$ -	per inch-foot	10,000	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
16.C.	For removal and relaying and/or replacement of Existing Gas Mains and services, as specified, the sum of Fifty Thousand Dollars and No Cents $ 50,000.00	Allowance	1	$ -
16.D.	For removal and relaying and/or replacement of Existing Miscellaneous Utilities, as specified, the sum of Twenty Five Thousand Dollars and No Cents $ 25,000.00	Allowance	1	$ -
16.E.	6-inch Water Main Line Stops - Not Used			
16.F.	For furnishing and removal of 8-inch Water Main Line Stops, as specified, the sum of $ -	per each	7	$ -
16.G.	For furnishing and removal of 10-inch Water Main Line Stops, as specified, the sum of $ -	per each	1	$ -
17.	Uniformed Traffic Police Officers - Paid by Owner			
18.A.	Engineer's Field Office - Not Used			
18.B.	For maintaining Engineer's Field Office, as specified, the sum of $ -	per week	42	$ -
19.	For furnishing, installing, maintaining and removing Environmental Protection, as specified, the sum of $ -	per l.s.	1	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
20.	For furnishing, installing, maintaining and removing Trench Dewatering System, as specified, the sum of			
	$ -	per l.f.	11,220	$ -
21.	Temporary By-pass Pumping - Not Used			
22.A.	Highway Crossing via Horizontal Directional Drilling - Not Used			
22.B.	MassDOT Inspections - Not Used			
23.A.	Pumping Station No. 1 - Not Used			
23.B.	Pumping Station No. 2 - Not Used			
23.C.	For furnishing and installing Pumping Station No. 3, as specified, the sum of			
	$ -	per l.s.	1	$ -
23.D.	For Electric Company Connection/Service Fee, as specified, the sum of			
	Twenty Five Thousand Dollars and No Cents			
	$ 25,000.00	Allowance	1	$ -
23.E.	For Telephone Company Connection/Service Fee, as specified, the sum of			
	Ten Thousand Dollars and No Cents			
	$ 10,000.00	Allowance	1	$ -
23.F.	For Planting Operations, as specified, the sum of			
	Ten Thousand Dollars and No Cents			
	$ 10,000.00	Allowance	1	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
24.	For furnishing and installing Tracer Wire in State Roadways, All Depths, as specified, the sum of			
	$ -	l.f.	15,000	$ -
	Item A-2 - Pump Stationing No. 3 Tributary Area (Bid Item 1. through 24., inclusive)			**$** -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
Item A-3 - Fiber Optic Conduits, Associated Fittings and Handholes				
A-3A.	For furnishing and installing 4-inch Fiber Optic Conduits and Associated Fittings, All Depths, as specified, the sum of $ -	l.f.	3,590	$ -
A-3B.	For furnishing and installing Fiber Optic Handholes, All Depths, as specified, the sum of $ -	ea.	10	$ -
	Item A-3 - Fiber Optic Conduits, Associated Fittings and Handholes (Bid Item A-3A. through A-3B., inclusive)			**$** -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
Item A-4 - Tracer Wire in Town Roadways				
A-4A.	For furnishing and installing Tracer Wire in Town Roadways All Depths, as specified, the sum of			
	$ -	l.f.	28,100	$ -
	Item A-4 -Tracer Wire in Town Roadways (Bid Item A-4A., inclusive)		**$**	-

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
Item A-5 - Highway Crossing Using Jacking				
A-4A.	For Additional Cost to furnish and install the Highway Crossing Using Jacking versus furnishing and installing the Highway Crossing Using Horizontal Directional Drilling , as specified, the sum of			
	$ -	l.s.	1	$ -
	Item A-5 - Highway Crossing Using Jacking (Bid Item A-5A., inclusive)			**$ -**

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF INELIGIBLE BID ITEMS			
Item B-1 - Replacement of Water Services				
B-1A.	For furnishing and installing 1-inch Polyvinyl Chloride Water Services and Associated Fittings from water main to property line as specified, the sum of $ -	per l.f.	2,040	$ -
B-1B.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	480	$ -
B-1C.	For furnishing and placing Permanent Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	100	$ -
	Item B-1 - Replacement of Water Services (Bid Items B-1A. through B-1C., inclusive)			**$** -

Note: **Funding for the SRF Ineligible Bid Items is anticipated to be obtained at the Annual Town Meeting proposed to be held in June 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF INELIGIBLE BID ITEMS			
Item B-2 - Replacement of Canal Road Water Main				
B-2A.	For furnishing and installing 8-inch DI water main and Associated Fittings, as specified, the sum of $ -	per l.f.	2,060	$ -
B-2B.	For furnishing and installing 1-inch Polyvinyl Chloride Water Services and Associated Fittings from water main to property line as specified, the sum of $ -	per l.f.	320	$ -
B-2C.	For furnishing and installing 6-inch Gate Valves and Boxes, as specified, the sum of $ -	per each	6	$ -
B-2D.	For furnishing and installing 8-inch Gate Valves and Boxes, as specified, the sum of $ -	per each	7	$ -
B-2E.	For furnishing and installing Fire Hydrants, as specified, the sum of $ -	per each	6	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
B-2F.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	560	$ -
B-2G.	For furnishing and placing Permanent Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	120	$ -
	Item B-2 - Replacement of Canal Road Water Main (Bid Items B-2A. through B-2G., inclusive)			**$** -

Note: **Funding for the SRF Ineligible Bid Items is anticipated to be obtained at the Annual Town Meeting proposed to be held in June 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF INELIGIBLE BID ITEMS			
Item B-3 - Water Quality Improvements				
B-3A.	For Brewster Cross Road Water Quality Improvements, as specified, the sum of			
	$ -	per l.s.	1	$ -
B-3B.	For Locust Road Water Quality Improvements, as specified, the sum of			
	$ -	per l.s.	1	$ -
	Item B-3 - Water Quality Improvements (Bid Items B-3A. through B-3B., inclusive)			**$** -

Note: **Funding for the SRF Ineligible Bid Items is anticipated to be obtained at the Annual Town Meeting proposed to be held in June 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

SECTION 01025

MEASUREMENT AND PAYMENT

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PART 1 - GENERAL

1.01 - SCOPE

A. The purpose of this section is to define the basis of measurement and payment for each of the unit price or lump sum items listed in DOCUMENT 00410, FORM OF GENERAL BID. If no quantity or bid item appears in DOCUMENT 00410, FORM OF GENERAL BID for any of the following described items, no Work of that description is anticipated on the project.

B. The Contractor shall become acquainted with all Work associated with each Payment Item and shall have no claim for additional compensation due to unfamiliarity with the Work required to complete each Item in accordance with the Contract Documents.

C. No payment will be made for any item of Work until all documentation required by the Contract Documents has been reviewed and approved by the Engineer. No payment will be made for additional materials that are not installed on the Project. The Owner reserves the right to withhold the fair market value for work not completed in addition to the retainage on work completed. Unbalanced bid items will specifically be subject to review and to this potential withholding from periodic payment applications.

1.02 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.03 - PAYMENT ITEMS

A. SRF Eligible Items

Item	Description
1	Mobilization/Demobilization
2	Sewer and Storm Drainage Pipelines and Associated Fittings
3	Precast Concrete Manholes and Structures
4	Manhole Frames, Covers and Grates
5	Interior Manhole Drop Connections
6	Chimneys
7	Miscellaneous Cement Concrete
8	Rock and/or Boulder Excavation
9	Replacement of Unsuitable Material
10	Experimental Excavation
11	Fill for Embankments – Not Used
12	Sheeting and/or Shoring Ordered Left in Place – Not Used
13	Soil Compaction Tests
14	Road Gravel
15	Pavement Restoration
16	Remove and Relay or Replace Existing Utilities
17	Uniformed Traffic Police Officers
18	Engineer's Field Office
19	Environmental Protection
20	Dewatering
21	Temporary By-Pass Pumping – Not Used
22	Highway Crossing
23	Pumping Stations
24	Fiber Optic Conduits and Handholes

B. SRF Eligible Bid Items - Alternatives

Item	Description
A-1	Pavement Restoration in Town Roadways
A-2	Pumping Station No. 3 Tributary Area
A-3	Fiber Optic Conduits, Associated Fittings and Handholes
A-4	Tracer Wire in Town Roadways
A-5	Highway Crossing Using Jacking

C. SRF Ineligible Bid Items

Item	Description
B-1	Replacement of Water Services
B-2	Replacement of Canal Road Water Main
B-3	Water Quality Improvements

1.04 - BASIS OF MEASUREMENT AND PAYMENT – SRF ELIGIBLE ITEMS

ITEM 1 - MOBILIZATION/DEMOBILIZATION

A. General. The price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include transporting, mobilization, demobilization, utility connection fees, permits, licenses, bonds, insurance and all other incidental Work relative thereto.

B. Measurement. Measurement for mobilization/demobilization shall be made based on the lump sum amount bid as approved by the Engineer.

C. Payment. Payment for mobilization/demobilization listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the lump sum price bid under this Bid Item. The amount of this lump sum shall not exceed five (5) percent of the Contract amount, excluding Item 1, and no payment shall be made in excess of this amount. An amount of seventy-five (75) percent of the amount bid under Item 1 (exclusive of normal Contract retainage) will be made when the Contractor has mobilized to the Project site(s) and is ready to start construction. The remaining twenty-five (25) percent (exclusive of normal Contract retainage) will be made following demobilization from the Project site(s) following final completion and acceptance of the work by the Owner.

ITEM 2 - SEWER PIPELINES AND ASSOCIATED FITTINGS

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include: transportation, handling and dispersal of materials; clearing and grubbing; saw cutting and removal of existing bituminous and cement concrete or reinforced cement concrete pavement; excavation (excluding that which is specified to be paid for under a separate Bid Item); backfill above trench grade including all bedding materials (excluding material used to replace unsuitable material, controlled density fill and road gravel); removal and legal disposal of all existing utility lines not being relaid (including pipes, services, manholes and appurtenances); removal and legal disposal of existing utility materials (as required); compacting trenches (excluding soil compaction tests specified to be paid for separately); sheeting and shoring not ordered left in place; loaming and seeding; landscaping; removing and resetting curbing, property markers, signs and mail boxes; connections to existing pipeline(s) and services; dust control including mechanical sweeping; all permanent and temporary fittings, caps, plugs, restraints and the like; two-way sewer lateral cleanout; service check valves, low pressure sewer service lateral and curb box, traffic control devices, flushing and testing; dewatering of trenches; polyethylene encasement; cleaning and television inspection of sewer lines, daily cleanup; restoration of all areas disturbed by the Contractor's operations; all Work as specified in DIVISION 1 – GENERAL REQUIREMENTS (excluding Environmental Protection specified to be paid for under a separate Bid Item); and all other incidental Work relative thereto.

B. Measurement. Measurement for furnishing and installing pipelines and associated fittings shall be as follows:

1. The length of pipe and fittings (pipeline), to be paid for shall be the horizontal measured length of pipeline in place from centerline of manhole to centerline of manhole. Measurement shall be by the linear foot with no deductions made for manholes, fittings or valves. The measurement for depth of gravity sewers shall be made vertically from the existing ground surface above the pipeline to the invert of the sewer.

2. The length of pipe and fittings to be paid for shall be the measured length of pipeline in place. Measurement shall be by the linear foot with no deductions made for fittings or valves.

3. Measurement for service connections shall be by the linear foot with no deductions made for fittings or valves.

   a. Measurement for sewer service connections shall be the horizontal measured length of pipeline in place from the face of the wye, tee or chimney to the terminus of the service pipeline.

   b. Measurement shall be as stated above with a minimum payment of five (5) linear feet.

4. Measurement for wyes, blow offs, air vents (manual or automatic), service connections and the like shall be per each installation, as approved by the Engineer.

C. Payment. Payment for furnishing and installing pipelines and associated fittings of the various types, diameters and depths listed in DOCUMENT 00410, FORM OF GENERAL BID, shall be made at the unit prices bid under the applicable divisions of this Bid Item.

1. Only eighty-five (85) percent of the price bid per linear foot of pipeline shall be paid for upon its installation, the balance shall be withheld until such time as pipeline(s) have been successfully flushed and tested (as required), accepted by the Owner for incorporation into the existing pipeline system and the site(s) has been fully restored. This percentage is exclusive of normal Contract retainage.

2. An additional five (5) percent shall be withheld until such time as the complete system has been cleaned and televised with records accepted by the Owner. This percentage is exclusive of normal Contract retainage.

3. The Contractor shall provide water for flushing and testing (as applicable) for each section of pipeline (transmission main and force main only) installed. Water utilizing the Owner's water system may be available, however, the Owner does not guarantee that its water supply will be available at any time during the duration of the Project. If available, water required for testing, puddling and/or jetting of trenches shall be provided by the Owner at no cost to the Contractor. All water shall be metered and the use of backflow prevention device(s) shall be required as approved by the Owner.

4. Payment for furnishing and installing fittings, restraints, solid sleeves, flexible couplings, transition couplings and the like shall be made under and included in the prices bid per linear foot.

5. Payment for service connections including fittings and/or valves shall be made at the unit price bid per linear foot.

6. Payment for sewer service wyes shall be made at the unit price bid for each approved installation. Payment will be made without regard to size.

ITEM 3 - PRECAST CONCRETE MANHOLES AND STRUCTURES

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include excavation, installation, steel reinforced copolymer polypropylene plastic steps, lifting rings, sealing materials in horizontal joints, pipe penetrations, dampproofing, invert, electrical and mechanical equipment, valves and fittings, external manhole encapsulation system, backfill, mancatchers on manholes over twenty (20) feet in depth, removal and legal disposal of existing structures to be replaced, as specified and/or shown on the Contract Drawings and all other incidental Work relative thereto.

B. Measurement. Measurement for furnishing and installing precast concrete manholes shall be as follows:

1. For sewer and drain manholes, measurement for depth shall be from the top of frame to the lowest invert in the manhole, as approved by the Engineer.

2. For air release and flushing/drain manholes, measurement shall be per each installation, regardless of depth, as approved by the Engineer.

3. For sump drain manholes and catch basins, measurement shall be from the top of frame to the lowest invert or sump in the structure, as approved by the Engineer.

4. For leaching catch basins measurement shall be from the top of frame to the lowest invert or sump in the structure, as approved by the Engineer.

C. Payment. Payment for furnishing and installing precast concrete manholes listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit prices bid under the applicable divisions of this Bid Item.

1. Payment for air vacuum and air release valve and/or flushing drain manholes shall be per each approved installation.

2. Payment for leaching catch basins shall be per each approved installation.

3. Only eighty-five (85) percent of the price bid for each manhole shall be paid for upon its installation, the balance shall be withheld until such time as the manhole has been successfully tested and accepted by the Owner. This percentage is exclusive of normal Contract retainage.

4. An additional ten (10) percent shall be withheld until such time as the invert, manhole steps, pig catchers, and mancatchers have been installed and accepted by the Owner. This percentage is exclusive of normal Contract retainage.

5. Only twenty (20) percent of the price bid for each:(a) Inline Flushing Manhole with Combination Air Valve; and (b) Terminal Flushing Manhole with Combination Air Valve manhole shall be paid for upon its installation, the balance shall be withheld until such time as the manhole has been successfully tested and accepted by the Owner. This percentage is exclusive of normal Contract re.

ITEM 4 - MANHOLE FRAMES, COVERS AND GRATES

A. General. The prices bid under each division of Item 4 shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include setting frames, covers and grates to existing grade initially and resetting frames, covers and grates to final grade prior to final pavement restoration and all other incidental Work relative thereto.

B. Measurement. Measurement for furnishing and installing manhole frames, covers and grates shall be per each installation as approved by the Engineer.

C. Payment. Payment for furnishing and installing manhole frames, covers and grates of the various types and sizes listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit prices bid per each under the applicable divisions of Item 4.

ITEM 5 - MANHOLE DROP CONNECTIONS

A. General. The prices bid under Item 5 shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include excavation, assembly, drop piping, fittings, hardware, and all other incidental Work relative thereto.

B. Measurement. Measurement for furnishing and installing interior manhole drop connections shall be from the invert of the manhole to the top of the drop connection.

C. Payment. Payment for furnishing and installing interior manhole drop connections listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid per vertical foot under Item 5.

ITEM 6 - CHIMNEYS

A. General. The price bid under Item 6 shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include excavation, vertical piping, wye fittings, caps, concrete encasement, and all other incidental Work relative thereto.

B. Measurement. Measurement for chimneys shall be from the top of the chimney to the top of the wye fitting for each installation as approved by the Engineer.

C. Payment. Payment for chimneys listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid under Item 6.

ITEM 7 - MISCELLANEOUS CEMENT CONCRETE

A. General. The price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, including thrust blocks, support for utilities, pipe encasements, and the like and any other incidental Work relative thereto.

B. Measurement. Measurement of miscellaneous cement concrete shall be the actual cubic yardage placed as approved by the Engineer.

C. Payment. Payment for miscellaneous cement concrete listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid per cubic yard under this Bid Item.

1. Payment for concrete used for manhole bases, joints and inverts, for setting frames and covers, for manhole drop connections and for chimneys shall be included as specified under the applicable Bid Item.

ITEM 8 - ROCK AND/OR BOULDER EXCAVATION

A. General. The price bid under Item 8 shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified which shall include excavation, use of drilling and blasting (if allowed); hydraulic hammers; hydraulic splitters; and/or drilling and expansion cement/grout. pre-blast survey(s), permit(s) and license(s), vibration monitoring, removal and legal disposal of rock and/or boulders, furnishing and placing replacement material, backfilling and compaction, and any other incidental Work relative thereto. The Contractor shall assume that Rock and/or Boulders may occur anytime throughout the Project Area and that the unanticipated discovery of Rock and/or Boulders is not a basis for a change in conditions.

B. Measurement. Measurement of rock and/or boulder excavation shall be made based on the volume removed and replaced as approved by the Engineer computed as follows:

1. Only boulders greater than one (1) cubic yard in volume, defined by the Engineer shall be measured and paid for under this Bid Item. Measurement shall be based on the length, width and depth of boulders excavated within the trench limits.

2. Rock in pipe trenches shall be measured from its surface to a point six (6) inches below the invert of the pipe and as follows:

   a. For pipe twenty-four (24) inches or less in diameter a width of five (5) feet for depths twelve (12) feet or less and a width of seven (7) feet for depths greater than twelve (12) feet.

   b. For pipe greater than twenty-four (24) inches in diameter a width of three (3) feet plus the inside diameter of the pipe for depths of twelve (12) feet or less and a width of five (5) feet plus the inside diameter of the pipe for depths greater than twelve (12) feet.

3. Rock or boulders encountered in other excavations, which are to be paid for separately, shall be measured from its surface to a point six (6) inches below the base of structure and to a width of one (1) foot outside the face of the structure.

4. Where more than one (1) pipe is installed in the same trench, payment shall be made on the basis of a common trench with the maximum trench width of seven (7) feet.

C. Payment. Payment for rock and/or boulder excavation listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid per cubic yard under this Bid Item.

1. No additional payment will be made for frost removal or for any other materials encountered in the excavations, no matter how stiff or compact of consistency, even if drilling and blasting (if allowed); hydraulic hammers; hydraulic splitters; and/or drilling and expansion cement/grout is required for removal. Soft or disintegrated rock that can be removed without the use of drilling and blasting (if allowed); hydraulic hammers; hydraulic splitters; and/or drilling and expansion cement/grout shall not be paid for under this Bid Item.

2. No additional payment will be made for rock and/or boulder excavation where existing utilities are removed and relaid to facilitate the Work within the trench limits defined hereinbefore.

3. Masonry or concrete structures encountered during the course of constructing the Work, which require drilling and blasting (if allowed); hydraulic hammers; hydraulic splitters; and/or drilling and expansion cement/grout for removal, shall be paid for subject to the limits and conditions described herein.

4. No payment will be made for excavation of rock and/or boulders beyond the specified limits.

The unit price for rock and/or boulder excavation shall be a minimum of $80 per cubic yard which shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified using drilling and blasting (if allowed); hydraulic hammers; hydraulic splitters; and/or drilling and expansion cement/grout.

ITEM 9 - REPLACEMENT OF UNSUITABLE MATERIAL

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified which shall include excavation, sheeting or shoring not ordered left in place, dewatering, removal and legal disposal of unsuitable materials, filter cloth, furnishing and placing replacement materials, transportation, backfilling, compaction and any other incidental Work relative thereto.

B. Measurement. Measurement for replacement of unsuitable material above and below trench grade and/or subgrade shall be made based on the volume removed and replaced as approved by the Engineer and as follows:

1. Unsuitable material below trench grade shall be measured from a point six (6) inches below the invert of pipe to the bottom of the excavation and as follows:

   a. For pipe twenty-four (24) inches or less in diameter a width of five (5) feet for depths twelve (12) feet or less and a width of seven (7) feet for depths greater than twelve (12) feet.

   b. For pipe greater than twenty-four (24) inches in diameter a width of three (3) feet plus the inside diameter of the pipe for depths of twelve (12) feet or less and a width of five (5) feet plus the inside diameter of the pipe for depths greater than twelve (12) feet.

2. Unsuitable material above trench grade shall be measured from a point one (1) foot plus the thickness of permanent pavement thickness below the existing pavement surface or from a point six (6) inches below the existing unpaved surface to a point one (1) foot above the pipe and as follows:

   a. For pipe twenty-four (24) inches or less in diameter a width of five (5) feet for depths twelve (12) feet or less and a width of seven (7) feet for depths greater than twelve (12) feet.

   b. For pipe greater than twenty-four (24) inches in diameter a width of three (3) feet plus the inside diameter of the pipe for depths of twelve (12) feet or less and a width of five (5) feet plus the inside diameter of the pipe for depths greater than twelve (12) feet.

3. Unsuitable material below precast concrete manholes shall be measured from a point six (6) inches below the base of the manhole to the bottom of the excavation and to a width of two (2) feet plus the outside diameter of the manhole.

4. Unsuitable material below foundations for structures shall be measured from the bottom of foundation varying in width on a forty-five (45) degree angle down from the bottom of foundation to a depth approved by the Engineer.

C. Payment. Payment for replacement of unsuitable material above and below trench grade and/or subgrade listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid per cubic yard under the applicable division of this Bid Item.

1. No payment will be made for replacement of unsuitable material above trench grade when suitable excess excavated material is available from other excavations made under this Project.

2. Bedding material placed from a point six (6) inches below the invert of pipe, to a point one (1) foot above the top of the pipe shall be included for payment under the applicable pipe laying Bid Item.

3. When more than one (1) pipe is installed in the same trench, payment will be based on a common trench with a minimum width of seven (7) feet.

4. No payment will be made for unsuitable material replaced beyond the limits approved by the Engineer.

ITEM 10 - EXPERIMENTAL EXCAVATION

A. General. The price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include notification of utility owners, machine and/or hand excavation to locate utilities, backfill, compaction, maintaining utility marking locations, repair to utilities damaged while performing experimental excavations, temporary bituminous concrete patch, furnishing assistance to the Engineer and all other incidental Work relative thereto.

B. Measurement. Measurement of experimental excavation shall be made based on the volume excavated and backfilled as approved by the Engineer.

C. Payment. Payment for experimental excavation listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid per cubic yard under this Bid Item. No payment will be made for any cost associated with damages caused to existing utilities made during the performance of experimental excavation operations.

ITEM 11 - FILL FOR EMBANKMENTS – Not Used

ITEM 12 - SHEETING AND/OR SHORING ORDERED LEFT IN PLACE – Not Used

ITEM 13 - SOIL COMPACTION TESTS

A. General. The price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include excavation, sampling, sieve analysis, laboratory and field testing, backfill, compaction and any other incidental Work relative thereto.

B. Measurement. Measurement of compaction testing shall be per each test as approved by the Engineer.

C. Payment. Payment for soils compaction tests listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid per each under this Bid Item.

1. For the purpose of payment, a test shall include, but not be limited to, exploratory excavation, laboratory analysis (sieve analysis and modified proctor), field testing (density test), backfill and compaction of excavations.

2. No payment will be made for any test that fails to meet the specified compaction requirements.

ITEM 14 - ROAD GRAVEL

A. General. The price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include transportation, preparation of sub-grade, placement, grading, compaction and any other incidental Work relative thereto.

B. Measurement. Measurement of road gravel as a subbase for permanent resurfacing shall be based on the approved volume furnished and placed as approved by the Engineer computed as follows:

1. The length of main trench shall be defined as the length of roadway surface disturbed by the pipeline Work. The length of service trench shall be defined as the length of roadway surface disturbed by the service line Work less three (3) feet from the centerline of the main sewer or water pipeline trench.

2. The width of main or service trench shall be defined as follows:

a. For pipe twenty-four (24) inches or less in diameter a width of five (5) feet for depths of twelve (12) feet or less and a width of seven (7) feet for depths greater than twelve (12) feet.

b. For pipe greater than twenty-four (24) inches in diameter a width of three (3) feet plus the inside diameter of the pipe for depths of twelve (12) feet or less and a width of five (5) feet plus the inside diameter of the pipe for depths greater than twelve (12) feet.

3. The width for manholes shall be measured from a width of two (2) feet plus the outside diameter of the manhole.

4. When more than one (1) pipe is installed in the same trench, payment will be based on a common trench with a maximum width of seven (7) feet.

5. The thickness of road gravel in local roadways shall be twelve (12) inches, unless otherwise specified or approved by the Engineer.

6. The thickness of road gravel in State Roadways shall be equal to the thickness of the existing undisturbed road gravel adjacent to the trench.

7. No payment will be made for road gravel course material when suitable excess excavated material is available from other excavations made under this Project.

C. Payment. Payment for furnishing and placing road gravel material listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid per cubic yard under this Bid Item.

ITEM 15 - PAVEMENT RESTORATION

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools, and materials necessary to complete the Work as specified, which shall include, preparation of subgrade, cutting and recutting of bituminous and cement concrete pavement, full width pavement removal, reshaping of the roadway surface, reshaping, loaming and seeding of roadway shoulders, furnishing and placing bituminous concrete dense graded gravel, furnishing and placing bituminous concrete (temporary and permanent), maintenance and protection of roadway surfaces, repainting of traffic control lines/wording, resetting of structures and utility boxes, milling of bituminous concrete surfaces, replacement of pavement markings (temporary and permanent), replacement of vehicle loop detectors, repair to roadways used as detours, and all other Work incidental thereto and all other Work incidental thereto.

B. Measurement. Measurement for pavement restoration shall be as follows:

1. Temporary Bituminous Concrete Trench Pavement. – Not Used

2. Permanent Bituminous Concrete Trench Pavement

a. Measurement for Permanent Bituminous Concrete Trench Pavement shall be based on the horizontal measured length of main line trench defined as the length of roadway disturbed by the main line Work from centerline of manhole to centerline of manhole. Measurement shall be by the linear foot with no deductions made for manholes, fittings or valves.

b. Measurement for Permanent Bituminous Concrete Trench Pavement shall be based on the horizontal measured length of service trench defined as the length of roadway surface disturbed by the service line Work less three (3) feet from the centerline of the main sewer or water pipeline trench. Measurement shall be by the linear foot with no deductions made for fittings or valves.

c. Measurement for Permanent Bituminous Concrete Trench Pavement for trenches with more than one (1) pipe laid in the same trench shall be treated as a common trench, unless otherwise approved by the Engineer.

3. Permanent Bituminous Concrete Full Width Overlay Pavement. Refer to SRF ELIGIBLE BID ITEMS - ALTERNATIVES.

4. Dense Graded Gravel

a. Measurement for dense graded gravel shall be defined as the length of roadway surface disturbed by the width of the roadway. Measurement shall be by the linear foot with no deductions made for manholes, fittings or valves.

b. Measurement for Permanent Bituminous Concrete Trench Pavement for trenches with more than one (1) pipe laid in the same trench shall be treated as a common trench, unless otherwise approved by the Engineer.

5. Miscellaneous Bituminous Concrete. Measurement for Miscellaneous Bituminous Concrete placed where directed by the Engineer shall be by the ton based on certified weight slips delivered daily to the Engineer.

6. Replacement of Vehicle Loop Detectors. Measurement for Replacement of Vehicle Loop Detectors shall be based on each location replaced as approved by the Engineer and MassDOT. Each location paid for shall be for the vehicle loop detector replaced following Permanent Bituminous Concrete Trench Pavement and replaced following Permanent Bituminous Concrete Full Width Overlay Pavement.

7. Repainting of Traffic Markings. Refer to SECTION 01020, ALLOWANCES.

8. Payment limits for pavement restoration specified above supersede the MassDEP Policy Memorandum CG-8.

C. Payment. Payment for pavement restoration listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made under the applicable divisions of this Bid Item.

1. Temporary Bituminous Concrete Trench Pavement – Not Used

2. Permanent Bituminous Concrete Trench Pavement. Payment for Permanent Bituminous Concrete Trench Pavement whether placed by machine or by hand listed in DOCUMENT 00410, FORM OF GENERAL BID will be made at the unit price bid per linear foot under the applicable divisions of this Bid Item.

3. Permanent Bituminous Concrete Full Width Pavement. Refer to SRF ELIGIBLE BID ITEMS - ALTERNATIVES.

4. Miscellaneous Bituminous Concrete. Payment for Miscellaneous Bituminous Concrete whether placed by machine or by hand, for leveling of existing roadways, driveway aprons, sidewalks, repairs to roadways used for detours, and other areas outside the trench limits listed in DOCUMENT 00410, FORM OF GENERAL BID will be made at the unit price bid per ton.

5. Dense Graded Gravel. Payment for furnishing and placing dense graded gravel listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid per cubic yard under this Bid Item.

6. Vehicle Loop Detectors. Payment for replacement of vehicle loop detectors listed in DOCUMENT 00410, FORM OF GENERAL BID shall be at the unit price bid per each location under this Bid Item.

7. The following utility allowance(s) shall be included in the applicable subdivision of this Bid Item:

   a. Repainting of Traffic Markings – Refer to SECTION 01020, ALLOWANCES.

8. Price Adjustment - Liquid Asphalt, Diesel, Gasoline and Portland Cement

   a. The intent of this provision is to insure adequate and fair compensation for unpredictable and fluctuating costs which, from time to time, occur in the prices of Liquid Asphalt, Diesel Fuel, Gasoline and Portland Cement. The price adjustment provisions are made part of the Contract to assure more realistic bidding and encourage competition. Price Adjustments will be based on the variance in price, for the material component only, between the Base Price and the Period Price. They shall not include transportation or other charges. Price Adjustments will occur on a monthly basis for Liquid Asphalt and at the end of the Project for Diesel Fuel, Gasoline and Portland Cement.

   b. Base Price - The Base Price of liquid asphalt on a project is a fixed price determined by the MassDOT at the time of the bid using the same method as the determination of the Period Price detailed below. The Base Price shall be used in all bids.

      The March 2020 base prices are as follows: liquid asphalt at $552.50 per ton and Portland cement at $135.50. The February 2020 base prices are as follows: diesel fuel at $2.094 per gallon and gasoline at $1.915 per gallon. MassDOT posts the Price Adjustments on their Highway Division's website at https://www.mass.gov/service-details/2019-massdot-contract-price-adjustments under the following link sequences: (1) Doing Business With Us; (2) Construction; and (3) Price Adjustments.

1. Hot Mix Asphalt

   a) Period Price - The Period Price is the price of liquid asphalt for each monthly period as determined by the MassDOT using the average selling price per standard ton of PG64-28 paving grade (primary binder classification) asphalt, FOB manufacturer's terminal, as listed under the "East Coast Market - New England, Boston, Massachusetts area" section of the Poten & Partners, Inc. "Asphalt Weekly Monitor". This average selling price is listed in the issue having a publication date of the second Friday of the month and will be posted as the Period Price for that month. The MassDOT will post this Period Price on its website at http://www.mhd.state.ma.us/ within two (2) business days following its receipt of the relevant issue of the "Asphalt Weekly Monitor". Poten and Partners has granted the MassDOT the right to publish this specific asphalt price information sourced from the Asphalt Weekly Monitor. This method of period price determination was formerly called the New Asphalt Period Price Method. Separate website postings using both the New Asphalt Period Price Method and the Old Asphalt Period Price Method were discontinued after June 2013.

   b) Price Adjustment Determination, Calculation and Payment - Price Adjustments, as herein provided, either upwards or downwards, will be made after the work has been performed using the monthly period price for the month during which the work was performed. Price Adjustments will be paid only if the variance from the Base Price is 5 percent or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5 percent from either upward or downward adjustments. The Price Adjustment applies only to the actual virgin liquid asphalt content in the mixture placed on the job in accordance with the Standard Specifications for Highways and Bridges, Division III, Section M3.11.03. No adjustment will be paid for work done beyond the completion date. Price Adjustments for a positive price adjustment (a payment) and a negative price adjustment (a deduction) will be calculated using the following equation:

   c) Price Adjustment = Tons of HMA Placed x Liquid Asphalt Content % x RAP Factor x (Period Price - Base Price).

2. Diesel Fuel` and Gasoline

   a) Price period - The Period Price will be the average of prices charged to the State, including State Tax for the bulk purchases made during each month.

   b) Price Adjustment Determination, Calculation and Payment - Price Adjustments, as herein provided, either upwards or downwards, will be made after the work has been performed using the monthly period price for the month during which the work was performed. This adjustment will be based on fuel usage factors for various items of work developed by the Highway Research Board in Circular 158, dated July 1974. These factors will be multiplied by the quantities of work done in each item during each monthly period and further multiplied by the variance in price from the Base Price to the Period Price. The Base Price of Diesel Fuel and Gasoline will be the price as indicated in the Department’s web site (www.MassDOT.state.ma.us) for the month in which the contract was bid, which includes State Tax. This adjustment will be affected only if the variance from the Base Price is 5 percent or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5 percent from either upward or downward adjustments. Any adjustment (increase or decrease) to estimated quantities made to each item at the time of final payment will have the fuel price adjustment figured at the average period price for the entire term of the project for the difference of quantity. No adjustment will be paid for work done beyond the completion date. The fuel price adjustment will apply only to the following items of work at the fuel factors shown:

SRF Eligible Bid Item Covered	Diesel Fuel	Gasoline
2. Sewer and Storm Drainage Pipelines and Associated Fittings	X	X
3. Precast Concrete Manholes and Structures	X	X
8. Rock and/or Boulder Excavation	X	X
9. Replacement of Unsuitable Material	X	X
10. Experimental Excavation	X	X
14. Road Gravel	X	X
15. Pavement Restoration	X	Does Not Apply

9. No additional payment will be made beyond the payment limits noted or for maintenance or repair of trenches.

10. Payment for joint sealant and/or tack coat shall be included under the applicable division of this Bid Item for bituminous concrete Work.

11. Payment for adjusting frames and covers, valve boxes and all other castings prior to placement of permanent bituminous concrete pavement shall be included under the applicable division of this Bid Item for bituminous concrete Work.

12. Payment for reshaping of roadways and/or road shoulders, roadway reclamation, regrading and compaction of roadway base course materials and or providing leveling course over settled trenches shall be included under the applicable division of this Bid Item for bituminous concrete Work.

ITEM 16 - REMOVE AND RELAY OR REPLACE EXISTING UTILITIES

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified which shall include transportation, handling and dispersal of materials, removal and legal disposal of excess materials, furnishing and installation of new replacement materials (including but not limited to pipe and accessories, couplings, fittings, manholes and catch basins), excavation (excluding that which is specified to be paid for separately), backfill above trench grade including all bedding materials (excluding material used to replace unsuitable material and road gravel), compacting trenches, sheeting and shoring not ordered left in place, testing (excluding soil compaction tests specified to be paid for separately), daily cleanup, restoration of all areas disturbed by the Contractor's operations that are not included for payment under another Bid Item, and all other incidental Work relative thereto.

B. Measurement. Measurement for removal and relaying or replacing existing utilities shall be as follows:

1. Measurement for the removal and relaying or replacement of existing water, sewer, storm drain, and/or gas pipelines and appurtenances, within the allowable trench width only, will be made by multiplying the inside diameter of the relaid or replaced pipeline by the length of relaid or replaced pipeline. For measurement purposes, the allowable trench width will be defined as follows:

   a. For pipe twenty-four (24) inches or less in diameter a width of five (5) feet for depths twelve (12) feet or less and a width of seven (7) feet for depths greater than twelve (12) feet.

   b. For pipe greater than twenty-four (24) inches in diameter a width of three (3) feet plus the inside diameter of the pipe for depths of twelve (12) feet or less and a width of five (5) feet plus the inside diameter of the pipe for depths greater than twelve (12) feet.

2. Measurement for removal and resetting or replacement of manholes and catch basins will be made by multiplying the inside diameter of the manhole or catch basins by its height.

C. Payment. Payment for the removal and relaying or replacement of existing water, sewer, storm drain and/or gas pipelines and appurtenances listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit prices bid per inch-foot under the applicable divisions of this Bid Item.

1. Payment will only be made for the removal and relaying or replacement of existing water, sewer, storm drain and/or gas pipelines and appurtenances when (1) such utilities are removed and relaid or replaced as a result of conflicts in elevation with the grade of the new pipelines or (2) the length of such existing utilities within the allowable trench width that cross above the new pipeline is greater than two and one-half (2.5) times the width of the allowable trench limit or (3) such utilities lie completely within the allowable trench width and the existing utility invert is a minimum of two (2) feet above the crown of the new pipeline as approved by the Engineer.

2. Payment for removal and resetting or replacement of manholes and catch basins shall include resetting frames and covers or grates.

3. No payment will be made for the removal and relaying or replacement of utilities which lie either partially or completely beyond the allowable trench width.

4. Payment for the removal and relaying or replacement of miscellaneous utilities shall be made at the unit price bid under this item. Payment for planting materials shall be made based on the actual charges paid by the Contractor. An amount of 100 percent of each paid invoice (no retainage) will be made to the Contractor based on paid invoice receipts.

5. No payment will be made for the removal and relaying or replacement of utilities other water, sewer, storm drain, and/or gas pipelines and appurtenances which are damage due to the contractor's means and methods of construction.

6. The following utility allowance(s) shall be included in the applicable subdivision of this Bid Item:

b. Removal and Relaying and/or Replacement of Existing Gas Main and Services. Refer to SECTION 01020, ALLOWANCES.

c. Removal and Relaying and/or Replacement of Existing Miscellaneous Utilities. Refer to SECTION 01020, ALLOWANCES. This allowance includes the scope of work to Remove and Relay and/or Replace the Existing Underground Electrical System and Underground Irrigation System located at the Snow Library and The Village Green.

ITEM 17 - UNIFORMED TRAFFIC POLICE OFFICERS

A. General. Payment for the services of uniformed police officers shall be made at the prevailing rates of pay for special duty details in effect at the time of services, for each permanent, special or reserve officer and for graduated rank. Uniformed police officers shall be paid directly by the Owner. The Contractor is responsible for coordination of the police details.

1. Uniformed police officers used for special duty details are paid a four (4) hour minimum.

2. If arrangements have been made for uniformed police officers and inclement weather or other factors prohibit Work, the Contractor must contact the Police Department not later than two (2) hours before the scheduled start time on the day of Work to cancel the police detail.

3. If the Contractor fails to notify the Police Department of the cancellation of a scheduled detail, then it assumes all costs for the (4) hour minimum.

B. Measurement. Not Applicable

C. Payment. Not Applicable

ITEM 18 - ENGINEER'S FIELD OFFICE

A. General. The prices bid under each division of the Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to furnish, install maintain and remove the Engineer's Field Office as specified, including all other incidental Work relative thereto. The Engineer shall notify the Contractor when the Engineer's Field Office is to be removed from the site.

B. Measurement. Measurement for furnishing, installing, maintaining and removing the Engineer's Field Office shall be as follows:

1. Measurement for payment for furnishing, installing and subsequent removal of the Engineer's Field Office shall be for one (1) complete and acceptable unit as approved by the Engineer.

2. Measurement for payment for maintaining the Engineer's Field Office shall be per week as approved by the Engineer.

C. Payment. Payment for furnishing, installing, maintaining and subsequent removal of the Engineer's Field Office listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the lump sum and unit prices bid under the applicable divisions of this Bid Item.

1. Payment for furnishing, installing and removal of the Engineer's Field Office shall be made at the lump sum price bid under the applicable division of the Bid Item. The lump sum price bid shall include transporting, mobilization, demobilization, utility connection fees, permits, licenses, insurance, and all other labor, materials, and equipment required to furnish the Engineer's Field Office as specified. An amount of seventy-five (75) percent of the amount bid (exclusive of normal contract retainage) will be made when the Engineer's Field Office is ready for occupancy and use on the Project. The remaining twenty-five (25) percent (exclusive of normal contract retainage) will be made following the removal of the Engineer's Field Office from the Project.

2. Payment for maintaining the Engineer's Field Office shall be made at the unit price bid per week under the applicable division of this Bid Item. Maintaining the Engineer's Field Office shall include all maintenance, rental fees, utility charges, sanitary fees, equipment rental charges, and all other costs related to the weekly operation of the Engineer's Field Office. Payment will be made for those periods of time that the Engineer has directed the Contractor to provide the Engineer's Field Office. No payment will be made for the Engineer's Field Office that was not requested by the Engineer, or that remained on the Project after the Engineer notified the Contractor to remove it.

3. The Owner reserves the right to delete from the Work any or all divisions of this Bid Item without penalty.

4. No payment shall be made once the Contractor's time for completion has been reached.

ITEM 19 - ENVIRONMENTAL PROTECTION

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include furnishing, installing, maintaining and removing sedimentation control barriers and structures and all other incidental Work relative thereto.

B. Measurement. Measurement for Environmental Protection shall be as follows:

1. Measurement for furnishing, placing, maintaining, and removal of sedimentation barriers shall be per linear foot of measured length of in-place barrier as approved by the Engineer.

2. Measurement for furnishing, placing, maintaining, and removal of sedimentation control structures shall be per each as approved by the Engineer.

C. Payment. Payment for Environmental Protection listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made under the applicable divisions of this Bid Item as follows:

1. Payment for sedimentation control barriers shall be made at the unit price bid per linear foot.
2. Payment for sedimentation control structures shall be made of the unit price bid per each approved installation.
3. No additional payment will be made for maintaining or replacing sedimentation barriers or control structures during the course of the Work.

ITEM 20 - DEWATERING

A. General. The price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified which shall include Work performed by the Contractor, Contractor's Subcontractor(s) or Consultants, design, permits, installation, operation, maintenance and removal of the dewatering system (including but not limited to pumps, well points, header pipes and approved discharge point preparation and restoration), legal disposal of all water discharged during the operation of the dewatering system, restoration of all areas disturbed by the Contractor's operations and all other incidental Work relative thereto. The Contractor shall engage a Commonwealth of Massachusetts Registered Professional Engineer with experience in the design of dewatering systems consisting of only well points in order to pre-drain the area prior to excavation below the groundwater level

B. Measurement. Measurement for dewatering shall be by the linear foot of pipe trench dewatered as approved by the Engineer.

C. Payment. Payment for dewatering listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the linear foot price bid under this Bid Item and as follows:

1. Payment will be made for well point dewatering systems utilized to dewater the trench excavation.
2. No payment will be made for other type of dewatering systems including dewatering systems utilized within the limit of the trench excavation.

ITEM 21 - TEMPORARY BY-PASS PUMPING – Not Used

ITEM 22 - HIGHWAY CROSSING VIA HORIZONTAL DIRECTIONAL DRILLING

A. General. The lump sum price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified including work performed by the Contractor, Subcontractor, or Contractor's Consultants, for the design, installation, and drilling operation. The work shall also include all piping, fittings, valves, conduits, pipe/conduit supports/spacers, temporary structures, excavation, backfill and compaction, legal disposal of excess materials, coordination with MassDOT, drilling pits, connections to existing pipes and conduits located at the Pay Limits, dewatering operations (well points, pumps, electrical controls, suction and discharge piping, environmental controls, etc.), monitoring wells, control survey, dewatering operations, furnishing and maintaining safety warning signs and devices and all other incidental work relative thereto.

B. Measurement. Measurement for Highway Crossing via Horizontal Directional Drilling shall include all work for the installation of the piping and conduits located within the Pay Limit shown on the Contract Drawings.

C. Payment. Payment for the Highway Crossing via Horizontal Directional Drilling listed in DOCUMENT 00410, FORM FOR GENERAL BID shall be made at the lump sum price bid under the Bid Item.

1. The Lump Sum bid under this item shall include any MassDOT fees not specified to be paid by the Owner, all permits, insurance and bonds required by the MassDOT for the complete Highway Crossing.
2. No other payment Item will be used for compensation of Work performed under this Bid Item.
3. The following utility allowance(s) shall be included in the applicable subdivision of this Bid Item:
    a. MassDOT Inspections. Refer to SECTION 01020, ALLOWANCES.

ITEM 23 - PUMPING STATIONS

A. General. The prices bid under each division of the Bid Item shall be considered as fair compensation for all labor, equipment, tools, and materials necessary to complete the Work, as specified, located within the limit of Work shown for the construction of each Pumping Station shown on the Contract Drawings. This shall include all Work performed by the Contractor, Subcontractor(s) or Contractor's Consultant(s) for the construction of a complete pumping station including but not limited to, wetwell, valve vault, piping, values, flow measurement device, odor control system, control pedestal, emergency generator, planting operations, restoration, utility company coordination/fees, start-up and testing, and all other incidental Work relative thereto.

In addition to the above, the Work shall include the following:

1. Pumping Station No. 1
    a. Coordination of Work to maintain continuous operation of the existing sanitary system, pumping station and leaching field.
    b. Connection of existing sanitary service into the new collection system upon acceptance by the Owner of the new collection system.
2. Pumping Station No. 2
    a. Coordination of Work to maintain continuous operation of the existing sanitary system, pumping station and treatment facility and leaching field.
    b. Upon completion and acceptance by the Owner of the new collection system, demolish and legally dispose of the existing on-site sewage disposal system.
    c. Upon completion and acceptance by the Owner of the new collection system, demolish and legally dispose of the existing Bioclere Innovative Alternative treatment facility.
    d. Connection of existing sanitary service into the new collection system upon acceptance by the Owner of the new collection system.

B. Measurement

1. Measurement for each pumping station constructed shall be made based on a percentage of the total lump sum amount bid under each subdivision of this Bid Item, as approved by the Engineer.
2. Measurement for utility charge allowance(s) shall be based on the actual paid invoices by the Contractor to each utility company and/or nursery. The following utility and nursey allowance(s) shall be included in the applicable subdivision of this Bid Item:
    a. Electric Company Connection/Service Fee. Refer to SECTION 01020, ALLOWANCES
    b. Telephone Company Connection/Service Fee. Refer to SECTION 01020, ALLOWANCES
    c. Planting Operations. Refer to SECTION 01020, ALLOWANCES

C. Payment.

1. Payment for each pumping station constructed listed in DOCUMENT 00410, FORM FOR GENERAL BID shall be made at the lump sum price bid under each subdivision of this Bid Item. Payment for each pumping station constructed shall be made as follows: An amount of 60 percent of applicable division of this Bid Item (exclusive of normal contract retainage) shall be made when each pumping station is completely constructed which includes all site and utilities Work. The remaining 40 percent (exclusive of normal contract retainage) shall be made following acceptance of each pumping station by the Owner, including startup and testing, training of Owner personnel, delivery and approval of Operation and Maintenance Manual(s) and receipt by Owner of all specified spare parts.
2. Payment for utility company charges shall be made based on the actual charges paid to each utility by the Contractor. An amount of 100 percent of each paid invoice (no retainage and not markup) will be made to the Contractor based on paid invoice receipts.

3. Payment for planting operations charges shall be made based on the actual charges paid to each landscaper and/or nursery by the Contractor. An amount of 100 percent of each paid invoice (no retainage and not markup) will be made to the Contractor based on paid invoice receipts.

4. No other payment Item will be used for compensation of Work performed within the limit of work line shown on the Contract Drawings for each pump station.

ITEM 24 – TRACER WIRE IN STATE ROADWAYS

A. General. The price bid under the Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include placement of tracer wire, connectors, termination points, grounding, testing and all other incidental Work relative thereto.

B. Measurement. Measurement for furnishing and installing tracer wire shall be the horizontal measured length of tracer wire installed.

C. Payment. Payment for furnishing and installing tracer wire listed in DOCUMENT 00410, FORM OF GENERAL BID, shall be made at the unit price bid per linear foot under Item 24.

1.05 – BASIS OF MEASUREMENT AND PAYMENT – SRF ELIGIBLE BID ITEMS - ALTERNATIVES

ITEM A-1 – PAVEMENT RESTORATION IN TOWN ROADWAYS

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools, and materials necessary to complete the Work as specified, which shall include, repair of holes, settlements, etc. of the trenches; cutting of bituminous and cement concrete pavement; reshaping of the roadway surface; resetting of structures and utility boxes; milling of bituminous concrete surfaces; repainting of traffic control lines/wording and markings (permanent); replacement of vehicle loop detectors; reshaping, loaming and seeding of roadway shoulders; repair to roadways used as detours; and all other Work incidental thereto and all other Work incidental thereto.

The Work for ITEM A-1 – PAVEMENT RESTORATION IN TOWN ROADWAYS for the SRF ELIGIBLE BID ITEMS – ALTERNATIVES is shown on the Contract Drawing(s) numbered:

00 G-001	00 G-002	00 G-003	00 C-001	01 C-101	01 C-102	01 C-103	00C-104
00 C-105	01 C-106	01 C-107	01 C-108	01 C-109	02 C-104	02 C-105	02 C-107
02 C-108	02 C-109	02 C-110	03 C-101	03 C-102	03 C-103	03 C-104	03 C-105
03 C-106	03 C-107	03 C-108	03 C-109	03 C-110	03 C-111	03 C-115	03 C-117

B. Measurement. Measurement for pavement restoration shall be as follows:

1. Permanent Bituminous Concrete Full Width Overlay Pavement. Measurement for Permanent Bituminous Concrete Full Width Overlay Pavement with or without milling will be made based on either: (a) Certified weight slips delivered daily to the Engineer or (b) the actual length and width of roadway overlaid as approved by the Engineer.

2. Miscellaneous Bituminous Concrete. Measurement for Miscellaneous Bituminous Concrete placed where directed by the Engineer shall be by the ton based on certified weight slips delivered daily to the Engineer.

3. Replacement of Vehicle Loop Detectors. Measurement for Replacement of Vehicle Loop Detectors shall be based on each location replaced as approved by the Engineer and MassDOT. Each location paid for shall be for the vehicle loop detector replaced following Permanent Bituminous Concrete Trench Pavement and replaced following Permanent Bituminous Concrete Full Width Overlay Pavement.

4. Repainting of Traffic Markings. Refer to SECTION 01020, ALLOWANCES.

5. Payment limits for pavement restoration specified above supersede the MassDEP Policy Memorandum CG-8.

C. Payment. Payment for pavement restoration listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made under the applicable divisions of this Bid Item.

1. Permanent Bituminous Concrete Full Width Pavement. Payment for Permanent Bituminous Concrete Full Width Pavement including milling, if applicable, listed in DOCUMENT 00410, FORM OF GENERAL BID will be made at the unit price bid per ton under the applicable divisions of this Bid Item.

   a. The factor of 0.055 tons per square yard per inch of thickness shall be used for weight-volume conversions for bituminous concrete.

   b. Certified weight slips for all bituminous concrete delivered to the site(s) and certified volume slips for all controlled density fill delivered to the site(s) shall be submitted to the Engineer on a daily basis.

   c. Payment for furnishing and placing permanent bituminous concrete pavement shall be made at the unit price bid per ton computed using one of the following methods:

      1) Method 1 (Measured in Place): The Engineer shall multiply the pavement area by the specified pavement thickness by the factor to obtain the tonnage of bituminous concrete.

      2) Method 2 (Delivered): Certified weight slips shall be used. Any bituminous concrete placed outside the payment limits, unless approved by the Engineer, shall be deducted (using Method 1) from the total tonnage obtained from the certified weight slips.

      3) Payment for furnishing and placing temporary and permanent bituminous concrete will be made based on the number of tons obtained using either Method 1 or Method 2, whichever is less.

2. Miscellaneous Bituminous Concrete. Payment for Miscellaneous Bituminous Concrete whether placed by machine or by hand, for leveling of existing roadways, driveway aprons, sidewalks, repairs to roadways used for detours, and other areas outside the trench limits listed in DOCUMENT 00410, FORM OF GENERAL BID will be made at the unit price bid per ton.

3. Vehicle Loop Detectors. Payment for replacement of vehicle loop detectors listed in DOCUMENT 00410, FORM OF GENERAL BID shall be at the unit price bid per each location under this Bid Item.

4. The following utility allowance(s) shall be included in the applicable subdivision of this Bid Item:

   a. Repainting of Traffic Markings – Refer to SECTION 01020, ALLOWANCES.

   b. Removal and Relaying and/or Replacement of Existing Gas Main and Services. Refer to SECTION 01020, ALLOWANCES.

   c. Removal and Relaying and/or Replacement of Existing Miscellaneous Utilities. Refer to SECTION 01020, ALLOWANCES.

5. Price Adjustment - Liquid Asphalt, Diesel, Gasoline and Portland Cement

   a. The intent of this provision is to insure adequate and fair compensation for unpredictable and fluctuating costs which, from time to time, occur in the prices of Liquid Asphalt, Diesel Fuel, Gasoline and Portland Cement. The price adjustment provisions are made part of the Contract to assure more realistic bidding and encourage competition. Price Adjustments will be based on the variance in price, for the material component only, between the Base Price and the Period Price. They shall not include transportation or other charges. Price Adjustments will occur on a monthly basis for Liquid Asphalt and at the end of the Project for Diesel Fuel, Gasoline and Portland Cement.

   b. Base Price - The Base Price of liquid asphalt on a project is a fixed price determined by the MassDOT at the time of the bid using the same method as the determination of the Period Price detailed below. The Base Price shall be used in all bids.

      The March 2020 base prices are as follows: liquid asphalt at $552.50 per ton and Portland cement at $135.50. The February 2020 base prices are as follows: diesel fuel at $2.094 per gallon and gasoline at $1.915 per gallon. MassDOT posts the Price Adjustments on their Highway Division's website at https://www.mass.gov/service-details/2019-massdot-contract-price-adjustments under the following link sequences: (1) Doing Business With Us; (2) Construction; and (3) Price Adjustments.

1. Hot Mix Asphalt

   a) Period Price - The Period Price is the price of liquid asphalt for each monthly period as determined by the MassDOT using the average selling price per standard ton of PG64-28 paving grade (primary binder classification) asphalt, FOB manufacturer's terminal, as listed under the "East Coast Market - New England, Boston, Massachusetts area" section of the Poten & Partners, Inc. "Asphalt Weekly Monitor". This average selling price is listed in the issue having a publication date of the second Friday of the month and will be posted as the Period Price for that month. The MassDOT will post this Period Price on its website at http://www.mhd.state.ma.us/ within two (2) business days following its receipt of the relevant issue of the "Asphalt Weekly Monitor". Poten and Partners has granted the MassDOT the right to publish this specific asphalt price information sourced from the Asphalt Weekly Monitor. This method of period price determination was formerly called the New Asphalt Period Price Method. Separate website postings using both the New Asphalt Period Price Method and the Old Asphalt Period Price Method were discontinued after June 2013.

   b) Price Adjustment Determination, Calculation and Payment - Price Adjustments, as herein provided, either upwards or downwards, will be made after the work has been performed using the monthly period price for the month during which the work was performed. Price Adjustments will be paid only if the variance from the Base Price is 5 percent or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5 percent from either upward or downward adjustments. The Price Adjustment applies only to the actual virgin liquid asphalt content in the mixture placed on the job in accordance with the Standard Specifications for Highways and Bridges, Division III, Section M3.11.03. No adjustment will be paid for work done beyond the completion date. Price Adjustments for a positive price adjustment (a payment) and a negative price adjustment (a deduction) will be calculated using the following equation:

   c) Price Adjustment = Tons of HMA Placed x Liquid Asphalt Content % x RAP Factor x (Period Price - Base Price).

2. Diesel Fuel` and Gasoline

   a) Price period - The Period Price will be the average of prices charged to the State, including State Tax for the bulk purchases made during each month.

   b) Price Adjustment Determination, Calculation and Payment - Price Adjustments, as herein provided, either upwards or downwards, will be made after the work has been performed using the monthly period price for the month during which the work was performed. This adjustment will be based on fuel usage factors for various items of work developed by the Highway Research Board in Circular 158, dated July 1974. These factors will be multiplied by the quantities of work done in each item during each monthly period and further multiplied by the variance in price from the Base Price to the Period Price. The Base Price of Diesel Fuel and Gasoline will be the price as indicated in the Department’s web site (www.MassDOT.state.ma.us) for the month in which the contract was bid, which includes State Tax. This adjustment will be affected only if the variance from the Base Price is 5 percent or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5 percent from either upward or downward adjustments. Any adjustment (increase or decrease) to estimated quantities made to each item at the time of final payment will have the fuel price adjustment figured at the average period price for the entire term of the project for the difference of quantity. No adjustment will be paid for work done beyond the completion date. The fuel price adjustment will apply only to the following items of work at the fuel factors shown:

SRF Eligible Bid Items – Alternatives Covered	Diesel Fuel	Gasoline
2. Sewer and Storm Drainage Pipelines and Associated Fittings	X	X
3. Precast Concrete Manholes and Structures	X	X
8. Rock and/or Boulder Excavation	X	X
9. Replacement of Unsuitable Material	X	X
10. Experimental Excavation	X	X
14. Road Gravel	X	X
15. Pavement Restoration	X	Does Not Apply

6. No additional payment will be made beyond the payment limits noted or for maintenance or repair of trenches.
7. Payment for joint sealant and/or tack coat shall be included under the applicable division of this Bid Item for bituminous concrete Work.
8. Payment for adjusting frames and covers, valve boxes and all other castings prior to placement of permanent bituminous concrete pavement shall be included under the applicable division of this Bid Item for bituminous concrete Work.
9. Payment for reshaping of roadways and/or road shoulders, roadway reclamation, regrading and compaction of roadway base course materials and or providing leveling course over settled trenches shall be included under the applicable division of this Bid Item for bituminous concrete Work.

ITEM A-2 – PUMPING STATION NO. 3 TRIBUTARY AREA

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include: transportation; handling and dispersal of materials; cutting and removal of existing bituminous and cement concrete or reinforced cement concrete pavement; excavation, backfill above trench grade including all bedding materials (controlled density fill and road gravel); conduits and handholes; compacting trenches; sheeting and shoring not ordered left in place; loaming and seeding; landscaping; removing and resetting curbing, property markers, signs and mail boxes; dust control including mechanical sweeping; all fittings, caps, plugs, restraints and the like; traffic control devices; flushing/cleaning of conduits; testing (pressure, leakage, compaction, etc.); dewatering of trenches; daily cleanup; restoration of all areas disturbed by the Contractor's operations; all Work as specified in DIVISION 1 – GENERAL REQUIREMENTS; and all other incidental Work relative thereto.

The Work for ITEM A-2 - PUMPING STATION NO. 3 TRIBUTARY AREA for the SRF ELIGIBLE BID ITEMS - ALTERNATIVES is shown on the Contract Drawing(s) numbered:

00 G-001	00 G-002	00 G-003	00 C-001	03 C-101	03 C-102	03 C-103	03 -C-104
03 C-105	03 C-106	03 C-107	03 C-108	03 C-109	03 C-110	03 C-111	03 C-112
03 C-113	03 C-114	03 C-115	03 C-116	03 C-117	03 C-401	99 C-501	99 C-502
99 C-503	99 C-504	99 C-505	99 C-506	99 C-507	99 C-508	99 C-509	99 C-510
99 C-511	99 C-601	99 C-602	99 C-603	00 D-001	00 D-002	00 D-003	03 D-101
99 D-501	00 E-001	00 E-601	03 E-001	03 E-002	03 E-101	03 E-601	03 E-602
03 E-603	99 E-501	99 E-502	99 E-503	00 DI-001	00 DI-601	03 DI-601	03 DI-602
99 DI-601							

In addition to the above, the Work shall include the following:

3. Pumping Station No. 3

   c. Coordination of Work to maintain continuous operation of the existing sanitary system, pumping station and leaching field.

   d. Upon completion and acceptance by the Owner of the new collection system, demolish and legally dispose of the existing on-site sewage disposal system.

   e. Connection of existing sanitary service into the new collection system upon acceptance by the Owner of the new collection system.

B. Measurement. Measurement for the work associated with the divisions of this Bid Item shall be in accordance with the measurement descriptions under the SRF ELIGIBLE BID ITEMS - BASE BID.

2. Measurement for utility charge allowance(s) shall be based on the actual paid invoices by the Contractor to each utility company and/or nursery. The following utility and nursey allowance(s) shall be included in the applicable subdivision of this Bid Item:

   a. Electric Company Connection/Service Fee. Refer to SECTION 01020, ALLOWANCES

   b. Telephone Company Connection/Service Fee. Refer to SECTION 01020, ALLOWANCES

   c. Planting Operations. Refer to SECTION 01020, ALLOWANCES

C. Payment. Payment for the work associated with the divisions of this Bid Item shall be in accordance with the payment descriptions under the SRF ELIGIBLE BID ITEMS - BASE BID.

ITEM A-3 - FIBER OPTIC CONDUITS ASSOCIATED FITTINGS AND HANDHOLES

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include: transportation; handling and dispersal of materials; cutting and removal of existing bituminous and cement concrete or reinforced cement concrete pavement; excavation, backfill above trench grade including all bedding materials (controlled density fill and road gravel); conduits, fittings and handholes; compacting trenches; sheeting and shoring not ordered left in place; loaming and seeding; landscaping; removing and resetting curbing, property markers, signs and mail boxes; dust control including mechanical sweeping; all fittings, caps, plugs, restraints and the like; traffic control devices; flushing/cleaning of conduits; testing (pressure, leakage, compaction, etc.); dewatering of trenches; daily cleanup; restoration of all areas disturbed by the Contractor's operations; all Work as specified in DIVISION 1 – GENERAL REQUIREMENTS; and all other incidental Work relative thereto.

The Work for ITEM A-3 - FIBER OPTIC CONDUITS ASSOCIATED FITTINGS AND HANDHOLES for the SRF ELIGIBLE BID ITEMS – ALTERNATIVES is shown on the Contract Drawing(s) numbered:

00 G-001	00 G-002	00 G-003	00 C-001	01 C-101	01 C-102	01 C-103	00C-104
00 C-105	01 C-106	99 C-506	99 C-507	00 E-001	00 E-002	00 E-003	00 E-601
01 E-001	02 E-001	03 E-001	99 E-501	99 E-502			

B. Measurement. Measurement for furnishing and installing fiber optic conduits, fittings and handholes shall be as follows:

1. The length of conduits to be paid for under the appropriate subdivision of this Bid Item shall be the horizontal measured length of conduit in place from centerline of handhole to centerline of handhole. Measurement shall be by the linear foot with no deductions made for fittings.

2. The number of handholes to be paid under the appropriate subdivision of this Bid Item and shall be equal to the actual number installed.

C. Payment. Payment for furnishing and installing conduits, fittings and handholes listed in DOCUMENT 00410, FORM OF GENERAL BID, shall be made at the unit prices bid under the applicable divisions of this Bid Item.

1. Only eighty-five (85) percent of the price bid per linear foot of conduit shall be paid for upon its installation, the balance shall be withheld until such time as the conduits have been successfully cleaned and tested (as required) and the site(s) has been fully restored. This percentage is exclusive of normal Contract retainage.

2. Payment for handholes will be paid under the appropriate subdivisions of this Bid Item and shall be equal to the actual number installed.

ITEM A-4 - TRACER WIRE IN TOWN ROADWAYS

A. General. The price bid under the Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include placement of tracer wire, connectors, termination points, grounding, testing and all other incidental Work relative thereto.

The Work for ITEM A-4 -TRACER WIRE IN TOWN ROADWAYS for the SRF ELIGIBLE BID ITEMS – ALTERNATIVES is shown on the Contract Drawing(s) numbered:

00 G-001	00 G-002	00 G-003	00 C-001	01 C-101	01 C-102	01 C-103	00C-104
00 C-105	01 C-106	01 C-107	01 C-108	01 C-109	02 C-104	02 C-105	02 C-107
02 C-108	02 C-109	02 C-110	03 C-101	03 C-102	03 C-103	03 C-104	03 C-105
03 C-106	03 C-107	03 C-108	03 C-109	03 C-110	03 C-111	03 C-115	03 C-117
99 C-508							

B. Measurement

1. Measurement for furnishing and installing tracer wire along the gravity sewer or low-pressure sewer shall be the horizontal measured length of tracer wire in place from centerline of manhole to centerline of manhole. Measurement shall be by the linear foot with no deductions made for manholes, connections and the like.

2. Measurement for furnishing and installing tracer wire along the force main shall be the horizontal measured length of tracer wire in place from the face of the Pumping Station Valve Vault to the centerline of the terminus manhole. Measurement shall be by the linear foot with no deductions made for manholes, connections and the likes.

3. Measurement for furnishing and installing tracer wire along the service connections shall be the horizontal measured length of tracer wire in place from the face of the wye, tee or chimney to the terminus of the service pipeline. Measurement shall be by the linear foot with no deductions made for manholes, connections and the likes.

C. Payment. Payment for furnishing and installing tracer wire listed in DOCUMENT 00410, FORM OF GENERAL BID, shall be made at the unit price bid unit linear foot under this Bid Item.

ITEM A-5 - HIGHWAY CROSSING VIA JACKING

A. General. The lump sum price bid under this Bid Item shall be considered as fair compensation for the additional cost for all labor, equipment, tools and materials necessary to complete the Highway Crossing using Jacking in place of using Horizontal Directional Drilling as specified under Item 22 of the SRF ELIGIBLE BID ITEMS - BASE BID as specified including work performed by the Contractor, Subcontractor, or Contractor's Consultants, for the design, installation, and jacking operation, The work shall also include all piping, fittings, valves, conduits, pipe/conduit supports/spacers, temporary structures, excavation, backfill and compaction, legal disposal of excess materials, coordination with MassDOT, jacking and receiving pits, connections to existing pipes and conduits located at the Pay Limits, grouting, filling the voids between the pipes conduits and the steel casing, dewatering operations (well points, pumps, electrical controls, suction and discharge piping, environmental controls, etc.), monitoring wells, control survey, dewatering operations, furnishing and maintaining safety warning signs and devices and all other incidental work relative thereto.

The Work for ITEM A-5 - HIGHWAY CROSSING VIA JACKING for the SRF ELIGIBLE BID ITEMS – ALTERNATIVES is shown on the Contract Drawing(s) numbered:

00 G-001	00 G-002	00 G-003	00 C-001	01 C-104	01 C-105	99 C-501	99 C-502
99 C-503	99 C-504	99 C-505	99 C-506	99 C-507	99 C-508	99 C-509	99 C-510
99 C-511	99 C-601	99 C-602	99 C-603	00 E-001	00 E-002	00 E-601	99 E-501
99 E-501							

B. Measurement. Measurement for Highway Crossing shall include the additional cost to complete the Highway Crossing using Jacking with a steel casing and all work for the installation of the piping and conduits located within in place of using Horizontal Directional Drilling as specified under Item 22 of the SRF ELIGIBLE BID ITEMS - BASE BID.

C. Payment. Payment for the Highway Crossing listed in DOCUMENT 00410, FORM FOR GENERAL BID shall be made at the lump sum price bid under the Bid Item.

1. The Lump Sum bid under this item shall be the additional cost to complete the Highway Crossing using Jacking in place of using Horizontal Directional Drilling as specified under Item 22 of the SRF ELIGIBLE BID ITEMS - BASE BID.

2. The Lump Sum price bid under this item shall include the removal of 100 cubic feet of rock and/or boulders located within the steel casing.

3. No other payment Item will be used for compensation of Work performed under this Bid Item.

1.06 - BASIS OF MEASUREMENT AND PAYMENT – SRF INELIGIBLE ITEMS

ITEM B-1 – REPLACEMENT OF WATER SERVICES

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include: transportation. handling and dispersal of materials; cutting and removal of existing bituminous and cement concrete or reinforced cement concrete pavement; excavation, backfill above trench grade including all bedding materials (controlled density fill and road gravel); removal and legal disposal of all existing water services and appurtenances being replaced; compacting trenches; sheeting and shoring not ordered left in place; loaming and seeding; landscaping; removing and resetting curbing, property markers, signs and mail boxes; connections to existing water pipeline(s) and services; dust control including mechanical sweeping; all permanent and temporary fittings, caps, plugs, restraints and the like; traffic control devices; flushing/cleaning of services; testing (pressure, leakage, bacteriological, compaction, etc.); dewatering of trenches; daily cleanup; restoration of all areas disturbed by the Contractor's operations; all Work as specified in DIVISION 1 – GENERAL REQUIREMENTS; and all other incidental Work relative thereto.

The Work for ITEM B-1 – REPLACEMENT OF WATER SERVICES for the SRF INELIGIBLE BID ITEMS is shown on the Contract Drawing(s) numbered:

00 G-001	00 G-002	00 G-003	00 C-001	01 C-101	00 C-109	00 C-110	02 C-101
02 C-102	02 C-103	02 C-104	02 C-105	02 C-106	02 C-107	02 C-108	02 C-109
02 C-110	03 C-102	03 C-103	03 C-113	03 C-114	03 C-116	03 C-117	

Note: Funding for this Bid Item is anticipated to be obtained at the Annual Town Meeting proposed to be held in May 2020. Therefore, performing the scope of work specified under this Bid Item is subject to this future appropriation and no payment will be made without written approval by the OWNER.

B. Measurement. Measurement for replacement of water services and associated fittings and valves shall be as follows:

1. Measurement shall be the horizontal measured length of water service in place from the face of the corporation to the terminus of the water service at the property line.

2. Measurement shall be as stated above with a minimum payment of five (5) linear feet.

3. Measurement for the following divisions of this Bid Item shall be in accordance with the measurement descriptions under the SRF ELIGIBLE BID ITEMS - BASE BID:

   a. Road Gravel Material

   b. Permanent Bituminous Concrete Trench Pavement

4. No other measurement Item will be used for compensation of Work performed under this Bid Item.

C. Payment. Payment for replacement of water services and associated fittings listed in DOCUMENT 00410, FORM OF GENERAL BID, shall be made at the unit prices bid under the applicable divisions of this Bid Item.

1. Payment for water services shall be made at the unit price bid per linear foot.

2. Payment for the following divisions of this Bid Item shall be in accordance with the payment descriptions under the SRF ELIGIBLE BID ITEMS - BASE BID:

   a. Road Gravel Material

   b. Permanent Bituminous Concrete Trench Pavement

3. No other payment Item will be used for compensation of Work performed under this Bid Item.

ITEM B-2 – REPLACEMENT OF CANAL ROAD WATER MAIN

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include: transportation. handling and dispersal of materials; cutting and removal of existing bituminous and cement concrete or reinforced cement concrete pavement; excavation, backfill above trench grade including all bedding materials (controlled density fill and road gravel); removal and legal disposal of all existing water mains, water services, fire hydrants, gate valves, etc. being replaced (including pipes, services, and appurtenances); temporary water polyethylene wrap; reconnecting existing fire hydrants; compacting trenches; sheeting and shoring not ordered left in place; loaming and seeding; landscaping; removing and resetting curbing, property markers, signs and mail boxes; connections to existing water pipeline(s) and services; dust control including mechanical sweeping; all permanent and temporary fittings, caps, plugs, restraints and the like; traffic control devices; flushing/cleaning of water mains; testing (pressure, leakage, bacteriological, compaction, etc.); dewatering of trenches; polyethylene encasement; daily cleanup; restoration of all areas disturbed by the Contractor's operations; all Work as specified in DIVISION 1 – GENERAL REQUIREMENTS; and all other incidental Work relative thereto.

The Work for ITEM B-2 – REPLACEMENT OF CANAL ROAD WATER MAIN for the SRF INELIGIBLE BID ITEMS is shown on the Contract Drawing(s) numbered:

00 G-001	00 G-002	00 G-003	00 C-001	03 C-105	03 C-108	03 C-109	03 C-110
99 C-501	99 C-502	99 C-503	99 C-504	99 C-505	99 C-506	99 C-507	99 C-508
99 C-509	99 C-510	99 C-511	99 C-601	99 C-602	99 C-603		

Note: Funding for this Bid Item is anticipated to be obtained at the Annual Town Meeting proposed to be held in May 2020. Therefore, performing the scope of work specified under this Bid Item is subject to this future appropriation and no payment will be made without written approval by the OWNER.

B. Measurement. Measurement for furnishing and installing water mains and associated fittings, water services fire hydrants and valves shall be as follows:

1. The length of water mains to be paid for shall be the horizontal measured length of pipeline in place from the start of the replacement to the end of the replacement (i.e. connection to existing water main to remain to connection to existing water main to remain). Measurement shall be by the linear foot with no deductions made for fittings or valves.

2. Measurement for water services shall be by the linear foot.

    a. Measurement for water services shall be the horizontal measured length of pipeline in place from the face of the corporation to the terminus of the water service at the property line.

    b. Measurement shall be as stated above with a minimum payment of five (5) linear feet.

3. The number of valves to be paid under the appropriate subdivisions of this Bid Item and shall be equal to the actual number installed.

4. The number of hydrants to be paid under the appropriate subdivisions of this Bid Item and shall be equal to the actual number installed.

5. Measurement for the following divisions of this Bid Item shall be in accordance with the measurement descriptions under the SRF ELIGIBLE BID ITEMS - BASE BID:

    a. Road Gravel Material

    b. Permanent Bituminous Concrete Trench Pavement

6. No other measurement Item will be used for compensation of Work performed under this Bid Item.

C. Payment. Payment for furnishing and installing water mains and associated fittings and water services of the various types, diameters and depths listed in DOCUMENT 00410, FORM OF GENERAL BID, shall be made at the unit prices bid under the applicable divisions of this Bid Item.

1. Only eighty-five (85) percent of the price bid per linear foot of water main shall be paid for upon its installation, the balance shall be withheld until such time as water main(s) have been successfully flushed and tested (as required), accepted by the Owner for incorporation into the existing water system and the site(s) has been fully restored. This percentage is exclusive of normal Contract retainage.

2. Payment for water services shall be made at the unit price bid per linear foot.

3. Payment for valves will be paid under the appropriate subdivisions of this Bid Item and shall be equal to the actual number installed.

4. Payment for fire hydrants will be paid under the appropriate subdivisions of this Bid Item and shall be equal to the actual number installed.

5. Payment for the following divisions of this Bid Item shall be in accordance with the payment descriptions under the SRF ELIGIBLE BID ITEMS - BASE BID:

    a. Road Gravel Material

    b. Permanent Bituminous Concrete Trench Pavement

6. The Contractor shall provide water for flushing and testing (as applicable) for each section of water main installed. Water utilizing the Owner's water system may be available, however, the Owner does not guarantee that its water supply will be available at any time during the duration of the Project. If available, water required for testing, puddling and/or jetting of trenches shall be provided by the Owner at no cost to the Contractor. All water shall be metered and the use of backflow prevention device(s) shall be required as approved by the Owner.

7. No other payment Item will be used for compensation of Work performed under this Bid Item.

ITEM B-3 – WATER QUALITY IMPROVEMENTS

A. General. The lump sum price bid under each division of the Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, including work performed by the Contractor, Subcontractor, or Contractor's Consultants, necessary to complete the Work as specified, which shall include: transportation. handling and dispersal of materials; cutting and removal of existing bituminous and cement concrete or reinforced cement concrete pavement; excavation, backfill above trench grade including all bedding materials (controlled density fill and road gravel); removal and legal disposal of all excess materials; pipes and fittings; compacting trenches; sheeting and shoring not ordered left in place; removal and relaying/replacement of

existing water main; loaming and seeding; landscaping; removing and resetting curbing, property markers, signs and mail boxes; temporary pavement restoration; dust control including mechanical sweeping; traffic control devices; flushing/cleaning of pipe and structures; dewatering of trenches; daily cleanup; restoration of all areas disturbed by the Contractor's operations; all Work as specified in DIVISION 1 – GENERAL REQUIREMENTS; and all other incidental Work relative thereto.

The Work for ITEM B-3 – WATER QUALITY IMPROVEMENTS for the SRF INELIGIBLE BID ITEMS is shown on the Contract Drawing(s) numbered:

00 G-001 00 G-002 00 G-003 00 C-001 02 C-104

Note: Funding for this Bid Item is anticipated to be obtained at the Annual Town Meeting proposed to be held in May 2020. Therefore, performing the scope of work specified under this Bid Item is subject to this future appropriation and no payment will be made without written approval by the OWNER.

B. Measurement. Measurement for Water Quality Improvements shall made based on a percentage of the total lump sum amount bid under each subdivision of this Bid Item, as approved by the Engineer.

C. Payment. Payment for the Water Quality Improvements listed in DOCUMENT 00410, FORM FOR GENERAL BID shall be made at the lump sum price bid under each subdivision of this Bid Item.

1. The Lump Sum price bid under this item shall include the removal of 10 cubic feet of rock and/or boulders located within the excavation.

2. No other payment Item will be used for compensation of Work performed under this Bid Item.

PART 2 - PRODUCTS – Not Used

PART 3 – EXECUTION – Not Used

END OF SECTION

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April 10, 2020

ADDENDUM NO. 10

TO

DOCUMENTS AND SPECIFICATIONS

FOR

Downtown Area Collection System and Pumping Stations

Contract No. 2019-02 and SRF No. 4486

Town of Orleans, MA

Department of Public Works & Natural Resources

This Addendum No. 10 forms a part of the Contract Documents and modifies the Bidding Documents dated January 2020 as noted below. Acknowledge receipt of this Addendum in the space provided in SECTION 00410, FORM OF GENERAL BID. Failure to do so may subject the Bidder to disqualification.

This Addendum consists of 6 pages and 80 pages of attachments for a total of 86 pages.

ATTACHMENTS

1. Orleans_MA-2019-02-Bid Form_Add_10-04-10-20
2. MassDOT Issued Permit 5-2019-0487
3. Section 13345, Data Network
4. Drawing 99 C-507, Details VII - Plate
5. Drawing 00 DI-601, System Architecture
6. Drawing 01 DI-602, Pump Station 1 Odor Control P&ID
7. Drawing 02 DI-602, Pump Station 2 Odor Control P&ID
8. Drawing 03 DI-602, Pump Station 3 Odor Control P&ID
9. Drawing 00 E-002, Electrical Site Plan – Fiber Network II
10. Drawing 00 E-002, Electrical Site Plan – Fiber Network II
11. Drawing 00 E-601, Electrical Schedules
12. Drawing 01 E-001, Pump Station No. 1 – Electrical Site Plan
13. Drawing 01 E-002, Pump Station No. 1 – Electrical Single Line Diagram
14. Drawing 01 E-101, Pump Station No. 1 – Electrical Power Plan
15. Drawing 01 E-601, Pump Station No. 1 – Electrical Riser Diagrams
16. Drawing 01 E-602, Pump Station No. 1 – EE-01 Elevation
17. Drawing 01 E-603, Pump Station No. 1 – Wiring Schematics
18. Drawing 02 E-001, Pump Station No. 1 – Electrical Site Plan
19. Drawing 02 E-002, Pump Station No. 1 – Electrical Single Line Diagram
20. Drawing 02 E-101, Pump Station No. 1 – Electrical Power Plan

21. Drawing 02 E-601, Pump Station No. 1 – Electrical Riser Diagrams
22. Drawing 02 E-602, Pump Station No. 1 – EE-02 Elevation
23. Drawing 02 E-603, Pump Station No. 1 – Wiring Schematics
24. Drawing 03 E-001, Pump Station No. 1 – Electrical Site Plan
25. Drawing 03 E-002, Pump Station No. 1 – Electrical Single Line Diagram
26. Drawing 03 E-101, Pump Station No. 1 – Electrical Power Plan
27. Drawing 03 E-601, Pump Station No. 1 – Electrical Riser Diagrams
28. Drawing 03 E-602, Pump Station No. 1 – EE-03 Elevation
29. Drawing 03 E-603, Pump Station No. 1 – Wiring Schematics

CHANGES TO BE MADE TO THE CONTRACT SPECIFICATIONS

1. GENERAL

   A. General Bid Opening – May 6, 2020 at 2:00 p.m.

2. SECTION 00100, ADVERTISEMENT FOR BIDS

   A. Page 00100-1, Paragraph 3., first subparagraph, delete the words "…until 2:00 p.m. prevailing time, on April 22, 2020 at which time and place…" and replace with the words "…until 2:00 p.m. prevailing time, on May 6, 2020 at which time and place…".

3. SECTION 00410, FORM OF GENERAL BID

   A. Delete "Orleans_MA-2019-02-Bid Form_Add_9-03-24-20" in its entirety and replace with the attached new "Orleans_MA-2019-02-Bid Form_Add_10-04-10-20" in both hard copy and Microsoft Excel format.

4. DOCUMENT 00858, SPECIAL CONDITIONS – PERMITS AND LICENSES

   A. Page 00858-1, Massachusetts Department of Transportation (MassDOT) - Road Opening

      ATTACHMENTS, add MassDOT Issued Permit 5-2019-0487, as attached.

5. SECTION 01025, MEASUREMENT AND PAYMENT

   A. Page 01025-16, ITEM 22 - HIGHWAY CROSSING VIA HORIZONTAL DIRECTIONAL DRILLING, Paragraph A., add the following to the end of the paragraph:

      The Contractor has the option to: (a) Drill the 48-inch Casing shown on the drawings followed by the installation of the three 8-inch pipelines and two 4-inch conduits or (b) Individually drill each 8-inch pipeline and the two 4-inch conduits.

6. SECTION 01030, SPECIAL REQUIREMENTS

   A. Page 01030-5, ARTICLE 1.11 - SCOPE OF WORK AND SEQUENCE OF CONSTRUCTION,

      1. Paragraph F, subparagraph 9.a., delete the subparagraph in its entirety and replace with the following new subparagraph:

         a. Method A - Permanent Surfacing of State Roadways

            (1) Prior to the start of construction, the Contractor and Contractor's paving subcontractor shall meet with the Owner, MassDOT and the Engineer to review roadway restoration.

            (2) Temporary Trench Pavement – Not Used.

            (3) Permanent Trench Pavement - Cut back each side of trenches by a minimum of 1-foot. Furnish and place 5-inch permanent bituminous concrete trench width pavement (base course). The base course shall be laid in two layers. A 3-inch Superpave base course and a 2-inch Superpave Intermediate course for a total base course of 5 inches. Permanent trench pavement shall occur between 90 to 180 days after pipeline installation subject to OWNER and MassDOT approval.

(4) Overlay - Mill 2-inches and furnish and place 2-inch permanent bituminous concrete full width pavement (top course). Overlay shall be placed the following construction season, allowing the trench to settle over a winter freeze thaw cycle. Mill and overlay shall occur following the completion of the permanent trench pavement subject to OWNER and MassDOT approval.

Permanent Bituminous Concrete Trench Pavement and Permanent Bituminous Concrete Full Width Pavement of State Roadways shall occur in the following locations:

Location	**Drawing Number**	**Manhole or Station ***	
		From	**To**
Cranberry Highway	01 C-110	SMH G-04-02	SMH G-03-11
Cranberry Highway	02 C-101 thru 02 C-102	SMH G-04-03	SMH F-04-54
Cranberry Highway	02 C-103	SMH F-04-14	SMH E-04-30
Cranberry Highway	03 C-112	SMH E-04-10	SMH E-04-01
South Orleans Road	03 C-112 thru 03 C-114	SMH E-04-01	SMH D-05-03
South Orleans Road	02 C-106	Exist. SMH F-04-31	SMH E-04-06
South Orleans Road	03 C-116	SMH E-04-01	SMH E-04-06

* Note: Final location to be determined in the field.

B. Page 01030-5, ARTICLE 1.11 - SCOPE OF WORK AND SEQUENCE OF CONSTRUCTION,

1. Paragraph F, subparagraph 9.b., delete the subparagraph in its entirety and replace with the following new subparagraph:

b. Method B - Permanent Surfacing of Local Streets

(1) Prior to the start of construction, the Contractor and Contractor's paving subcontractor shall meet with the Owner and the Engineer to review roadway restoration.

(2) Temporary Trench Pavement – Not Used.

(3) Permanent Trench Pavement - Cut back each side of trenches by a minimum of 1-foot. Furnish and place 4-1/2-inch permanent bituminous concrete trench width pavement (base course). Permanent trench pavement shall occur between 90 to 180 days after pipeline installation subject to OWNER approval.

(4) Overlay - Furnish and place 1-1/2-inch permanent bituminous concrete full width pavement (top course). Overlay shall be placed the following construction season, allowing the trench to settle over a winter freeze thaw cycle. Mill and overlay shall occur following the completion of the permanent trench pavement subject to OWNER approval.

Permanent Trench Pavement and Overlay of Local Roadways shall occur in the following locations:

Location	Drawing Number	Manhole or Station *	
		From	To
Center Place	02 C-109	SMH F-04-17	SMH F-04-25
Jones Road	03 C-105	SMH D-04-08	SMH D-04-10
Liberty Lane	03 C-106	SMH E-04-18	SMH E-04-33
Old County Road	03 C-115	SMH E-05-10	SMH D-05-12

* Note: Final location to be determined in the field.

7. SECTION 02150, HIGHWAY CROSSING (JACKING)

   A. Page 02150-5, ARTICLE 2.03 – CASING PIPE (SLEEVE), delete Paragraph D. in its entirety and replace with the following new paragraph:

      D. Permalok Casing Pipe and Tri-Loc Casing Pipe can be substituted for the Casing Pipe (Sleeve) subject to the Casing Pipe requirements of the previous paragraphs and subject to MassDOT approval.

8. SECTION 02210, EARTH EXCAVATION, BACKFILL, FILL AND GRADING

   A. Page 02210-10, ARTICLE 3.15 - MATERIAL PLACEMENT AND COMPACTION REQUIREMENTS, add the following new paragraph.

      E. Material Placement and Compaction Requirements – State Roads

         1. Material placement and compaction requirements for work in State Roads shall comply with the requirements of MassDOT Permit No. 5-2019-0487.

         2. The Contractor shall perform the work for backfill testing methods as follows:

            a. All methods used to determine and verify the proper compaction of backfill shall be in accordance with AASHTO Standard Specifications of Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth) (Designation T238-86 Method B - Direct Transmission shall be used to determine in-place density) and Moisture Content of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth) (Designation T239-91). Backfill material shall be in accordance with MassDOT, Highway Division Standard Specifications, Section 150.64, Subsection C.

            b. All methods and work shall be performed by a technician on location certified in "soils" by the New England Transportation Technician Certification Program (NETTCP). All data and results shall be submitted to the appropriate District Highway Director for its review and acceptance.

9. SECTION 02503, PAVING, CURBING, SIDEWALKS, AND ROADWAYS

   A. Page 02503-3, ARTICLE 2.03-BASE COURSE, add the following new paragraph C.:

      C. Base Course in State Highways shall conform with the requirements of MassDOT Permit 5-2019-0487. The Base Course shall consist of 8-inches of gravel plus 4-inches of Dense Graded Crushed Stone over it. Materials shall meet MassDOT's latest (2020) Standards and Specifications for Highways and Bridges.

10. SECTION 13300, INSTRUMENTATION AND CONTROL SYSTEM – GENERAL

    A. Page 13300-2, ARTICLE 1.01 – SCOPE, delete Paragraph F. in its entirety and replace with the following new paragraph:

       F. Not Used

    B. Page 13300-3, ARTICLE 1.04 – SUBMITTALS, delete Paragraph B.2. in its entirety.

11. SECTION 13345, DATA NETWORK

    A. Delete the section in its entirety and replace with the new section, as attached.

12. SECTION 15857, ODOR CONTROL SYSTEMS – CARBON

    A. Page 15857-7, ARTICLE 2.03 - ADSORBER VESSEL, delete Paragraph F. in its entirety.

    B. Page 15857-9, ARTICLE 2.09 – CENTRIFUGAL FANS, Paragraph A.5., delete the words "…enters the inner bearing housinh with a neoprene…" and replace with the words "…enters the inner bearing housing with a neoprene…".

    C. Page 15857-10, ARTICLE 2.13 – CONTROL PANEL, delete the article in its entirety and replace with the following new article:

       ARTICLE 2.13 – CONTROL PANEL – Not Used.

    D. Page 15857-10, ARTICLE 2.14 – EQUIPMENT SCHEDULE, Paragraph C., delete subparagraph 3. In its entirety and replace with the following new subparagraph:

       3. Motor HP: As indicated on the Fan Schedule.

CHANGES TO BE MADE TO THE CONTRACT DRAWINGS

1. DRAWING 99 C-507, DETAILS VII

    A. Typical Trench Repair & Pavement Section Detail, delete the detail in its entirety and replace with the new detail as attached.

2. DRAWING 00 DI-601, SYSTEM ARCHITECTURE

    A. Delete the drawing in its entirety and replace with the new drawing as attached.

3. DRAWING 01 DI-602, PUMP STATION 1 ODOR CONTROL P&ID

    A. Delete the drawing in its entirety and replace with the new drawing as attached.

4. DRAWING 02 DI-602, PUMP STATION 2 ODOR CONTROL P&ID

    A. Delete the drawing in its entirety and replace with the new drawing as attached.

5. DRAWING 03 DI-602, PUMP STATION 3 ODOR CONTROL P&ID

    A. Delete the drawing in its entirety and replace with the new drawing as attached.

6. DRAWING 00 E-002, ELECTRICAL SITE PLAN – FIBER NETWORK I

    A. Delete the drawing in its entirety and replace with the new drawing as attached.

7. DRAWING 00 E-003, ELECTRICAL SITE PLAN – FIBER NETWORK II

    A. Delete the drawing in its entirety and replace with the new drawing as attached.

8. DRAWING 00 E-601, ELECTRICAL SCHEDULES I

    A. Delete the drawing in its entirety and replace with the new drawing as attached.

9. DRAWING 01 E-001, PUMP STATION NO. 1 – ELECTRICAL SITE PLAN

    A. Delete the drawing in its entirety and replace with the new drawing as attached.

10. DRAWING 01 E-002, PUMP STATION NO. 1 – ELECTRICAL SINGLE LINE DIAGRAM

    A. Delete the drawing in its entirety and replace with the new drawing as attached.

11. DRAWING 01 E-101, PUMP STATION NO. 1 – ELECTRICAL POWER PLAN

    A. Delete the drawing in its entirety and replace with the new drawing as attached.

12. DRAWING 01 E-601, PUMP STATION NO. 1 – ELECTRICAL RISER DIAGRAMS

    A. Delete the drawing in its entirety and replace with the new drawing as attached.

13. DRAWING 01 E-602, PUMP STATION NO. 1 –EE-01 ELEVATION
    A. Delete the drawing in its entirety and replace with the new drawing as attached.
14. DRAWING 01 E-603, PUMP STATION NO. 1 – WIRING SCHEMATICS
    A. Delete the drawing in its entirety and replace with the new drawing as attached.
15. DRAWING 02 E-001, PUMP STATION NO. 2 – ELECTRICAL SITE PLAN
    A. Delete the drawing in its entirety and replace with the new drawing as attached.
16. DRAWING 02 E-002, PUMP STATION NO. 2 – ELECTRICAL SINGLE LINE DIAGRAM
    A. Delete the drawing in its entirety and replace with the new drawing as attached.
17. DRAWING 02 E-101, PUMP STATION NO. 2 – ELECTRICAL POWER PLAN
    A. Delete the drawing in its entirety and replace with the new drawing as attached.
18. DRAWING 02 E-601, PUMP STATION NO. 2 – ELECTRICAL RISER DIAGRAMS
    A. Delete the drawing in its entirety and replace with the new drawing as attached.
19. DRAWING 02 E-602, PUMP STATION NO. 2 –EE-02 ELEVATION
    A. Delete the drawing in its entirety and replace with the new drawing as attached.
20. DRAWING 02 E-603, PUMP STATION NO. 2 – WIRING SCHEMATICS
    A. Delete the drawing in its entirety and replace with the new drawing as attached.
21. DRAWING 03 E-001, PUMP STATION NO. 3 – ELECTRICAL SITE PLAN
    A. Delete the drawing in its entirety and replace with the new drawing as attached.
22. DRAWING 03 E-002, PUMP STATION NO. 3 – ELECTRICAL SINGLE LINE DIAGRAM
    A. Delete the drawing in its entirety and replace with the new drawing as attached.
23. DRAWING 03 E-101, PUMP STATION NO. 3 – ELECTRICAL POWER PLAN
    A. Delete the drawing in its entirety and replace with the new drawing as attached.
24. DRAWING 03 E-601, PUMP STATION NO. 3 – ELECTRICAL RISER DIAGRAMS
    A. Delete the drawing in its entirety and replace with the new drawing as attached.
25. DRAWING 03 E-602, PUMP STATION NO. 3 –EE-03 ELEVATION
    A. Delete the drawing in its entirety and replace with the new drawing as attached.
26. DRAWING 03 E-603, PUMP STATION NO. 3 – WIRING SCHEMATICS
    A. Delete the drawing in its entirety and replace with the new drawing as attached.

CHANGES TO BE MADE TO THE CONTRACT ATTACHMENTS

None

END OF ADDENDUM NO. 10

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - BASE BID			
1.	For Mobilization/Demobilization, as specified (maximum of five (5) percent of System Expansion bid), the sum of $ -	l.s.	1	$ -
2.A.	For furnishing and installing 1-1/2-inch through 2-inch, inclusive, Polyvinyl Chloride/High Density Polyethylene Low Pressure Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	930	$ -
2.B.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Less Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	3,930	$ -
2.C.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Greater Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	5,310	$ -
2.D.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	930	$ -

Company's Name	Date
Company's Address	**Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.**

Item	Description	Unit of Measure	Quantity	Extended Total
2.E.	For furnishing and installing 12-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	2,410	$ -
2.F.	For furnishing and installing 18-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,900	$ -
2.G.	For furnishing and installing 6-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	450	$ -
2.H.	For furnishing and installing 8-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	710	$ -
2.I.	For furnishing and installing 8-inch PVC Effluent Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	3,590	$ -
2.J.	For furnishing and installing 1-1/4-inch Polyvinyl Chloride Low-Pressure Sewer Service Connections and Associated Fittings from main line to property line, All Depths, as specified, the sum of $ -	per l.f.	170	$ -

Company's Name

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Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.K.	For furnishing and installing 6-inch Polyvinyl Chloride Service Connections and Associated Fittings from main line to property line as specified, the sum of $ -	per l.f.	3,270	$ -
2.L.	For furnishing and installing LPS Wyes, All Depths, as specified, the sum of $ -	per each	8	$ -
2.M.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	95	$ -
2.N.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	11	$ -
2.O.	For furnishing and installing 12-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	11	$ -
2.P.	For furnishing and installing 18-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	18	$ -
2.Q.	For furnishing and installing Low Pressure Sewer Main Line Valves, All Sizes and Depths, as specified, the sum of $ -	per each	2	$ -

Company's Name

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Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
3.A.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Less Than 10 feet in Depth, the sum of $ -	per each	11	$ -
3.B.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Greater Than 10 feet in Depth, the sum of $ -	per each	50	$ -
3.C.	For furnishing and installing 5-foot Diameter Precast Concrete Sewer Manholes, All Depths, as specified, the sum of $ -	per each	7	$ -
3.D.	For furnishing and installing 6-foot Diameter Precast Concrete Low Pressure Sewer Terminal Flushing Manholes, All Depths, as specified, the sum of $ -	per each	2	$ -
3.E.	For furnishing and installing 6-foot Diameter Precast Concrete Effluent Force Main In-Line Flushing Manholes, All Depths, as specified, the sum of $ -	per each	1	$ -
3.F.	For furnishing and installing 6-foot Diameter Precast Concrete Leaching Catch Basins with Grates, All Depths, as specified, the sum of $ -	per each	4	$ -

Company's Name

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
4.A.	For furnishing and installing Standard Manhole Frames and Covers, as specified, the sum of $ -	per each	72	$ -
4.B.	For furnishing and installing Bolted and Gasketed Manhole Frames and Covers, as specified, the sum of $ -	per each	3	$ -
5.	For furnishing and installing Interior Manhole Drop Connections, as specified, the sum of $ -	per v.f.	60	$ -
6.	For furnishing and installing chimneys, as specified, the sum of $ -	per v.f.	150	$ -
7.	For furnishing and placing miscellaneous cement concrete, as specified, the sum of $ -	per c.y.	240	$ -
8.	For Rock and Boulder Excavation including Replacement with Suitable Fill Material, as specified, the sum of * $ - * Minimum Bid = $80/c.y.	per c.y.	300	$ -
9.A.	For Replacement of Unsuitable Material Below Trench Grade and/or Subgrade, as specified, the sum of $ -	per c.y.	420	$ -

Company's Name

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
9.B.	For Replacement of Unsuitable Material Above Trench Grade, as specified, the sum of $ -	per c.y.	840	$ -
10.	For Experimental Excavation, as specified, the sum of $ -	per c.y.	240	$ -
11	Fill for embankments – Not Used			
12.	Sheeting and/or shoring ordered left in place – Not Used			
13.	For performing Soil Compaction Tests, as specified, the sum of $ -	per each	80	$ -
14.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	5,580	$ -
15.A.	3-inch Temporary Bituminous Concrete Trench Pavement (base course) - Not Used			
15.B.	For furnishing and placing 7-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in State Roadways, as specified, the sum of * $ -	per l.f.	5,320	$ -

* Minimum Bid = $80/ton

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.C.	For milling and furnishing and placing 2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in State Roadways, as specified, the sum of *			
	$ - * Minimum Bid = $80/ton	per ton	2,470	$ -
15.D.	Not Used			
15.E.	1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (base course) in Town Roadways - Not Used			
15.F.	For furnishing and placing Dense Graded Gravel, as specified, the sum of			
	$ -	per c.y.	350	$ -
15.G.	For furnishing and placing 4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways, as specified, the sum of *			
	$ - * Minimum Bid = $80/ton	per ton	4,460	$ -
15.H.	1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways - Not Used			
15.I.	For Miscellaneous Restoration of State and Town Roadways, as specified, the sum of *			
	$ - * Minimum Bid = $80/ton	per ton	360	$ -
15.J.	For furnishing and placing Miscellaneous Bituminous Concrete Pavement, as specified, the sum of *			
	$ - * Minimum Bid = $80/ton	per ton	230	$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.K.	For repair and/or replacement of the Vehicle Loop Detectors, as specified, the sum of $ -	per each	10	$ -
15.L.	For repainting of Traffic Markings - Lines, Symbols and Wording, as specified, the sum of Twenty Five Thousand Dollars and No Cents $ 25,000.00	Allowance	1	$ 25,000.00
16.A.	For removal and relaying and/or replacement of Existing Water Mains, associated fittings, valves and services, as specified, the sum of $ -	per inch-foot	6,000	$ -
16.B.	For removal and relaying and/or replacement of Existing Storm Drains, as specified, the sum of $ -	per inch-foot	10,000	$ -
16.C.	For removal and relaying and/or replacement of Existing Gas Mains and services, as specified, the sum of Fifty Thousand Dollars and No Cents $ 50,000.00	Allowance	1	$ 50,000.00
16.D.	For removal and relaying and/or replacement of Existing Miscellaneous Utilities, as specified, the sum of Fifty Thousand Dollars and No Cents $ 50,000.00	Allowance	1	$ 50,000.00
16.E.	For furnishing and removal of 6-inch Water Main Line Stops, as specified, the sum of $ -	per each	1	$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
16.F.	For furnishing and removal of 8-inch Water Main Line Stops, as specified, the sum of $ -	per each	11	$ -
16.G.	10-inch Water Main Line Stops - Not Used			
17.	Uniformed Traffic Police Officers - Paid by Owner			
18.A.	For furnishing, installing, and removing Engineer's Field Office, as specified, the sum of $ -	per l.s.	1	$ -
18.B.	For maintaining Engineer's Field Office, as specified, the sum of $ -	per week	49	$ -
19.	Environmental Protection - Not Used			
20.	Trench Dewatering System - Not Used			
21.	Temporary By-pass Pumping - Not Used			
22.A.	For furnishing and installing Highway Crossing via Horizontal Directional Drilling, as specified, the sum of $ -	per l.s.	1	$ -
22.B.	For MassDOT Inspections, as specified, the sum of Ten Thousand Dollars and No Cents $ 10,000.00	Allowance	1	$ 10,000.00

Company's Name

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
23.A.	For furnishing and installing Pumping Station No. 1, as specified, the sum of $ -	per l.s.	1	$ -
23.B.	For furnishing and installing Pumping Station No. 2, as specified, the sum of $ -	per l.s.	1	$ -
23.C.	Pumping Station No. 3 - Not Used			
23.D.	For Electric Company Connection/Service Fee, as specified, the sum of One Hundred Thousand Dollars and No Cents $ 100,000.00	Allowance	1	$ 100,000.00
23.E.	For Telephone Company Connection/Service Fee, as specified, the sum of Twenty Thousand Dollars and No Cents $ 20,000.00	Allowance	1	$ 20,000.00
23.F.	For Planting Operations, as specified, the sum of Twenty Thousand Dollars and No Cents $ 20,000.00	Allowance	1	$ 20,000.00
24.	For furnishing and installing Tracer Wire in State Roadways, All Depths, as specified, the sum of $ -	l.f.	15,000	$ -

Company's Name

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF INELIGIBLE BID ITEMS - BASE BID			
B-1.	Replacement of Water Services			
		$		-
B-2.	Replacement of Canal Road Water Main			
		$		-
B-3.	Water Quality Improvements			
		$		-

Note: **Funding for the SRF Ineligible Bid Items - Base Bid (Bid Items B-1. through B.3., inclusive) is anticipated to be obtained at the Annual Town Meeting proposed to be held in June 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

TOTAL AMOUNT OF BASE BID (SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) PLUS SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B.3., inclusive) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF

$ **-**

Company's Name

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Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
A-1.	Pavement Restoration in Town Roadways			
		$		-
A-2.	Pumping Station No. 3 Tributary Area			
		$		-
A-3.	Fiber Optic Conduits, Associated Fittings and Handholes			
		$		-
A-4.	Tracer Wire in Town Roadways			
		$		-
A-5.	Highway Crossing Using Jacking			
		$		-

Company's Name

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Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
BASIS OF AWARD				

BASIS OF AWARD - The OWNER's goal is to accomplish the work identified in SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B.3., inclusive) plus as many of the SRF ELIGIBLE BID ITEMS - ALTERNATIVES as its funding constraints will allow. The BASIS OF AWARD, therefore, is the lowest bid for the sum of SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B.3., inclusive) plus the cost of the greatest number of SRF ELIGIBLE BID ITEMS - ALTERNATIVES not exceeding its fudning constraints. The SRF ELIGIBLE BID ITEMS - ALTERNATIVES are listed in the order of their priority for award. Bidders must provide a bid figure for each alternative required regardless of the cost. Additional Funding may be obtained at the Annual Town Meeting proposed to be held in June 2020.

TOTAL AMOUNT OF BASE BID BASED ON ENGINEER'S ESTIMATE OF QUANTITIES: SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B.3., inclusive)	**$ -**
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B.3., inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Item A-1.)	**$ -**
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B.3., inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Items A-1 through A-2., inclusive.)	**$ -**
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B.3., inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Items A-1 through A-3., inclusive.)	**$ -**
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B.3., inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Items A-1 through A-4., inclusive.)	**$ -**
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B.3., inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Items A-1 through A-5., inclusive.)	**$ -**

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
Item A-1- Pavement Restoration in Town Roadways				
1.	For Mobilization/Demobilization, as specified (maximum of five (5) percent of System Expansion bid), the sum of $ -	l.s.	1	$ -
2.	Sewer Pipelines and Associated Fittings - Not Used			
3.	Precast Concrete Manholes and Structures - Not Used			
4.	Manhole Frames, Covers and Grates - Not Used			
5.	Interior Manhole Drop Connections - Not Used			
6.	Chimneys - Not Used			
7.	Miscellaneous Cement Concrete - Not Used			
8.	Rock and Boulder Excavation - Not Used			
9.	Replacement of Unsuitable Material - Not Used			
10.	Experimental Excavation - Not Used			

Company's Name

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
11.	Fill for embankments – Not Used			
12.	Sheeting and/or shoring ordered left in place – Not Used			
13.	For performing Soil Compaction Tests, as specified, the sum of			
14.	For furnishing and placing Road Gravel Material, as specified, the sum of			
15.A.	3-inch Temporary Bituminous Concrete Trench Pavement - (base course) - Not Used			
15.B.	7-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in State Roadways - Not Used			
15.C.	2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in State Roadways - Not Used			
15.D.	Not Used			
15.E.	For furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (base course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	430	$ -
	* Minimum Bid = $80/ton			
15.F.	Dense Graded Gravel - Not Used			
15.G.	4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways - Not Used			

Company's Name

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Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.H.	For milling and furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	4,900	$ -
	* Minimum Bid = $80/ton			
15.I.	For Miscellaneous Restoration of Town Roadways, as specified, the sum of *			
	$ -	per ton	50	$ -
	* Minimum Bid = $80/ton			
15.J.	For furnishing and placing Miscellaneous Bituminous Concrete Pavement, as specified, the sum of *			
	$ -	per ton	240	$ -
	* Minimum Bid = $80/ton			
15.K.	For repair and/or replacement of the Vehicle Loop Detectors, as specified, the sum of			
	$ -	per each	20	$ -
15.L.	For repainting of Traffic Markings - Lines, Symbols and Wording, as specified, the sum of			
	Twenty Five Thousand Dollars and No Cents			
	$ 25,000.00	Allowance	1	$ -
16.	Remove and Relaying and/or Replace Existing Utilities - Not Used			
17.	Uniformed Traffic Police Officers - Paid by Owner			
18..	Engineer's Field Office - Not Used			
19.	Environmental Protection - Not Used			

Company's Name

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Company's Address

**Refer to the Instructions in SECTION 00410,
Page 2 - Bid Proposal
in filling out this Proposal Form.**

Item	Description	Unit of Measure	Quantity	Extended Total
20.	Trench Dewatering Equipment - Not Used			
21.	Temporary By-pass Pumping - Not Used			
22.	Highway Crossing - Not Used			
23.	Pumping Station s- Not Used			
24.	Tracer Wire in State Roadways - Not Used			
	Item A-1 - Pavement Restoration in Town Roadways (Bid Item 1. through 24., inclusive)			**$ -**

Company's Name

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
	Item A-2 - Pumping Station No. 3 Tributary Area			
1.	For Mobilization/Demobilization, as specified (maximum of five (5) percent of System Expansion bid), the sum of $ -	l.s.	1	$ -
2.A.	For furnishing and installing 1-1/2-inch through 2-inch, inclusive, Polyvinyl Chloride/High Density Polyethylene Low Pressure Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,100	$ -
2.B.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Less Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	3,070	$ -
2.C.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Greater Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	8,440	$ -
2.D.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,020	$ -
2.E.	12-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths - Not Used			
2.F.	18-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths - Not Used			

Company's Name

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.G.	For furnishing and installing 6-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	2,610	$ -
2.H.	8-inch PVC Force Main and Associated Fittings, All Depths - Not Used			
2.I.	8-inch PVC Effluent Force Main and Associated Fittings, All Depths - Not Used			
2.J.	For furnishing and installing 1-1/4-inch Polyvinyl Chloride Low-Pressure Sewer Service Connections and Associated Fittings from main line to property line, All Depths, as specified, the sum of $ -	per l.f.	430	$ -
2.K.	For furnishing and installing 6-inch Polyvinyl Chloride Service Connections and Associated Fittings from main line to property line as specified, the sum of $ -	per l.f.	2,830	$ -
2.L.	For furnishing and installing LPS Wyes, All Depths, as specified, the sum of $ -	per each	13	$ -
2.M.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	95	$ -

Company's Name

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Company's Address

**Refer to the Instructions in SECTION 00410,
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Item	Description	Unit of Measure	Quantity	Extended Total
2.N.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	1	$ -
2.O.	12-inch Polyvinyl Chloride Sewer Wyes, All Depths - Not Used			
2.P.	18-inch Polyvinyl Chloride Sewer Wyes, All Depths - Not Used			
2.Q.	For furnishing and installing Low Pressure Sewer Main Line Valves, All Sizes and Depths, as specified, the sum of $ -	per each	2	$ -
3.A.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Less Than 10 feet in Depth, the sum of $ -	per each	13	$ -
3.B.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Greater Than 10 feet in Depth, the sum of $ -	per each	52	$ -
3.C.	For furnishing and installing 5-foot Diameter Precast Concrete Sewer Manholes, All Depths, as specified, the sum of $ -	per each	2	$ -

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Item	Description	Unit of Measure	Quantity	Extended Total
3.D.	For furnishing and installing 6-foot Diameter Precast Concrete Low Pressure Sewer Terminal Flushing Manholes, All Depths, as specified, the sum of $ -	per each	3	$ -
3.E.	6-foot Diameter Precast Concrete Effluent Force Main In-Line Flushing Manholes, All Depths - Not Used			
3.F.	6-foot Diameter Precast Concrete Leaching Catch Basins with Grates, All Depths - Not Used			
4.A.	For furnishing and installing Standard Manhole Frames and Covers, as specified, the sum of $ -	per each	36	$ -
4.B.	For furnishing and installing Bolted and Gasketed Manhole Frames and Covers, as specified, the sum of $ -	per each	34	$ -
5.	For furnishing and installing Interior Manhole Drop Connections, as specified, the sum of $ -	per v.f.	20	$ -
6.	For furnishing and installing chimneys, as specified, the sum of $ -	per v.f.	340	$ -
7.	For furnishing and placing miscellaneous cement concrete, as specified, the sum of $ -	per c.y.	200	$ -

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Item	Description	Unit of Measure	Quantity	Extended Total
8.	For Rock and Boulder Excavation including Replacement with Suitable Fill Material, as specified, the sum of *			
	$ -	per c.y.	250	$ -
	* Minimum Bid = $80/c.y.			
9.A.	For Replacement of Unsuitable Material Below Trench Grade and/or Subgrade, as specified, the sum of			
	$ -	per c.y.	400	$ -
9.B.	For Replacement of Unsuitable Material Above Trench Grade, as specified, the sum of			
	$ -	per c.y.	790	$ -
10.	For Experimental Excavation, as specified, the sum of			
	$ -	per c.y.	200	$ -
11	Fill for embankments – Not Used			
12.	Sheeting and/or shoring ordered left in place – Not Used			
13.	For performing Soil Compaction Tests, as specified, the sum of			
	$ -	per each	70	$ -
14.	For furnishing and placing Road Gravel Material, as specified, the sum of			
	$ -	per c.y.	5,160	$ -

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Item	Description	Unit of Measure	Quantity	Extended Total
15.A.	3-inch Temporary Bituminous Concrete Trench Pavement (base course) - Not Used			
15.B.	For furnishing and placing 7-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in State Roadways, as specified, the sum of *			
	$ -	per l.f.	3,680	$ -
	* Minimum Bid = $80/ton			
15.C.	For milling and furnishing and placing 2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in State Roadways, as specified, the sum of *			
	$ -	per ton	1,970	$ -
	* Minimum Bid = $80/ton			
15.D.	Not Used			
15.E.	1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (base course) in Town Roadways - Not Used			
15.F.	For furnishing and placing Dense Graded Gravel, as specified, the sum of			
	$ -	per c.y.	350	$ -
15.G.	For furnishing and placing 4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	4,460	$ -
	* Minimum Bid = $80/ton			
15.H.	1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways - Not Used			

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Item	Description	Unit of Measure	Quantity	Extended Total
15.I.	For Miscellaneous Restoration of State and Town Roadways, as specified, the sum of *			
	$ -	per ton	190	$ -
	* Minimum Bid = $80/ton			
15.J.	For furnishing and placing Miscellaneous Bituminous Concrete Pavement, as specified, the sum of *			
	$ -	per ton	210	$ -
	* Minimum Bid = $80/ton			
15.K.	For repair and/or replacement of the Vehicle Loop Detectors, as specified, the sum of			
	$ -	per each	10	$ -
15.L.	For repainting of Traffic Markings - Lines, Symbols and Wording, as specified, the sum of			
	Twenty Five Thousand Dollars and No Cents		1	$ -
	$ 25,000.00	Allowance		
16.A.	For removal and relaying and/or replacement of Existing Water Mains, associated fittings, valves and services, as specified, the sum of			
	$ -	per inch-foot	6,000	$ -
16.B.	For removal and relaying and/or replacement of Existing Storm Drains, as specified, the sum of			
	$ -	per inch-foot	10,000	$ -

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Item	Description	Unit of Measure	Quantity	Extended Total
16.C.	For removal and relaying and/or replacement of Existing Gas Mains and services, as specified, the sum of Fifty Thousand Dollars and No Cents $ 50,000.00	Allowance	1	$ -
16.D.	For removal and relaying and/or replacement of Existing Miscellaneous Utilities, as specified, the sum of Twenty Five Thousand Dollars and No Cents $ 25,000.00	Allowance	1	$ -
16.E.	6-inch Water Main Line Stops - Not Used			
16.F.	For furnishing and removal of 8-inch Water Main Line Stops, as specified, the sum of $ -	per each	7	$ -
16.G.	For furnishing and removal of 10-inch Water Main Line Stops, as specified, the sum of $ -	per each	1	$ -
17.	Uniformed Traffic Police Officers - Paid by Owner			
18.A.	Engineer's Field Office - Not Used			
18.B.	For maintaining Engineer's Field Office, as specified, the sum of $ -	per week	42	$ -
19.	For furnishing, installing, maintaining and removing Environmental Protection, as specified, the sum of $ -	per f.f.	2,830	$ -

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Item	Description	Unit of Measure	Quantity	Extended Total
20.	For furnishing, installing, maintaining and removing Trench Dewatering System, as specified, the sum of $ -	per l.f.	11,220	$ -
21.	Temporary By-pass Pumping - Not Used			
22.A.	Highway Crossing via Horizontal Directional Drilling - Not Used			
22.B.	MassDOT Inspections - Not Used			
23.A.	Pumping Station No. 1 - Not Used			
23.B.	Pumping Station No. 2 - Not Used			
23.C.	For furnishing and installing Pumping Station No. 3, as specified, the sum of $ -	per l.s.	1	$ -
23.D.	For Electric Company Connection/Service Fee, as specified, the sum of Twenty Five Thousand Dollars and No Cents $ 25,000.00	Allowance	1	$ -
23.E.	For Telephone Company Connection/Service Fee, as specified, the sum of Ten Thousand Dollars and No Cents $ 10,000.00	Allowance	1	$ -
23.F.	For Planting Operations, as specified, the sum of Ten Thousand Dollars and No Cents $ 10,000.00	Allowance	1	$ -

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Item	Description	Unit of Measure	Quantity	Extended Total
24.	For furnishing and installing Tracer Wire in State Roadways, All Depths, as specified, the sum of $ -	l.f.	15,000	$ -
	Item A-2 - Pump Stationing No. 3 Tributary Area (Bid Item 1. through 24., inclusive)			**$** -

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Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
	Item A-3 - Fiber Optic Conduits, Associated Fittings and Handholes			
A-3A.	For furnishing and installing 4-inch Fiber Optic Conduits and Associated Fittings, All Depths, as specified, the sum of $ -	l.f.	3,590	$ -
A-3B.	For furnishing and installing Fiber Optic Handholes, All Depths, as specified, the sum of $ -	ea.	10	$ -
	Item A-3 - Fiber Optic Conduits, Associated Fittings and Handholes (Bid Item A-3A. through A-3B., inclusive)			**$ -**

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Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
Item A-4 - Tracer Wire in Town Roadways				
A-4A.	For furnishing and installing Tracer Wire in Town Roadways All Depths, as specified, the sum of $ -	l.f.	28,100	$ -
	Item A-4 -Tracer Wire in Town Roadways (Bid Item A-4A., inclusive)			**$** -

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Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
Item A-5 - Highway Crossing Using Jacking				
A-4A.	For Additional Cost to furnish and install the Highway Crossing Using Jacking versus furnishing and installing the Highway Crossing Using Horizontal Directional Drilling , as specified, the sum of $ -	l.s.	1	$ -
	Item A-5 - Highway Crossing Using Jacking (Bid Item A-5A., inclusive)			**$** -

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Item	Description	Unit of Measure	Quantity	Extended Total
	SRF INELIGIBLE BID ITEMS			
Item B-1 - Replacement of Water Services				
B-1A.	For furnishing and installing 1-inch Polyvinyl Chloride Water Services and Associated Fittings from water main to property line as specified, the sum of $ -	per l.f.	2,040	$ -
B-1B.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	480	$ -
B-1C.	For furnishing and placing Permanent Bituminous Concrete Trench Pavement, as specified, the sum of * $ -	per ton	100	$ -
	* Minimum Bid = $80/ton			
	Item B-1 - Replacement of Water Services (Bid Items B-1A. through B-1C., inclusive)			**$ -**

Note: **Funding for the SRF Ineligible Bid Items is anticipated to be obtained at the Annual Town Meeting proposed to be held in June 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

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Item	Description	Unit of Measure	Quantity	Extended Total
	SRF INELIGIBLE BID ITEMS			
Item B-2 - Replacement of Canal Road Water Main				
B-2A.	For furnishing and installing 8-inch DI water main and Associated Fittings, as specified, the sum of $ -	per l.f.	2,060	$ -
B-2B.	For furnishing and installing 1-inch Polyvinyl Chloride Water Services and Associated Fittings from water main to property line as specified, the sum of $ -	per l.f.	320	$ -
B-2C.	For furnishing and installing 6-inch Gate Valves and Boxes, as specified, the sum of $ -	per each	6	$ -
B-2D.	For furnishing and installing 8-inch Gate Valves and Boxes, as specified, the sum of $ -	per each	7	$ -
B-2E.	For furnishing and installing Fire Hydrants, as specified, the sum of $ -	per each	6	$ -

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Item	Description	Unit of Measure	Quantity	Extended Total
B-2F.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	560	$ -
B-2G.	For furnishing and placing Permanent Bituminous Concrete Trench Pavement, as specified, the sum of * $ - #REF!	per ton	120	$ -
	Item B-2 - Replacement of Canal Road Water Main (Bid Items B-2A. through B-2G., inclusive)			**$** -

Note: **Funding for the SRF Ineligible Bid Items is anticipated to be obtained at the Annual Town Meeting proposed to be held in June 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

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Item	Description	Unit of Measure	Quantity	Extended Total
	SRF INELIGIBLE BID ITEMS			
Item B-3 - Water Quality Improvements				
B-3A.	For Brewster Cross Road Water Quality Improvements, as specified, the sum of $ -	per l.s.	1	$ -
B-3B.	For Locust Road Water Quality Improvements, as specified, the sum of $ -	per l.s.	1	$ -

Item B-3 - Water Quality Improvements (Bid Items B-3A. through B-3B., inclusive) **$ -**

Note: **Funding for the SRF Ineligible Bid Items is anticipated to be obtained at the Annual Town Meeting proposed to be held in June 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

5-2019-0487

PERMIT - ORLEANS

Subject to all terms, conditions, and restrictions printed or written below, permission is hereby granted to the **TOWN OF ORLEANS**, Tom Daley, 19 School Road, Orleans, MA 02653 to enter upon the State Highway in the Town of **ORLEANS** on Auto Routes 6A and 28, locally known as Cranberry Highway and South Orleans Road respectively, for the purpose of installing a gravity sewer main, sewer force mains, forty (40) sewer manholes, sewer services, and communications conduit within the State Highway Layout as follows:

This work is being granted to install the sewer force mains and gravity sewer mains, with appurtenances, to accommodate a new sanitary sewer collection system and pump stations in the Downtown Area.

SEWER FORCE MAIN

ROUTE 6A – BETWEEN WEST ROAD AND #119 CRANBERRY HIGHWAY (ROUTE 6A)

The first sewer force main installation will begin at a proposed sewer manhole (SMH G-03-11) to be located at the intersection of Cranberry Highway (Route 6A) and West Road, at approximate Station 0+00. The installation will proceed easterly within an open cut trench along Cranberry Highway (Route 6A) approximately 1,083 ft. where it will end at proposed sewer manhole (SMH G-04-2), at approximate Station 10+83.

The second sewer force main installation will begin at proposed sewer manhole (SMH G-04-03) to be located in the middle of Cranberry Highway (Route 6A), at approximate Station 11+50. The installation will proceed easterly within an open cut trench along Cranberry Highway (Route 6A) approximately 1,950 ft. where it will end at proposed sewer manhole (SMH F-04-54), at approximate Station 30+50.

ROUTE 6A – BETWEEN #96 CRANBERRY HIGHWAY (ROUTE 6A) AND THE EASTHAM TOWN LINE

The first sewer force main installation will begin at an existing sewer manhole (SMH F-04-14) located in the middle of Cranberry Highway (Route 6A) in front of the property at #96 Cranberry Highway, at approximate Station 42+20. The installation will proceed easterly within an open cut trench along Cranberry Highway (Route 6A) approximately 580 ft. where it will end at proposed sewer manhole (SMH E-04-30), at approximate Station 48+00.

The second sewer force main installation will begin at proposed sewer manhole (SMH E-04-10) to be located in the middle of Cranberry Highway (Route 6A), at approximate Station 48+75. The installation will proceed easterly within an open cut trench along Cranberry Highway (Route 6A), to approximate Station 55+00 where it will cross southerly to the sewer manhole (SMH E-04-01) located on South Orleans Road, at approximate Station 6+75 = 56+06 and proceed

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northerly along South Orleans Road where it will be tied to a proposed sewer manhole (SMH D-05-03), at approximate Station 77+57.

ROUTE 28 – BETWEEN ROUTE 6A AND CUMMINGS ROAD

The first sewer force main installation will extend from the existing sewer manhole (SMH E-04-01) located at the westerly corner of South Orleans Road, at approximate Station 6+75. The installation will proceed southerly within an open cut trench along South Orleans Road (Route 28) approximately 675 ft. where it will be tied to an existing sewer manhole (SMH E-04-05), at approximate Station 0+00.

The second sewer force main installation will begin at a proposed sewer manhole (SMH E-04-06) to be located in front of #25 South Orleans Road, at approximate Station 0+00. The installation will proceed southerly within an open cut trench along South Orleans Road (Route 28) approximately 928 ft. where it will be tied to an existing sewer manhole (SMH F-04-31), at approximate Station 9+28. The installation will then proceed westerly along Cummings Road and out of the State Highway Layout.

SEWER MANHOLES

The following sewer manholes will be installed along Cranberry Highway (Route 6A) and South Orleans Road (Route 28), at locations/Stations as shown on the approved plans, within the State Highway Layout.

CRANBERRY HIGHWAY: SMH G-03-15, SMH G-03-16, SMH G-03-17, SMH G-03-18, SMH G-03-19, SMH G-04-2, SMH G-04-03, SMH G-04-04, SMH G-04-05, SMH G-04-06, SMH G-04-07, SMH F-04-23, SMH F-04-22, SMH F-04-52, SMH F-04-53, SMH F-04-54, SMH E-04-31, SMH E-04-30, SMH E-04-10, SMH E-04-09, SMH E-04-08, SMH E-04-07, SMH E-05-07, SMH E-05-06, SMH E-05-05, SMH E-05-04, SMH E-05-09, SMH E-05-10, SMH D-05-01, SMH D-05-02 and SMH D-05-03.

SOUTH ORLEANS ROAD: SMH E-04-06, SMH F-04-34, SMH F-04-33. SMH F-04-32, SMH E-04-01, SMH E-04-13, SMH E-04-05, SMH E-04-04, SMH E-04-03, SMH E-04-02 and SMH E-04-01.

All other proposed sewer manholes shown on the approved plans are located outside the State Highway Layout.

LATERAL SEWER SERVICE CONNECTIONS - CRANBERRY HIGHWAY (ROUTE 6A)

There are seven (7) sewer service connections which will extend from the newly installed 8-inch gravity sewer main, three (3) in a southerly direction and four (4) northerly, as is shown on the approved plans.

LATERAL SEWER SERVICE CONNECTIONS - SOUTH ORLEANS ROAD (ROUTE 28)

There are three (3) sewer service connections which will extend from the newly installed 8-inch gravity sewer main, two (2) will extend in an easterly direction, and one (1) will extend both easterly and westerly along Cove Road and out of the State Highway Layout, as is shown on the approved plans.

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In conjunction with this work, the Grantee will replace numerous water services and water main connections as shown on the approved plans.

The proposed work requires temporary and permanent easements for the construction, installation, maintenance, improvement, repair, replacement and/or relocation of subsurface sanitary sewer force main, gravity sewer lines, pipes, and appurtenances. Therefore, the recorded documentation has been submitted and is considered an integral part of this Permit.

IT IS NOTED THAT THE LONGITUDINAL SEWER MAIN IS WITHIN THE TRAVEL LANE(S) AND IMPACTS THE TRAVEL LANE(S) OF MOTORISTS. THE PAVEMENT REPAIR WILL THEREFORE REQUIRE MILLING AND OVERLAYING WITH 2" (INCHES) OF SURFACE COURSE (CURB TO CURB). THE PERMANENT REPAIR OF THE TRENCH, INCLUDING THE MILLING AND OVERLAYING, MUST BE DONE AFTER COMPLETION OF THE 90-DAY SETTLEMENT PERIOD AS DESCRIBED IN THIS PERMIT.

FINAL PAVEMENT REPAIR JOINTS MUST BE SQUARE AND PERPENDICULAR TO THE DIRECTION OF TRAVEL.

The permanent trench repair shall be done as indicated below. Please note that the final trench repair must include a minimum of 7" (inches) of Hot Mix Asphalt or match the existing thickness of the Hot Mix Asphalt for the roadway, whichever is larger.

1. 8" (inches) of gravel plus 4" (inches) Dense Graded Crushed Stone (DGCS) over it.
2. 3" (inch) Intermediate or Base Course
3. 2" (inch) Intermediate Course
4. 2" (inch) Surface Course
5. Asphalt emulsion tack coat (RS-1H) must be placed between each course.
6. All vertical edges must be coated with hot poured joint sealer.
7. All damaged pavement markings shall be restriped in kind.

All pavement compositions must meet MassDOT's latest Standards and Specifications for Highways and Bridges.

THE TOWN MUST COORDINATE THIS WORK WITH THE WORK INVOLVED UNDER PERMIT #5-2019 -0473, ISSUED TO THE TOWN OF ORLEANS ON FEBRUARY 19, 2020 FOR THE EXTENSION OF A SEWER FORCE MAIN TO ACCOMMODATE A NEW SANITARY SEWER COLLECTION, TREATMENT AND DISPOSAL SYSTEM FOR THE DOWNTOWN AREA OF THE TOWN OF ORLEANS, MASSACHUSETTS.
A THREE-YEAR PERFORMANCE BOND FOR THE AMOUNT OF $3,000,000.00 IS REQUIRED PRIOR TO STARTING ANY CONSTRUCTION WORK WITHIN THE STATE HIGHWAY LAYOUT.

All work is to be done as described herein and as shown on the plan(s) entitled "Town of Orleans, MA – Downtown Area Collection System and Pump Station, MassDOT Permit Plans Route 6A & 28, Contract No. 2019-02" as drafted by AECOM Technical Services, Inc., 9 Jonathan Bourne Drive, Pocasset, MA 02559, tel.: (508) 833-6950 and last revised February 26, 2020.

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THIS PERMIT IS BEING ISSUED FOR WORK WITHIN THE STATE HIGHWAY LAYOUT (S.H.L.O.) ONLY. AUTHORIZATION TO PERFORM ASSOCIATED WORK OUTSIDE OF S.H.L.O. MUST BE GRANTED BY IMPACTED PROPERTY OWNERS.

PLEASE BE ADVISED THAT IN THE EVENT THAT ANY OF THE DRAINAGE STRUCTURES/PIPES ARE IMPACTED BY THIS WORK THE TOWN WILL BE RESPONSIBLE TO PERFORM THE NECESSARY REPAIRS.

Prior to any work being done within the State Highway Layout, the Grantee(s) must upload/submit a Work Request in State Highway Access Permit System (SHAPS) to obtain approval for the proposed work schedule. Said form to be completed/uploaded can be found under the Forms and Sample Submission Documents tab and is entitled "Work Request Form D1 - D5". One (1) of these forms must be uploaded by the close of business every Thursday for the entire duration of the project in order to request approval for the following week's work schedule.

The Grantee(s) must adhere to 520 CMR 14.00: Excavation and Trench Safety as promulgated by the Department of Public Safety in conjunction with the Division of Occupational Safety pursuant to authority granted by M.G.L. c. 82a § 1. If not already approved, a Trench Permit Rider must be completed and uploaded to SHAPS before any trench work is performed under this Permit.

The Grantee(s) must strictly adhere to the Order of Conditions issued by the Orleans Conservation Commission (D.E.P. #SE 54-2481) which is considered an integral part of this Permit.

The Grantee(s) shall be responsible for all litter and debris generated from their property during the work as described herein and/or from all prospective residents, visitors or patrons of all existing or proposed facilities mentioned herein. This responsibility shall remain in effect for the entirety of all current or future owners of said property. The Grantee(s) shall perform routine inspections and upkeep within the State Highway Layout. If conditions warrant an individual to enter in or within the proximity of a travelled way, the Grantee(s) shall assume all liability and responsibility for the removal of all litter and debris or the hiring of an appropriate party to perform such duties. Significant work within the travelled way may require a police detail. In consideration to all abutters, the Grantee(s) must take notice to the drifting of debris and the removal thereof. If it is found that this requirement is not being fulfilled in a satisfactory manner, MassDOT, Highway Division may decide to clean the area at the Grantee's expense.

CONTROLLED DENSITY FILL (CDF) WAIVER

At the written request of the Grantee(s) and approval from MassDOT, Highway Division, CDF is NOT required on this project for trenches greater than 48" in depth. The Grantee(s) shall perform the work for conventional backfill methods as follows:

1. All methods used to determine and verify the proper compaction of backfill shall be in accordance with AASHTO Standard Specifications of Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth) (Designation T238-86 Method B - Direct Transmission shall be used to determine in-place density) and Moisture Content of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth) (Designation T239-91). Backfill material shall be in accordance with MassDOT, Highway Division Standard Specifications, Section 150.64, Subsection C.

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All methods and work shall be performed by a technician on location certified in "soils" by the New England Transportation Technician Certification Program (NETTCP). All data and results shall be submitted to the appropriate District Highway Director for its review and acceptance.

Soil compaction needs to be performed every 6 inches. Nuclear Gauge Density Testing shall be performed every 1' (foot) of depth and at least twice a week. Proctor/Sieve Analysis testing shall be performed once a week per source of material.

2. A **Performance Bond** in the (approximate) amount of **$3,000,000.00** is required by the Grantee(s) to warranty the work described in this waiver. The Performance Bond must be submitted before any work commences on State Property. The life of the Performance Bond shall continue for three (3) additional years from the date MassDOT, Highway Division signs off on the permit.

The Performance Bond shall be in a form satisfactory to MassDOT, Highway Division, furnished by a surety company incorporated pursuant to M.G.L. chapter 175, section 105 or authorized to do business in the Commonwealth under M.G.L. Chapter 175, section 106 and satisfactory to the awarding authority. The name of the agency or agent writing these bonds shall be identified within the bond.

3. The Completion of Work Form shall be electronically uploaded, via the State Highway Access Permit System (SHAPS), as soon as possible after the completion of the physical work to begin the sign-off process. MassDOT, Highway Division, will hold the Permit on file for a period of not less than three (3) years.

4. The Grantee(s) shall assume full responsibility for the structural integrity of any trench described in this Permit. This responsibility shall remain in place for a period of three (3) years after the completion of work which time starts with MassDOT, Highway Division, receiving the Completion of Work Form.

The Grantee(s) shall immediately respond to trench maintenance requests by the District Highway Director. The Grantee(s) must respond within two (2) working days for non-emergency situations. Non-response within the specified time will result in the required maintenance work being done by MassDOT, Highway Division, with all expenses charged to the Grantee(s).

5. Supplying, positioning, adjusting, and re-positioning of all required signs and traffic warning devices shall be the responsibility of the Grantee(s). All signs and devices shall be in accordance with the current Manual on Uniform Traffic Control Devices. The number and location of all signs and devices shall be deemed necessary by the District Highway Director for the safe and efficient performance of the work and safety of the travelling public.

Care must be exercised so as not to disturb any existing State Highway Drainage or Traffic Duct/wiring Systems or any underground structures that exist. If said system is disturbed, it shall be restored immediately to its original condition. All expenses for restoring conditions shall be the responsibility of the Grantee(s).

6. Uniformed Police Officers or Certified Flaggers shall be provided and compensated by the Grantee(s) and shall be in attendance at all times until completion of the physical work.

"WORK WITHIN THE HARDENED SURFACE WITH CDF WAIVER APPROVED"

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The pavement shall be saw-cut in neat, true lines along the length of the trench. The trench shall then be excavated, the utility installed, and backfilled. The backfill material shall consist of gravel or other suitable material conforming to MassDOT Specifications throughout, to a compacted depth of three inches below the existing surface.

The material shall be selected from excavation free from large lumps, clods, or rock placed between the pipe and the walls of the trench in layers not exceeding 6" (inches) in depth and thoroughly compacted. Each layer, if dry, shall be moistened and then compacted by rolling or by tamping with mechanical rammers. Special care shall be taken to thoroughly compact the fill under the haunches of the pipe or conduit. This method of filling and compacting shall be continued until the material is level with the top of the pipe or conduit. The remainder of the filling shall consist of suitable material placed in successive layers not more than 6" (inches) in depth. The top layer shall be thoroughly compacted to within 3" (inches) of the existing surface.

The trench will then be patched temporarily with a minimum of 3" (inches) of Surface Course placed in one layer to the finished grade of the roadway surface. Be advised that a temporary patch with a minimum of 4" (inches) of Surface Course is required on high traffic volume roadways.

In the cases where the trench needs to include the repair of the entire travel lane/paved shoulder/curb-to-curb, the Grantee may patch the temporary trench with a minimum of 7" (inches) of Hot Mix Asphalt pavement or match existing thickness of this for the roadway, whichever is larger. Pavement composition must meet MassDOT's latest standards. Then after the 90-day settlement period (SOP HMD-75-03-1-000), the Grantee will have to mill 2" (inches) of the existing pavement and overlay the travel lane/paved shoulder/curb-to-curb with two 2" (inches) of Surface Course.

If required, steel plates may be utilized for the safety of overnight motorists. However, steel plates create a slippery surface and should only be used when necessary. The plates may need to be recessed to the finished grade of the roadway as directed by the Engineer. No plates may be left over the weekend. Therefore, the Grantee(s) shall schedule the work accordingly.

Temporary patches shall remain in place for ninety (90) days before being replaced with permanent patch or until in the Engineer's judgment that final compaction and settlement of the trench area has taken place.

The Grantee(s) must then excavate the temporary patching and material to a depth of 7" (inches) below the existing surface and replace with the permanent patch which shall consist of 3" (inches) of Intermediate or Base Course, 2" (inches) of Intermediate Course, and 2" (inches) of Surface Course.

All abutting edges of the existing pavement shall be coated with hot poured joint sealer immediately prior to the placement of the permanent patch.

The District Office must be notified two days prior to starting this work, so that an inspector may be assigned. This mix must be machine laid.

All traffic safety lines if disturbed shall be replaced in kind.

All trenches shall be maintained by the Grantee(s) from inception of this project at all times until the resurfacing of this particular portion of highway by MassDOT, Highway Division.

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If it becomes necessary, MassDOT, Highway Division shall assign an inspector on any project and the inspector will be paid for under a reimbursable account by the Grantee(s).

The Grantee(s) shall be responsible for the maintenance and repair of this portion of the roadway and shall perform routine inspections for deficiencies such as settling, heaving, cracks, etc. This responsibility shall remain in effect until the resurfacing of this particular portion of highway is performed by MassDOT, Highway Division.

THE BACKFILLING METHOD FOR WORK WITHIN THE SHOULDER AREA WILL BE AS FOLLOWS:

Backfill for conduit or pipe shall be selected from excavation free from large lumps, clods or rock placed between the pipe and the walls of the trench in layers not exceeding 6" (inches) in depth and thoroughly compacted. Each layer, if dry, shall be moistened and then compacted by rolling or by tamping with mechanical rammers. Special care should be taken to thoroughly compact the fill under the haunches of the pipe or conduit. This method of filling and compacting shall be continued until the material is level with the top of the pipe or conduit. The remainder of the filling shall consist of suitable material placed in successive layers not more than 6-inch in depth. Each layer shall be thoroughly compacted as specified above.

If the work is to be performed within the soft shoulder, the excavation might be performed within the immediate area along the edge of road and may diminish the integrity of the hardened surface. Therefore, if the excavation directly abuts or tapers under the hardened surface of the roadway, the opening must be backfilled with Controlled Density Fill (CDF) to prevent undermining and preserve the roadway.

The Grantee(s) shall be responsible for the shoulder and roadway areas affected by the proposed work to be performed as described herein and shall routinely inspect said areas for deficiencies such as settling, heaving, cracks etc. This responsibility shall remain until work is performed at the subject location by MassDOT, Highway Division.

SIDEWALK RECONSTRUCTION

The sidewalk shall match the existing conditions and shall be reconstructed with 4" dense graded crushed stone with a 3" hot mix asphalt top course laid in 2 lifts of 1.75" and 1.25", respectively, or 4" of cement concrete. If the cement concrete sidewalk crosses a driveway, the driveway apron shall be constructed with 6" cement concrete.

The reconstructed sidewalk must be compacted and graded in such a manner that no ponding of water occurs within the Highway Layout. If such ponding results, the Grantee(s) shall be responsible for its correction.

Sidewalks and concrete wheelchair ramps shall be in conformance with the Architectural Access Board Regulations within all sidewalk areas located at drives or roadway intersections that may be included in this project.

The Grantee(s) shall be responsible for the maintenance and repair of the portion of the proposed sidewalk located within the State Highway Layout and shall routinely inspect the sidewalk for deficiencies such as settling, heaving, cracks etc. This responsibility shall remain in effect until MassDOT, Highway Division, or the Town reconstructs the sidewalk.

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Upon completion of the work, the Grantee or Agent must upload into SHAPS, a letter from the local building inspector or governing authority, indicating the installed ramps and sidewalks are in conformance with AAB and ADA regulations.

UTILITY WORK IN DRIVE

Whereas the proposed work is to be performed within the apron of an existing drive, the Grantee(s) shall restore the drive with an eight-inch gravel base that has been machine compacted then paved with 4" (inches) of hot mix asphalt laid in two (2) courses consisting of a 2-1/2" (inch) intermediate course and a 1-1/2" (inch) surface course. Any hot mix asphalt berm or granite edging that exists in the driveway area must be sawcut and removed. The new pavement must butt into and not overlap the edge of the hardened surface of the roadway.

All abutting edges of the existing pavement shall be coated with hot poured joint sealer immediately prior to the placement of the permanent bituminous concrete.

The Grantee(s) shall be responsible for this portion of the drive and shall routinely inspect it for deficiencies such as settling, heaving, cracks etc. Such deficiencies shall be corrected at the cost of the Grantee(s) and to the satisfaction of the Engineer.

PAVEMENT MILLING AND OVERLAY

This work will be performed as indicated on the approved plans.

No milling shall take place sooner than seventy-two (72) hours prior to the scheduled final paving operations. The Grantee/Resident Engineer shall ensure that the Permits Office is notified of this scheduled work at least five (5) days prior to the commencement of any milling.

All raised structures located within the roadway must be ramped with hot mix asphalt immediately following milling operations.

The Grantee/Resident Engineer/Contractor shall make every effort to protect the structural integrity of all edging and structures and prevent all cold planning material from entering the State Highway's drainage structures and inspect all structures and grates for damage and clogging.

All proposed work must be transitioned properly to match the existing roadway conditions.

All proposed pavement markings must match existing conditions.

If existing pavement markings are so disturbed during construction or altered according to the Traffic Management Plan, the Grantee(s) shall restore said markings in conformance to MassDOT, Highway Division Standards and as per the final Traffic Markings Plan.

Before scheduling this work, the Grantee must provide the following information to the Permits Section:

I) Schedule of paving work with proposed work hours for review by the District.

II) The Town, Fire and Police Department must be notified about this work.

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III) Information of the Qualified Contractor who will be performing the paving, and the asphalt plant that will be providing the mix.

IV) Specifications of the Superpave Mix and quantification (Tons) that will be used for the project.

V) Traffic Management Plan to be used during the milling/paving work.

VI) Advance notification should be provided to residents and businesses that may be affected by the work.

TIME RESTRICTIONS AND NOTIFICATIONS

DUE TO HEAVY SUMMER TRAFFIC, NO WORK SHALL BE PERFORMED ON THIS PROJECT BETWEEN MEMORIAL DAY WEEKEND AND LABOR DAY WEEKEND WITHOUT PRIOR APPROVAL FROM THE DISTRICT HIGHWAY DIRECTOR.

Special attention shall be given when performing work that will impact MassDOT, Highway Division, snow and ice operations.

No work shall be performed on the hardened surface of the roadway between November 15th and April 1st of any year without prior written approval from the District Highway Director.

No pavement shall be laid between November 15th and April 1st of any year without prior written approval from the District Highway Director.

No work shall be performed on this project on Saturdays, Sundays, and Holidays, or on the Friday after a Thursday Holiday. Work is also restricted on the day before and the day after a long Holiday weekend without prior written approval by the District Highway Director.

No equipment, trucks, etc., shall occupy any part of the travelled way except between the hours of **9:00 a.m. and 3:00 p.m., Monday - Friday**. In no case will operations exceed the specified hours. This includes the placement of traffic control devices, equipment, or anything that restricts the flow of traffic through the construction zone. Any change in work hours will require prior written approval by the District Highway Director. The 12-minute rule will remain in effect for the duration of the permit.

All other work off the pavement on this project is restricted to a normal 8-hour day, Monday - Friday, with the prime Contractor and all subcontractors working on the same shift. Any change in work hours will require prior written approval by the District Highway Director.

GENERAL TRAFFIC MANAGEMENT AND SAFETY REQUIREMENTS

If required by MassDOT, Highway Division District 5, variable message boards (VMBs) shall be utilized as part of the approved traffic management plan under this Permit which must be properly secured with regards to hacking and unauthorized tampering prevention. The Grantee(s) shall adhere to all appropriate security specifications and take all necessary precautions to mitigate the risk of the boards being hacked. All VMBs shall be stored in a secured area and shall have a lockable, weatherproof enclosure for the operator interface, removable local keyboards which shall be

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removed whenever possible, and a password protected controller with local administrative passwords changed on a regular basis.

When any portion of the roadway will be blocked with equipment to facilitate the proposed work, the Grantee(s) will be required to adhere to the attached Traffic Management Plan (TMP) or submit a proposed TMP to MassDOT, Highway Division, to be reviewed and approved by the District Traffic Maintenance Engineer prior to working within or impacting the roadway. The plan must include information relating to proper signing, traffic control device placement and police details.

It is imperative to maintain two-way traffic at all times and these operations are managed so that motorists travel "delay" is minimized. At any time during the operation when a traffic delay of over twelve (12) minutes occurs and the situation is worsening, the Resident Engineer, Contractor, or Police Detail will begin to suspend operations. Continuously increasing "delays" of over twelve (12) minutes are not to be permitted.

If traffic must be "stopped", the duration shall not be more than five (5) minutes.
Uniformed State/Local Police Officer(s) and their official vehicle(s) may be necessary to provide protection for those installing and removing all temporary traffic warning signs and devices and to perform all traffic management as required.

The Grantee(s) will monitor the flow of traffic during peak traffic volumes and if necessary, shall suspend all operations. Work will resume at the discretion of the Police detail officer and/or to the satisfaction of the supervising MassDOT, Highway Division, Engineer.

In the event of inclement weather or dense fog, which lessens the visibility of advance warning signs, vehicles and workers, the Grantee(s) will suspend all operations so as not to interfere with the safety of the motoring public and the operations of work. In the event of snow or icing conditions, all vehicles and equipment must be removed from the roadway and/or shoulder area so as not to interfere with Snow and Ice Operations.

The Grantee(s) shall provide safe and ready means of access and egress to all public and private roads and drives 24 hours per day. Every effort must be made as not to interfere with or inconvenience all abutters throughout the duration of this project.

Signs and traffic control devices are required for advance notice of the work and within the work area.

The Grantee(s) or Applicant will supply all required signs and traffic warning devices and shall be in accordance with the Massachusetts Manual on Uniform Traffic Control Devices. The number and location of all signs and devices shall be deemed necessary by the Engineer for the safe and efficient performance of the work and the safety of the travelling public.

All warning devices shall be subject to removal, replacement, and/or repositioning by the applicant as often as deemed necessary by the Engineer.

Cones or non-reflectorized warning devices shall not be left in operating position on the highway when the daytime operations have ceased. If it becomes necessary for MassDOT, Highway Division, to remove the construction warning devices or their appurtenances from the project due to negligence by the applicant, all costs for this work will be charged to the Grantee(s).

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All vehicles, except passenger's cars, which are assigned to the permitted project and which operate on the site at speeds of 25 MPH or less, shall have an official SLOW-MOVING VEHICLE emblem displayed. All vehicles and equipment on this project must be equipped with back-up alarms.

All personnel who are working on the travelled way or breakdown lanes shall wear approved safety vests and hard hats.

GENERAL CONDITIONS AND APPROVED PROCEDURES

The Grantee(s) must contact the "Dig Safe" Center at 811 to obtain a "Dig Safe" number prior to starting the proposed excavation for the purpose of identifying the location of underground utilities.

IF THE PROPOSED WORK FALLS WITHIN THE AREA OF A SIGNALIZED INTERSECTION, the Grantee(s) must contact the District Traffic Maintenance Engineer at (508) 884-4208 at least two (2) weeks prior to the commencement of said work to locate the existing traffic signal conduit/detectors and to coordinate this work so as not to disturb the traffic signals. The Grantee(s) will be responsible to repair/replace all damaged items and will be billed for any cost incurred to restore normal operation to MassDOT, Highway Division, signal equipment to the satisfaction of the Engineer.

Unless otherwise stated, no hardened surface of the State Highway may be disturbed.

When an opening in the roadway is required and permitted herein, the opening must be as small as possible to perform the proposed work.

If the integrity of any existing sidewalks, catch basins, manholes or any other underground structures or equipment is compromised, the Grantee(s) will reconstruct and/or replace all items according to MassDOT, Highway Division, Standards at the cost of the Grantee(s) and to the satisfaction of the Engineer.

The Grantee(s) must not disturb or remove any MassDOT, Highway Division, bound(s) (MHB) associated with this project. If so disturbed or missing, the bound(s) must be reset/replaced by a Registered Land Surveyor. All procedures and materials must be in compliance with Massachusetts Design and Construction Standards. A copy of the paid bill must be submitted to this office upon completion of said work.

All traffic safety lines if disturbed shall be replaced in kind.

All disturbed areas within the State Highway Layout must be graded, loamed, and seeded to the Engineer's satisfaction.

All debris and litter remaining from the proposed construction shall be removed by the Grantee(s) and the area left clean daily.

DRAINAGE AND UTILITY CASTINGS

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"The use of risers to adjust drainage and utility structures will not be allowed. All adjustment work done to existing or new drainage structures shall conform to Section 220 of MassDOT, Highway Division, Standard Specifications and according to Plates 201.3.0 and 202.9.0 of MassDOT, Highway Division, Construction Standards."

ENVIRONMENTAL LIABILITY AND COMPLIANCE

The Grantee(s) assumes all risk associated with any environmental condition within the subject property and shall be solely responsible for all costs associated with evaluating, assessing, and remediating, in accordance with all applicable laws, any environmental contamination (1) discovered during Grantee's work or activities under this Permit to the extent such evaluation, assessment or remediation is required for Grantee's work, or (2) resulting from the Grantee's work or activities under this Permit. The Grantee(s) shall notify MassDOT, Highway Division, of any such assessment and remediation activities.

The Grantee(s) is hereby held solely responsible for obtaining and maintaining any and all environmental compliance permits required by local, state, and federal laws and regulations when regular or emergency work is proposed within, or in close proximity to, any wetland area. These environmental compliance requirements include, but are not limited to, a Negative Determination of Applicability or Order of Conditions from the local Conservation Commission, a Water Quality Certificate from the Department of Environmental Protection, and a Programmatic General Permit from the U.S. Army Corps of Engineers. The Grantee(s) shall forward to MassDOT, Highway Division, a copy of each such environmental compliance permit.

CLOSING CONDITIONS

All of said work shall comply with the terms and conditions herein and must be done as directed by and to the satisfaction of the engineer.

All work done under this contract shall be in conformance with the 2020 Edition of the MassDOT Highway Division Standard Specifications for Highways and Bridges. All construction shall conform to the October 2017 edition of the Massachusetts Department of Transportation, Highway Division "Construction Standard Details (English Edition)"; the latest Manual on Uniform Traffic Control Devices with Massachusetts Amendments; the latest edition to the following: the 1996 Construction and Traffic Standard Details (as related to Traffic Standard details only); the 1990 Standard Drawings for Traffic Signs and Supports; the 1968 Standard Drawings for Traffic Signals and Highway Lighting; the latest edition of American Standard for Nursery Stock; the Plans and these Special Provisions.

The Grantee(s) shall indemnify and save harmless the Commonwealth and MassDOT, Highway Division, against all suits, claims or liability of every name and nature arising at the time out of or in consequence of the acts of the Grantee(s) in the performance of the work covered by this Permit and/or failure to comply with the terms and conditions of this Permit whether by themselves or their employees or subcontractors.

It is noted that the Grantee(s) will be responsible for future corrective actions resulting from defective work under the subject permit. Any damage to the roadway and/or shoulder as a result of the permitted work is the Grantee's responsibility and shall be repaired at his/her expense.

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The Completion of Work Form and supporting photos shall be electronically uploaded, along with local AAB approval (if required), via the State Highway Access Permit System (SHAPS), as soon as possible after the completion of the physical work to begin the sign-off process.

MassDOT, Highway Division, will hold the Permit on file for a period of not less than three (3) years. If the Completion of Work Form is not uploaded, the liability assumed under this Permit will continue.

A copy of this Permit must be on the job site at all times for inspection. Failure to have this Permit available at the site will result in suspension of the rights granted by the Permit.

"FOLLOWING CONDITIONS APPLY TO PERMITS"
Conditions Relating Particularly to Permits for the Laying of Pipes, Conduits, etc.

After any pipes, conduits, drains or other underground structures are laid, or any excavation is made in the roadway, the trenches or openings shall be properly backfilled with suitable material, the back-filling shall be thoroughly tamped, and the surface of the road over said structures shall be left even with the adjoining ground. If the work is done in cold weather no frozen material shall be used for backfilling.

Wherever the hardened surface of the roadway, gutters, or any part of the surface of the highway is disturbed it shall be replaced in as good condition as before it was disturbed, and if new materials are required, they shall correspond with those already in place on the road.

Where service pipes are to cross the highway, the connections shall be made without disturbing the hardened surface of the roadway, by driving the pipes under the roadway, or the service pipes shall be carried under and across the road in a larger pipe, unless otherwise ordered by the Director.

The Grantee shall maintain the surface of the roadway over said structures as long as MassDOT may deem necessary, until all signs of the trenches shall have been eliminated.

CONDITIONS RELATING PARTICULARLY TO PERMITS FOR THE ERECTION OF POLES, WORKS AND OVERHEAD STRUCTURES, AND THE CUTTING AND TRIMMING OF TREES

In the erection of pole lines, unless otherwise herein provided, no trees located within the limits of the State Highway shall be cut or trimmed. No guy wires shall be attached to trees without a special Permit from MassDOT, and in no event shall they be so attached as to girdle the trees or in any way interfere with their growth. The wires shall be so protected at all time and places that they shall not interfere with or injure the trees either inside or outside the location of the highway.

Where the cutting or trimming of trees is authorized by this Permit, only such cutting, and trimming shall be done as may be designated by the Director.

In the construction or reconstruction of pole lines no guy wires shall be erected nearer to the surface of the ground than 6' (feet); provided, however, that the owners of such lines may maintain such guy wires at a lower elevation than 6' (feet) from the ground until such time as MassDOT shall notify them to remove said wires or to the elevation first stated.

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In order to protect the trees through which any wires may pass, said wires shall be insulated and such other tree guards used as may be directed by the Director. Where high tension wires are erected under this Permit, they shall be so located that, under conditions of maximum severity as regards a coating of ice or snow, there shall be a space of at least 8' (feet) between such high-tension wires and other wires.

The Grantee shall, within sixty (60) days from the date of completion of the work, file in the office of MassDOT a plan showing the location of each pole erected in accordance with the Permit, said plan to be of such size and in such form as MassDOT may direct.

GENERAL AND ADDITIONAL CONDITIONS

Whenever the word "MassDOT" is used herein it shall mean the Massachusetts Department of Transportation of the Commonwealth of Massachusetts.

Whenever the word "Director" is used herein it shall mean the District Highway Director or other authorized representative of MassDOT.

Whenever the word "Grantee" is used herein it shall mean the person or persons, corporation or municipality to whom this Permit is granted, or their legal representatives.

During the progress of the work all structures underground and above ground shall be properly protected from damage or injury; such barriers shall be erected and maintained as may be necessary for the protection of the traveling public; the same shall be properly lighted at night; and the Grantee shall be responsible for the damages to persons or property due to or resulting from any work done under this Permit.

Except as herein authorized, no excavation shall be made, or obstacle placed within the limits of the State highways in such a manner as to interfere unnecessarily with the travel over said road.

If any grading of sidewalk work done under this Permit interferes with the drainage of the State highway in any way, such catch basins and outlets shall be constructed as may be necessary, in the opinion of the Director, to take proper care of such drainage.

Wherever the hardened surface of the roadway is disturbed and the Director may consider it necessary or advisable to do so, said surface will be restored by the employees of MassDOT, at such time as MassDOT may direct, and the expense thereof shall be borne by the Grantee, who shall purchase and deliver on the road the materials necessary for said work if and when directed by the Director. All payments to the supplier and to laborers, inspectors, etc., employed by MassDOT for or on account of the work herein contemplated shall be made by said Grantee forthwith on receipt of written orders, pay rolls, or vouchers approved by MassDOT.

IF THE GRANTEE DOES ANY WORK CONTRARY TO THE ORDERS OF THE DIRECTOR, AND, AFTER DUE NOTICE, FAILS TO CORRECT SUCH WORK OR TO REMOVE STRUCTURES OR MATERIALS ORDERED TO BE REMOVED, OR FAILS TO COMPLETE WITHIN THE SPECIFIED TIME THE WORK AUTHORIZED BY THIS

PERMIT, MASSDOT MAY, WITH OR WITHOUT NOTICE, CORRECT OR COMPLETE SUCH WORK IN WHOLE OR IN PART, OR REMOVE SUCH STRUCTURES OR MATERIALS, AND THE GRANTEE SHALL REIMBURSE MASSDOT FOR ANY EXPENSE INCURRED IN CORRECTING AND/OR COMPLETING THE WORK OR REMOVING THE STRUCTURES OR MATERIALS.

ALL OF THE WORK HEREIN CONTEMPLATED SHALL BE DONE UNDER THE SUPERVISION AND TO THE SATISFACTION OF THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, AND THE ENTIRE EXPENSE THEREOF SHALL BE BORNE BY THE GRANTEE.

On the completion of the work herein contemplated all rubbish and debris shall be removed and the roadway and roadsides shall be left neat and presentable and satisfactory to the Director.

MassDOT hereby reserves the right to order the change of location or the removal of any structure or structures authorized by this Permit at any time, said change or removal to be made by and at the expense of the Grantee or its / their successors or assigns.

This Permit may be modified or revoked at any time by MassDOT without rendering said MassDOT or the Commonwealth of Massachusetts liable in any way.

The Grantee shall pay the salary, subsistence, and travel expenses of any inspector appointed by MassDOT to supervise the work herein contemplated.

All of the above conditions shall be applicable to the work herein authorized, unless the same are inconsistent with the conditions on the face of the Permit, in which case the conditions written or printed on the face of the Permit shall apply.

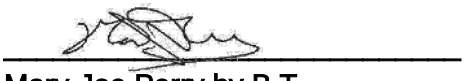
The acceptance of this Permit or the doing of any work thereunder shall constitute an agreement by the Grantee to comply with all of the conditions and restrictions printed or written herein.

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Charles D. Baker. Governor
Karyn E. Polito, Lieutenant Governor
Stephanie Pollack, Secretary & CEO
Jonathan L. Gulliver, Highway Administrator

massDOT
Massachusetts Department of Transportation
Highway Division

Approved Signature



Mary-Joe Perry by B.T.
District Highway Director

Date of Issue: March 30, 2020

Permit Expiration: Wednesday, March 31, 2021

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SECTION 13345

DATA NETWORK

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1.01 - SCOPE 1
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2.04 - NETWORK EQUIPMENT ENCLOSURES 4
2.05 - MANAGED ETHERNET SWITCHES 4
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PART 1 - GENERAL

1.01 - SCOPE

A. This section is provided for reference only. Work required under this section will be provided under Contract No. 2019-01, Downtown Area WWTF and Effluent Disposal.

B. Fiber optic cables used with the WWTF and Collection System SCADA control system shall be provided under Contract No. 2019-01, Downtown Area WWTF and Effluent Disposal.

C. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 – SUBMITTALS – Not Used

1.05 - PRODUCT HANDLING – Not Used

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

C. Quality Assurance

1. Fiber optic cables and related equipment shall be the products of approved manufacturers. Fabrication of the fiber optic cables and related equipment shall utilize the most advanced commercial materials and manufacturing processes. Manufacturer shall be ISO 9001 and TL-9000 certified.

2. Fiber optic cable installation shall be performed by experienced fiber optic cable installers who shall have been regularly engaged in the installation of fiber optic cables for the last five (5) years at the minimum.

3. Fiber optic cable splicing and terminations shall be performed by experienced cable splicers who shall have been regularly engaged in splicing and termination of fiber optic cables for the last five (5) years at the minimum.

4. Retain the services of the fiber optic cable manufacturers technical representative to certify that the fiber optic cable installation is in accordance with the manufacturer’s installation requirements.

5. Retain the services of an independent testing firm who shall perform acceptance testing of the fiber optic cable installation. The testing firm shall have experience in the inspection and testing of cables of the specified type and shall be a member company of NETA.

6. All cables and terminations shall be identified at all locations. All cables shall terminate in an alphanumeric sequence at termination locations.

7. All Fiber Optic cable terminations shall comply with and be tested to ANSI/TIA/EIA 568-B standards for single-mode and multi-mode Fiber installation for Fiber Optics.
8. All optical fiber components (optical fiber, cable, connectors, patch panels, hardware and patch cords) shall be manufactured by a single company, unless otherwise noted, in order to ensure consistency and compatibility.

D. Equipment Identification

1. Each fiber shall be labeled at each termination point and all splice location including spares. Conductor or circuit identification shall be applied at specified points with circuit numbers or other identification stamped on terminal boards when provided, or on the cable itself in such a manner that the identification is visible around the cable's circumference.
2. Each fiber shall be identified in junction boxes, pull boxes, manholes, handholes, terminal boxes, and cabinets. Where no termination is made, use a plastic-coated, self-adhesive, wire marker. Where termination is made, use a plastic, pre-printed sleeve wire marker. Paper self-adhesive wire markers are not acceptable.

E. Shop Tests

1. Fiber optic cables and equipment shall be shop tested at the manufacturer's plant in accordance with the manufacturer's standard testing procedures. Shop tests shall be performed prior to shipment.
2. Submit manufacturer's shop test reports.

1.07 - REFERENCES

A. National Fire Protection Association (NFPA):

1. NFPA-70: National Electrical Code (NEC).

B. Underwriters Laboratories, Inc. (UL):

1. U.L. 1581 VW-1: Vertical Tray Cable Flame Test
2. U.L. 1666: Riser Cable
3. U.L. 508: Standards for Safety, Industrial Control Equipment

C. Institute of Electrical and Electronics Engineers (IEEE):

1. IEEE Standard 383: Flame Retardancy.
2. IEEE 802 (Series): Standards for Local and metropolitan Area Networks.
3. IEEE 1588: Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems.

D. American National Standards Institute (ANSI):

1. ANSI/ISA-99: Security for industrial Automation and Control Systems.

E. NETA: The International Testing Association Acceptance Testing Specification.

1. TIA/EIA-568-B/C (Series): commercial Building Telecommunications Cabling Standards.
2. TIA/EIA-569 (Series): commercial Building Standard for Telecommunications Pathways and Spaces.
3. TIA/EIA-526 (Series): Standard Test Procedures for Fiber Optic Systems.
4. TIA/EIA-604 (Series): Fiber Optic Connector Intermateability Standard (FOCIS).
5. Internet Engineering Task Force (IETF) RFC documents (various).

F. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.08 – WARRANTY – Not Used

PART 2 – PRODUCTS

2.01 - FIBER OPTIC CABLE AND APPURTENANCES

A. All fiber optic cable required under this contract will be provided under Contract No. 2019-01, Downtown Area WWTF and Effluent Disposal.

2.02 - CAT6 CABLE

A. All CAT6 cable required under this contract will be provided under Contract No. 2019-01, Downtown Area WWTF and Effluent Disposal.

2.03 - OPTICAL HARDWARE

A. All optical hardware required under this contract will be provided under Contract No. 2019-01, Downtown Area WWTF and Effluent Disposal.

2.04 - NETWORK EQUIPMENT ENCLOSURES

A. All network equipment enclosures required under this contract will be provided under Contract No. 2019-01, Downtown Area WWTF and Effluent Disposal.

2.05 - MANAGED ETHERNET SWITCHES

A. All managed Ethernet Switches required under this contract will be provided under Contract No. 2019-01, Downtown Area WWTF and Effluent Disposal.

2.06 – RADIO

A. All radio equipment required under this contract will be provided under Contract No. 2019-01, Downtown Area WWTF and Effluent Disposal.

PART 3 - EXECUTION

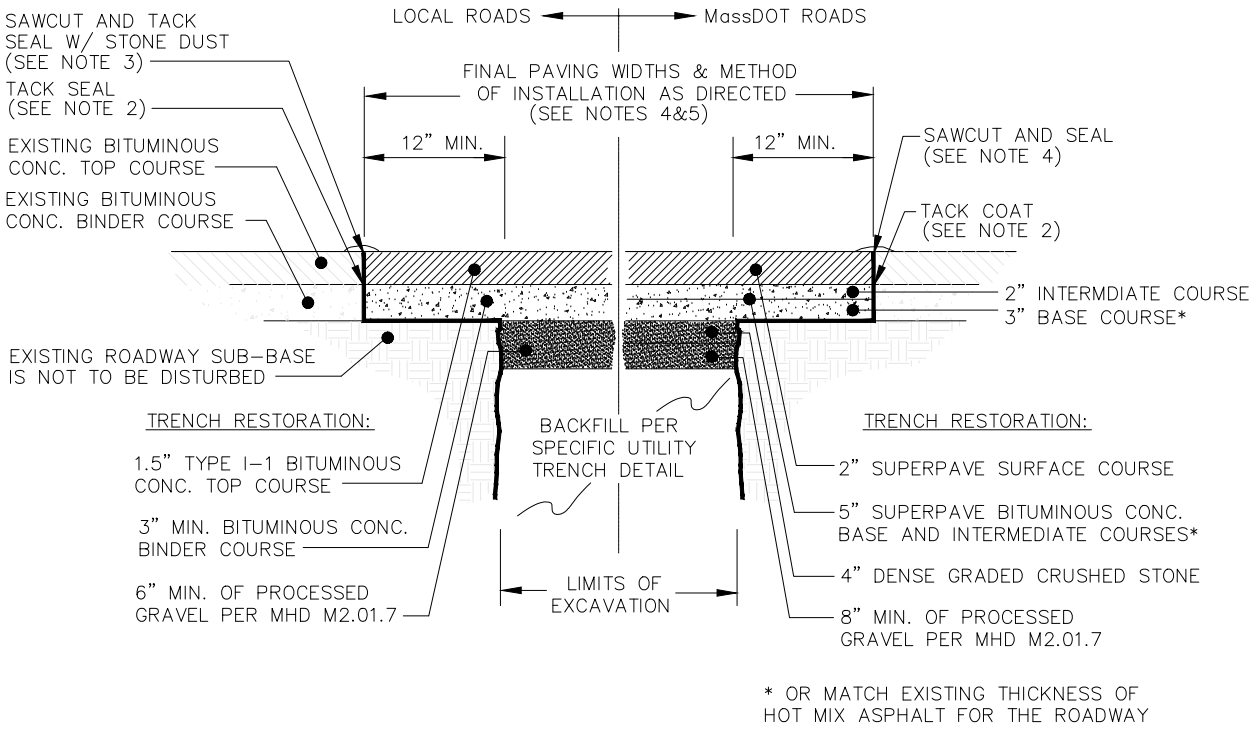
3.01 - GENERAL

A. All execution, including installation, terminations, checkout and testing required under this contract will be provided under Contract No. 2019-01, Downtown Area WWTF and Effluent Disposal.

3.06 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT

END OF SECTION



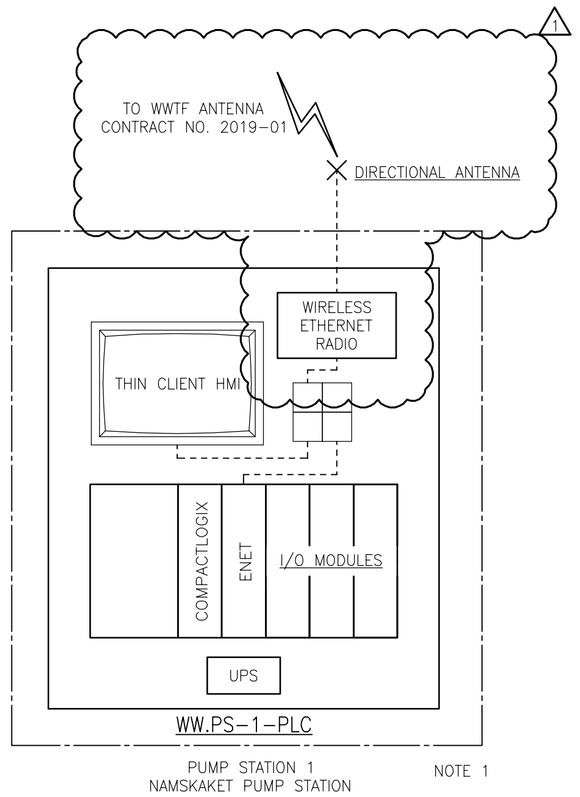
1. ALL INSTALLATION AND MATERIAL SPECIFICATIONS PER MASS. HIGHWAY DEPARTMENT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES, 2020 AS AMENDED, AND THE REQUIREMENTS OF THE MASSDOT PERMIT 5-2019-0487.
2. ASPHALT EMULSION TACK COAT (RS-IH) MUST BE PLACED BETWEEN EACH COURSE.
3. ALL EXPOSED JOINTS ARE TO BE SEALED WITH TACK AND STONE DUST.
4. ALL VERTICAL EDGES MUST BE COATED WITH HOT POURED JOINT SEALER
5. FINAL PAVEMENT REPAIR JOINTS MUST BE SQUARE AND PERPENDICULAR TO THE DIRECTION OF TRAVEL.
6. ANY TOP COURSE APPLIED AT A WIDTH OF 6' WIDE OR GREATER IS TO BE PLACED BY MACHINE/BOX SPREADER WHEN & AS DIRECTED BY THE TOWN OF ORLEANS.

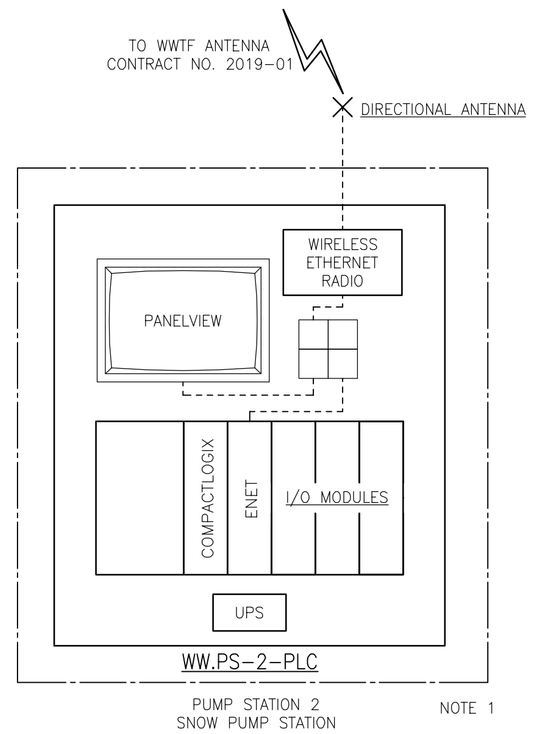
TYPICAL TRENCH REPAIR & PAVEMENT SECTION DETAIL

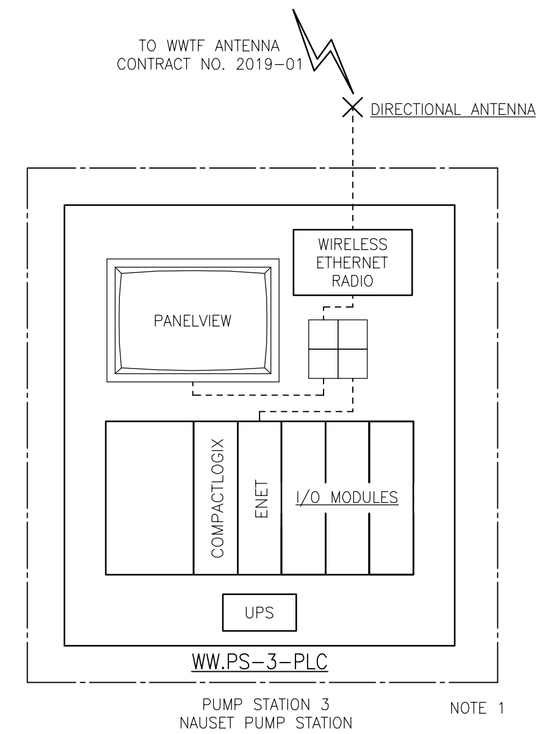
NOT TO SCALE

	Orleans Standard Details TYPICAL TRENCH REPAIR & PAVEMENT SECTION DETAIL		
SHEET REFERENCE: 99 C-507	SCALE: Not to Scale	DATE: April 2020	

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LAST UPDATE: Thursday, April 02, 2020 8:19:02 AM PLOT DATE: Thursday, April 02, 2020 8:21:01 AM







NOTES:

1. PUMP STATION PLC PANELS, REMOTE COMMUNICATION HARDWARE AND CONFIGURATION/INTEGRATION TO BE PROVIDED UNDER THE WWTF CONTRACT AND HAVE BEEN SHOWN HERE FOR CLARITY.
2. FIBER OPTIC CABLE, ANCILLARY HARDWARE, AND ASSOCIATED TERMINATIONS AND TESTING ASSOCIATED WITH THE REMOTE PUMP STATIONS TO BE PROVIDED UNDER THE WWTF CONTRACT.

LEGEND

----------	ETHERNET
—·—·—·—	FIBER MEDIA
⊞	MANAGED ETHERNET SWITCH
FPP	FIBEROPTIC PATCH PANEL
FMC	FIBER MEDIA CONVERTER
UPS	UNINTERRUPTIBLE POWER SUPPLY

NOTES:

1. PLC BASED CONTROL PANELS TO BE PROVIDED UNDER CONTRACT NO. 2019-1, DOWNTOWN AREA WWTF AND EFFLUENT DISPOSAL.

AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

OWNER

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SARAH PAPAZIAN
INSTRUMENTATION
No.52296
REGISTERED
PROFESSIONAL ENGINEER

Jan 24 2020

ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	4/7/20	ADDENDUM NO. 10

PROJECT NUMBER

60587515

Designed By:	S. PAPAZIAN
Drawn By:	S. PAPAZIAN
Dept Check:	Y. RIZK
Proj Check:	T. PARECE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

INSTRUMENTATION

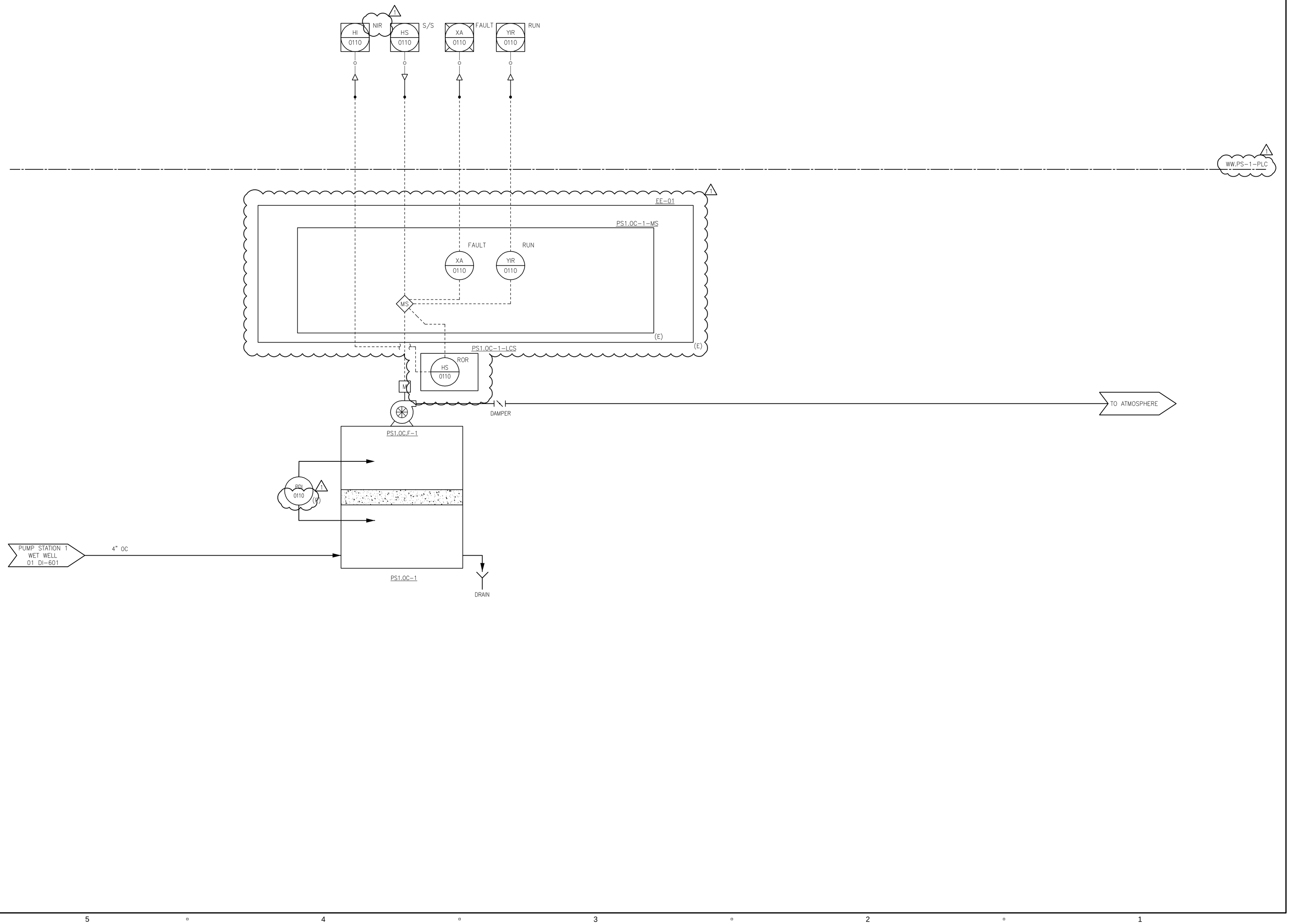
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SYSTEM ARCHITECTURE

SHEET NUMBER

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PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

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Scale:	AS NOTED

DISCIPLINE

INSTRUMENTATION

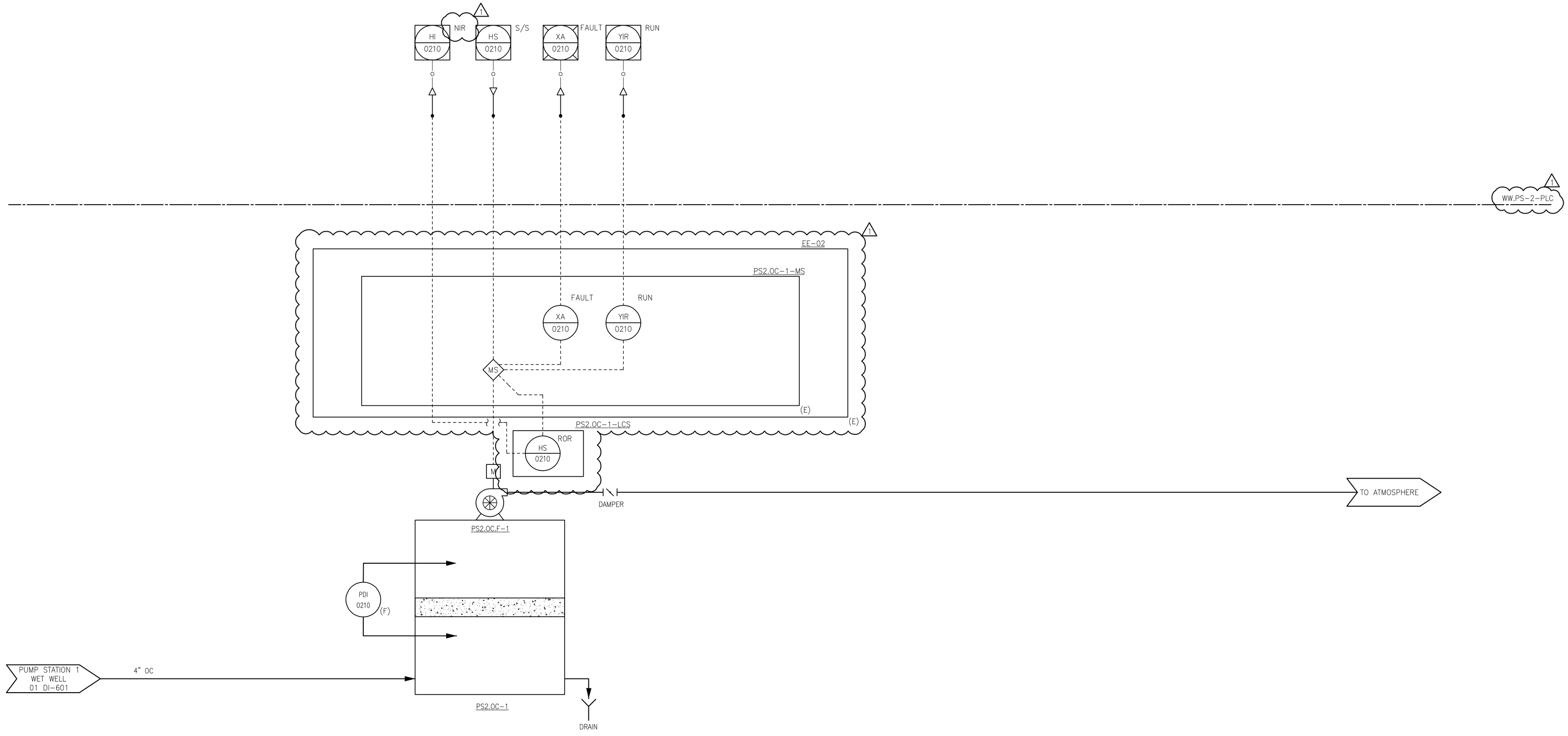
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SHEET NUMBER

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Designed By:	----
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Dept Check:	----
Proj Check:	T. PARECE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

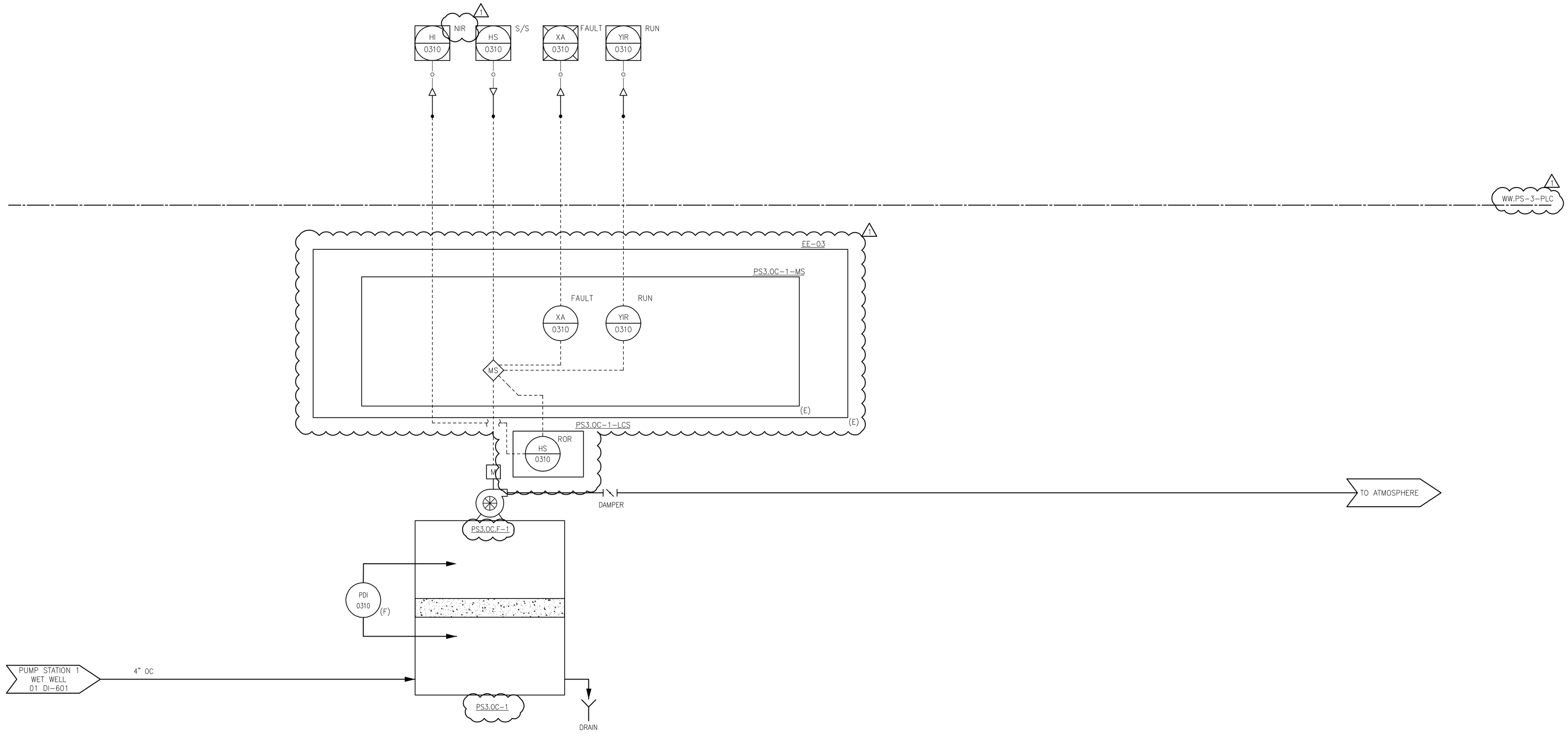
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SHEET NUMBER

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PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

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Date:	JANUARY 2020
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DISCIPLINE

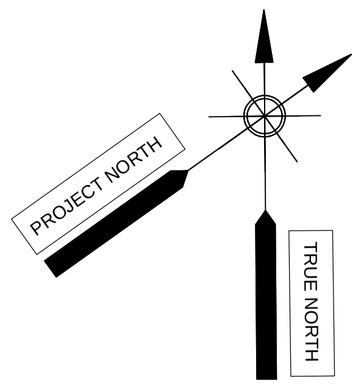
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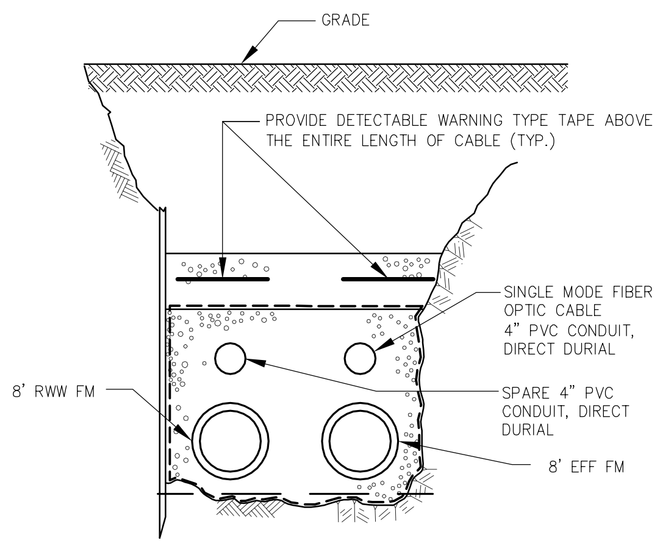
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PUMP STATION 3 ODOR CONTROL P&ID

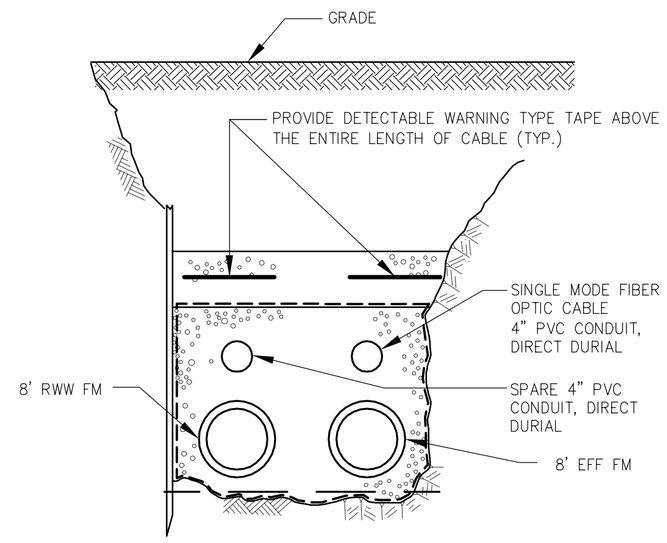
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03 DI-602





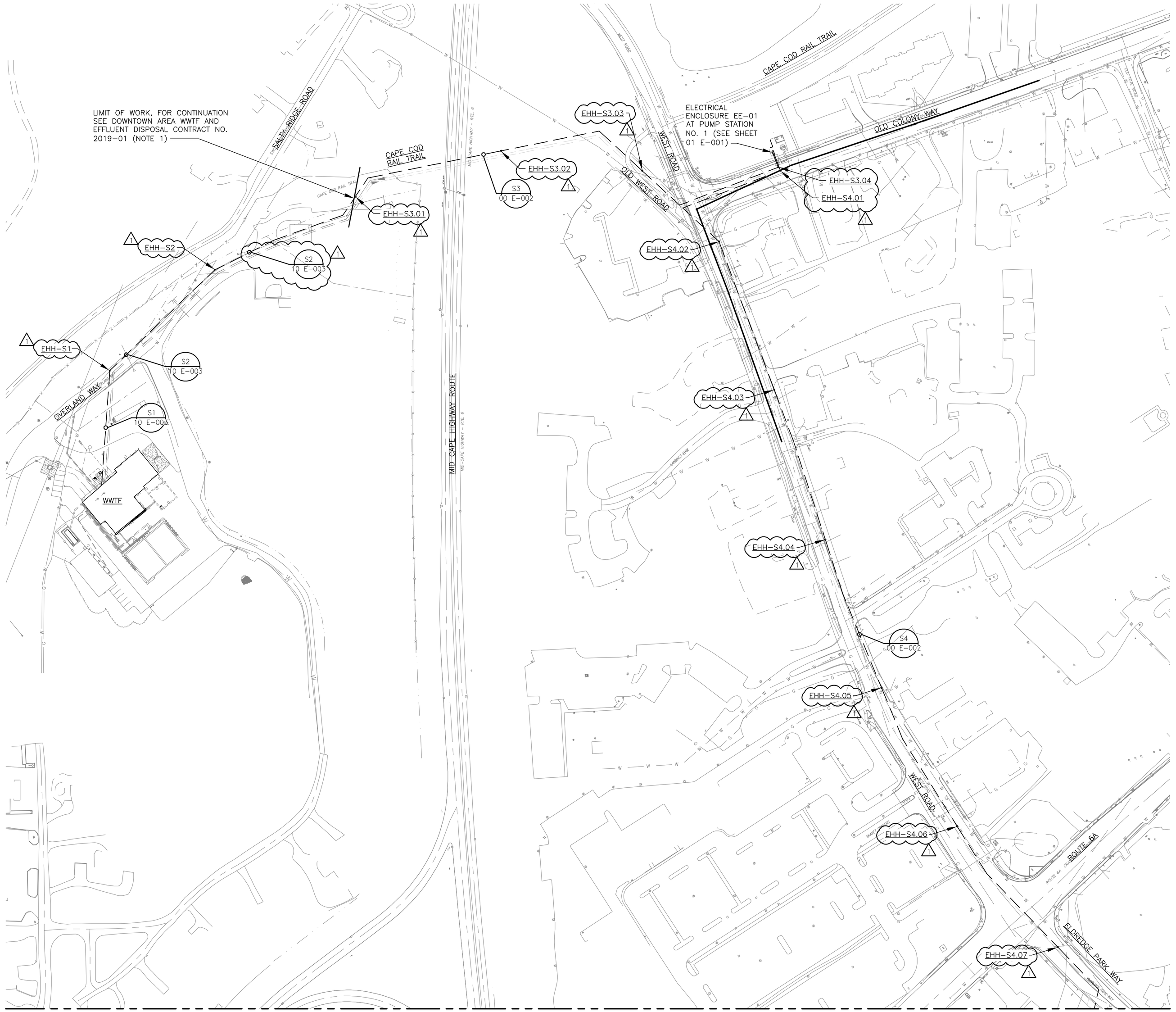
TRENCH DETAIL S3 / 00 E-002
NTS



TRENCH DETAIL S4 / 00 E-002
NTS

NOTES

1. SEE WWTF AND COLLECTION SYSTEM SCOPE DELINEATION TABLE ON SHEET 00 E-601 FOR FIBER NETWORK SCOPE
2. SEE WWTF AND EFFLUENT DISPOSAL CONTRACT FOR FIBER TRENCH SECTIONS S1, S2



MATCHLINE A-A (FOR CONTINUATION SEE SHEET 00 E-003)

COLLECTION SYSTEMS AND PUMP STATIONS - ELECTRICAL SITE PLAN - FIBER NETWORK I

SCALE: 1'=100'-0"

1" = 100' SCALE 0 100 200 300 FEET

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PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

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REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	04-08-2020	ADDENDUM 10

PROJECT NUMBER

60587515

Designed By:	A. ABRAHAM
Drawn By:	B. DESOUZA
Dept Check:	Y. RIZK
Proj Check:	T. PARECE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

ELECTRICAL

SHEET TITLE

ELECTRICAL SITE PLAN - FIBER NETWORK I

SHEET NUMBER

00 E-002

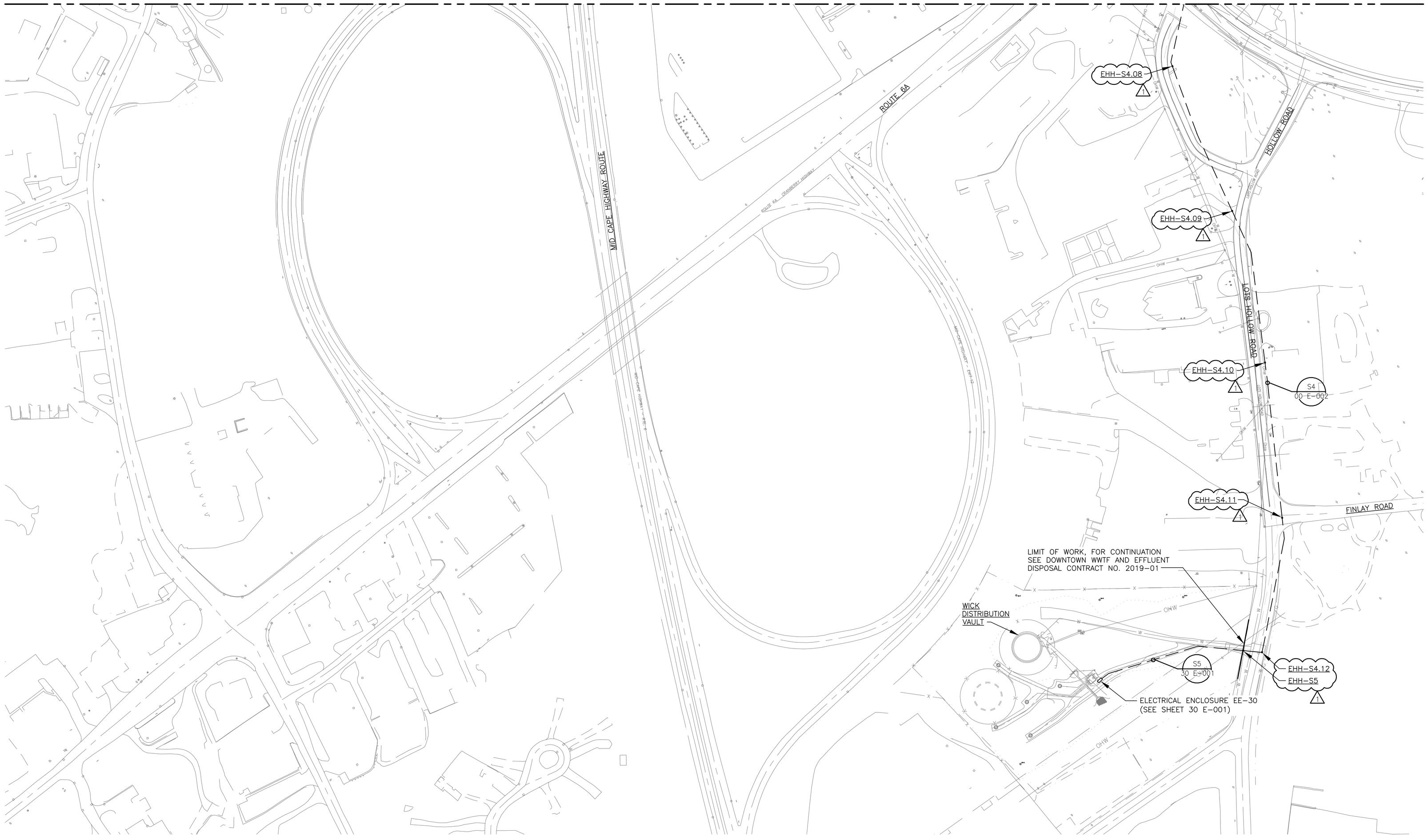
NOTES

1. SEE WWTF AND COLLECTION SYSTEM SCOPE DELINEATION TABLE ON SHEET 00 E-601 FOR FIBER NETWORK SCOPE
2. SEE WWTF AND EFFLUENT DISPOSAL CONTRACT FOR FIBER TRENCH SECTION S5

PROJECT NORTH

TRUE NORTH

MATCHLINE A-A (FOR CONTINUATION SEE SHEET 00 E-002)



COLLECTION SYSTEMS AND PUMP STATIONS - ELECTRICAL SITE PLAN - FIBER NETWORK II

SCALE: 1"=100'-0"

1" = 100' SCALE 0 100 200 300 FEET

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AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

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REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	04-08-2020	ADDENDUM 10

PROJECT NUMBER

60587515

Designed By:	A. ABRAHAM
Drawn By:	B. DESOUZA
Dept Check:	Y. RIZK
Proj Check:	T. PARECE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

ELECTRICAL

SHEET TITLE

ELECTRICAL SITE PLAN - FIBER NETWORK II

SHEET NUMBER

00 E-003

CONDUIT AND WIRE SCHEDULE

MEDIUM VOLTAGE POWER WIRING

[MV-1] 5"C, CABLE PROVIDED AND INSTALLED BY ELECTRICAL UTILITY.

LOW VOLTAGE POWER WIRING

[PA] 1"C, 2-12 AWG, 1-12 AWG (G)
[PA-4] 1"C, 4-12 AWG, 1-12 AWG (G)
[PA-6] 1"C, 6-12 AWG, 1-12 AWG (G)
[PB] 1"C, 3-12 AWG, 1-12 AWG (G)
[PC] 1C, 3-10 AWG, 1-10 AWG (G)
[PC-2] 1"C, 2-10 AWG, 1-10 AWG (G)
[PD] 1"C, 3-8 AWG, 1-10 AWG (G)
[PD-1] 1"C, 3-8 AWG, 1-10 AWG (G)
[PD-2] 1"C, 2-8 AWG, 1-10 AWG (G)
[PD-4] 1"C, 4-8 AWG, 1-10 AWG (G)
[PE] 1"C, 3-6 AWG, 1-10 AWG (G)
[PE-2] 1"C, 2-6 AWG, 1-10 AWG (G)
[PE-4] 1"C, 4-6 AWG, 1-10 AWG (G)
[PF] 1"C, 3-4 AWG, 1-10 AWG (G)
[PF-4] 1 1/2"C, 4-4 AWG, 1-10 AWG (G)
[PG] 1"C, 3-4 AWG, 1-8 AWG (G)
[PG-4] 1"C, 4-4 AWG, 1-8 AWG (G)
[PH] 1 1/4"C, 3-2 AWG, 1-8 AWG (G)
[PH-4] 1 1/2"C, 4-2 AWG, 1-8 AWG (G)
[PJ] 1 1/2"C, 3-1 AWG, 1-8 AWG (G)
[PJ-4] 1 1/2"C, 4-1 AWG, 1-8 AWG (G)
[PK] 1 1/2"C, 3-1 AWG, 1-6 AWG (G)
[PK-4] 1 1/2"C, 4-1 AWG, 1-6 AWG (G)
[PL] 1 1/2"C, 3-1/0 AWG, 1-6 AWG (G)
[PL-4] 1 1/2"C. 4-1/0 AWG, 1-6 AWG (G)
[PM] 1 1/2"C, 3-2/0 AWG, 1-6 AWG (G)
[PM-4] 2"C, 4-2/0 AWG, 1-6 AWG (G)
[PN] 2"C, 3-3/0 AWG, 1-6 AWG (G)
[PP] 2"C, 3-4/0 AWG, 1-4 AWG (G)
[PQ] 2 1/2"C, 3-250 KCM, 1-4 AWG (G)
[PR] 3"C, 3-350 KCM, 1-4 AWG(G)
[PS] 3"C, 3-350 KCM, 1-2 AWG(G)
[PT] 3"C, 3-500 KCM, 1-2 AWG(G)

SIGNAL WIRING

[D2] 3/4"C, 2-14 AWG, 1-14 AWG (G)
[D3] 3/4"C, 3-14 AWG, 1-14 AWG (G)
[D4] 3/4"C, 4-14 AWG, 1-14 AWG (G)
[D5] 3/4"C, 5-14 AWG, 1-14 AWG (G)
[D6] 3/4"C, 6-14 AWG, 1-14 AWG (G)
[D7] 3/4"C, 7-14 AWG, 1-14 AWG (G)
[D8] 3/4"C, 8-14 AWG, 1-14 AWG (G)
[D9] 3/4"C, 9-14 AWG, 1-14 AWG (G)
[D10] 3/4"C, 10-14 AWG, 1-14 AWG (G)
[D11] 1"C, 11-14 AWG, 1-14 AWG (G)
[D12] 1"C, 12-14 AWG, 1-14 AWG (G)
[D13] 1"C, 13-14 AWG, 1-14 AWG (G)
[D14] 1"C, 14-14 AWG, 1-14 AWG (G)
[D15] 1"C, 15-14 AWG, 1-14 AWG (G)
[D16] 1"C, 16-14 AWG, 1-14 AWG (G)
[D17] 1"C, 17-14 AWG, 1-14 AWG (G)
[D18] 1"C, 18-14 AWG, 1-14 AWG (G)
[D19] 1"C, 19-14 AWG, 1-14 AWG (G)
[D20] 1"C, 20-14 AWG, 1-14 AWG (G)
[D28] 1"C, 28-14 AWG, 1-14 AWG (G)
[D30] 1"C, 30-14 AWG, 1-14 AWG (G)
[D34] 1 1/2"C, 34-14 AWG, 1-14 AWG (G)
[D40] 1 1/2"C, 40-14 AWG, 1-14 AWG (G)

GROUND WIRING:

NOTE: ALL G SERIES WIRING SHALL BE CONNECTED TO GROUNDING BUS BAR LOCATED IN THE ELECTRICAL ROOM UNLESS OTHERWISE INDICATED. INSTALL IN PVC CONDUIT.

[G1] 1"C, 1-12 AWG (G)
[G2] 1"C, 1-10 AWG (G)
[G3] 1"C, 1-8 AWG (G)
[G4] 1C, 1-6 AWG (G)
[G5] 1"C, 1-4 AWG (G)
[G6] 1"C, 1-2 AWG (G)
[G7] 1"C, 1-1/0 AWG (G)
[G8] 1"C, 1-2/0 AWG (G)
[G9] 1 1/2"C, 1-3/0 AWG (G)
[G10] 1 1/2"C, 1-4/0 AWG (G)
[G11] 1 1/2"C, 1-250 KCM (G)
[G12] 2"C, 1-350 KCM (G)
[G13] 2"C, 1-500 KCM (G)

CONTROL WIRING

[VSC] 1"C, VENDOR SUPPLIED CABLE
[CX] 1" C, COAXIAL CABLE
[E1] 1"C, 1-CAT 6 CABLE
[E2] 1"C, 2-CAT 6 CABLES
[FO1] 1"C, 1-FIBER OPTIC MEDIA CABLE
[FO2] 1"C, 2-FIBER OPTIC MEDIA CABLES
[C1] 1"C, 1-TSP 16 AWG
[C2] 1"C, 2-TSP 16 AWG
[C3] 1"C, 3-TSP 16 AWG
[C4] 1 1/2"C, 4-TSP 16 AWG
[C5] 1 1/2"C, 5-TSP 16 AWG

CONDUIT AND WIRE SCHEDULE NOTES:

1. FOR CIRCUITS RUN IN DUCT BANKS, THE DUCT SIZE INDICATED ON THE DUCT BANK SCHEDULE GOVERNS THE CONDUIT SIZE IN THE DUCT BANK. CONDUIT SIZES SHOWN HERE GOVERNS CONDUIT SIZE WHEN NOT RUN IN DUCT BANK.

TABLE OF RESPONSIBILITY – FIBER NETWORK SCOPE FOR WWTF & COLLECTION SYSTEM CONTRACTS

	ELEMENT	COLLECTION SYSTEM/ PUMP STATIONS CONTRACT 2019-01	WWTF/EFFLUENT DISPOSAL CONTRACT 2019-02
1	FURNISH AND INSTALL FIBER OPTIC NETWORK CABLE		X
2	FURNISH AND INSTALL CONDUITS FOR FIBER CONNECTION FROM WWTF TO RT. 7 CROSSING (TRENCH SECTIONS S1, S2) (EHH-S1, EHH-S2) 1		X
3	FURNISH AND INSTALL CONDUITS FOR FIBER CONNECTION FROM RT.7 CROSSING TO PS #1 (TRENCH SECTION S3) (EHH-S3.01/02/03/04) 1	X	
4	FURNISH AND INSTALL CONDUITS FOR FIBER CONNECTION FROM PUMP STATION #1 TO LOTS HOLLOW RD. (TRENCH SECTION S4) (EHH-S4.01/02/03/04/05/06/07/08/09/10/11/12) 1	X	
5	FURNISH AND INSTALL CONDUITS FOR FIBER CONNECTION FROM LOTS HOLLOW RD. TO WICK DIST. VAULT (TRENCH SECTION S5) (EHH-S5) 1		X

TABLE OF RESPONSIBILITY – ELECTRICAL, GENERAL, AND SYSTEM INTEGRATOR

	ELEMENT	GENERAL CONTRACTOR	SYSTEM INTEGRATOR	ELECTRICAL CONTRACTOR
1	FURNISH, TEST AND CALIBRATE INSTRUMENTS		X	
2	INSTALL INSTRUMENTS	X		
3	INSTALL FIELD LOCATED DEVICES ASSOCIATED WITH INSTRUMENTS INCLUDING TRANSMITTERS, INDICATORS, CONTROL PANELS, AND ANCIALLARY COMPONENTS THAT ARE NOT LOCATED WITHIN PROCESS PIPING AND TANKS. LOCATIONS SHALL BE AS INDICATED ON THE ELECTRICAL DRAWINGS.	X		
4	FURNISH RADIO SYSTEM HARDWARE		X	
5	INSTALL RADIO SYSTEM HARDWARE			X
4	FURNISH AND INSTALL INTERCONNECTING WIRE, CABLE, CONDUIT, AND CONNECTIONS FOR INSTRUMENTS			X
6	FURNISH AND INSTALL FIBER OPTIC NETWORK CABLE		X	

ENVIRONMENTAL CLASSIFICATIONS*

LOCATION	NEMA TYPE					HAZARDOUS CLASS 1 GROUP D**		REMARKS
	1	3R	4	4X	12	DIV. 1	DIV. 2	SEE BELOW
(01) - PUMP STATION NO.1								
WET WELL						x		R3
VALVE VAULT							x	R2
(02) - PUMP STATION NO.2								
WET WELL						x		R3
VALVE VAULT							x	R2
(03) - PUMP STATION NO.3								
WET WELL						x		R3
VALVE VAULT							x	R2
OUTDOORS (UNLESS OTHERWISE COVERED ABOVE)				x				R1

REMARKS:

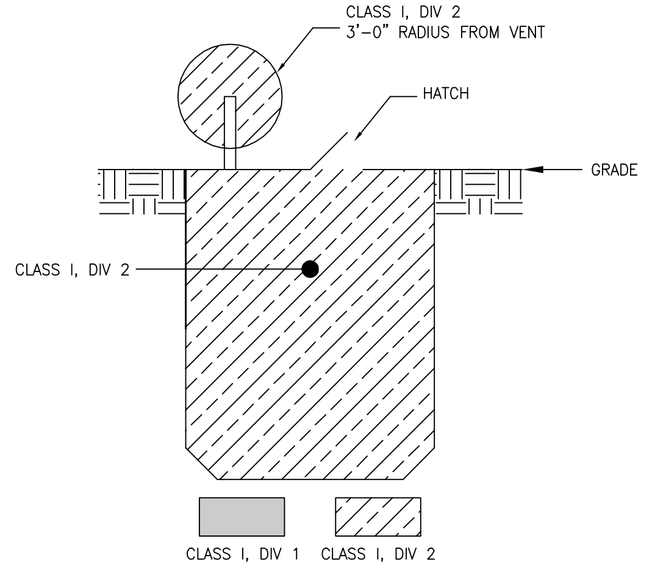
* PROVIDE EQUIPMENT AND INSTALLATION TO COMPLY WITH AREA CLASSIFICATION REQUIREMENTS.

** RADIUS SHALL EXTEND TO ALL DIRECTIONS UNLESS SPECIFICALLY IDENTIFIED AS A HORIZONTAL OR VERTICAL RADIUS.

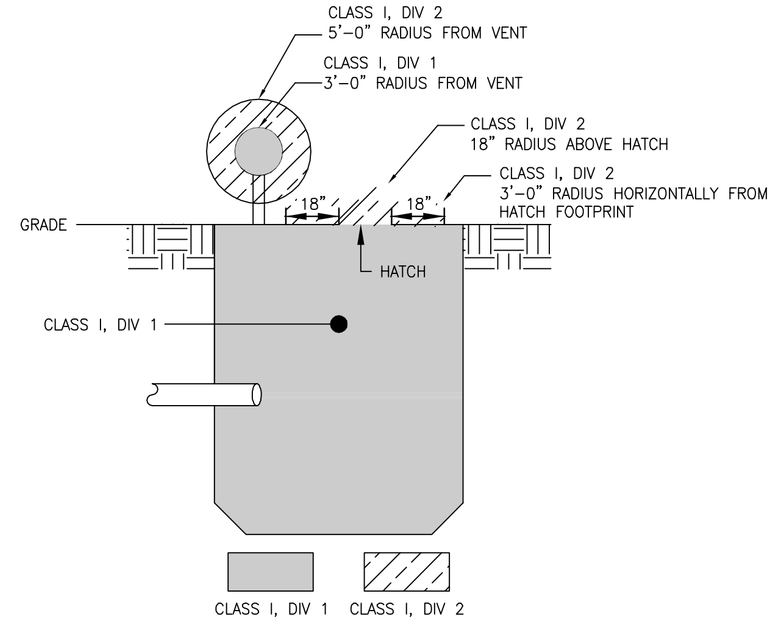
R1 = OUTDOORS ARE AREAS NOT ENCLOSED BY WALLS AND CEILING.

R2 = DRY WELL OR VAULT
CLASS 1 DIVISION 2 INSIDE VAULT
CLASS 1 DIVISION 2 WITHIN 0.9 M (3 FT) RADIUS FROM VENT
NEMA 4X AREA BEYOND CLASSIFIED RADIUS
SEE FIGURE R2 THIS SHEET.

R3 = WET WELL OR BASIN
CLASS 1 DIVISION 1 INSIDE WET WELL
CLASS 1 DIVISION 1 WITHIN 0.9 M (3 FT) RADIUS FROM VENT
CLASS 1 DIVISION 2 WITHIN 1.5 M (5 FT) RADIUS FROM VENT
CLASS 1 DIVISION 2 WITHIN 0.9 M (3 FT) HORIZONTAL RADIUS FROM HATCH
CLASS 1 DIVISION 2 WITHIN 1.5 M (5 FT) VERTICAL RADIUS FROM HATCH
NEMA 4X AREA BEYOND CLASSIFIED RADIUS
SEE FIGURE R3 THIS SHEET.



R2
DRY WELL OR VAULT
CLASSIFICATION DETAIL



R3
WET WELL OR BASIN
CLASSIFICATION DETAIL

AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

OWNER

TOWN OF ORLEANS, MA
19 SCHOOL ROAD
ORLEANS, MA 02653
(508) 240-3700

ENGINEER

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REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	04-08-2020	ADDENDUM 10

PROJECT NUMBER

60587515

Designed By:	A. ABRAHAM
Drawn By:	A. ABRAHAM
Dept Check:	Y. RIZK
Proj Check:	T. PARECE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

ELECTRICAL

SHEET TITLE

ELECTRICAL SCHEDULES I

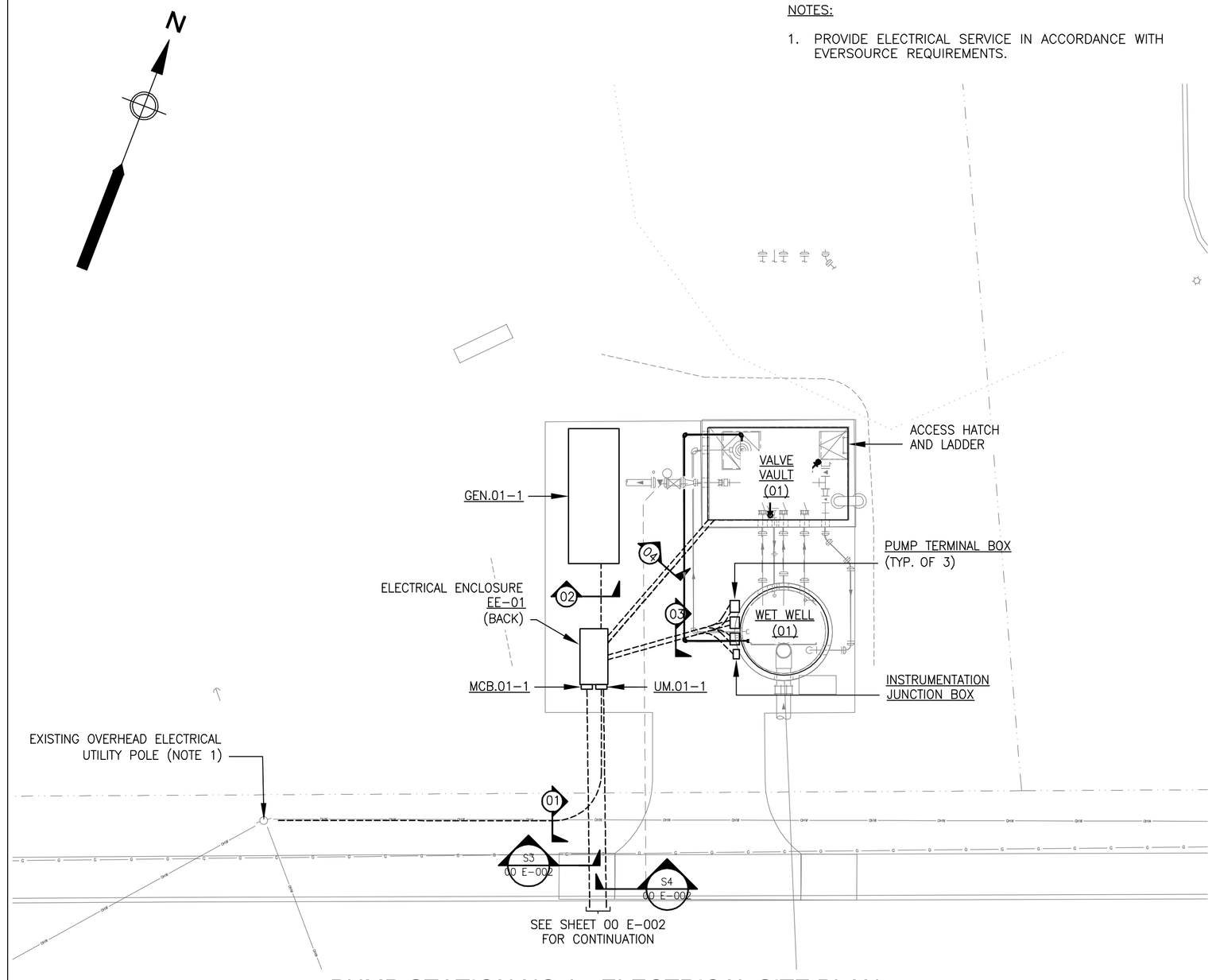
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00 E-601

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NOTES:

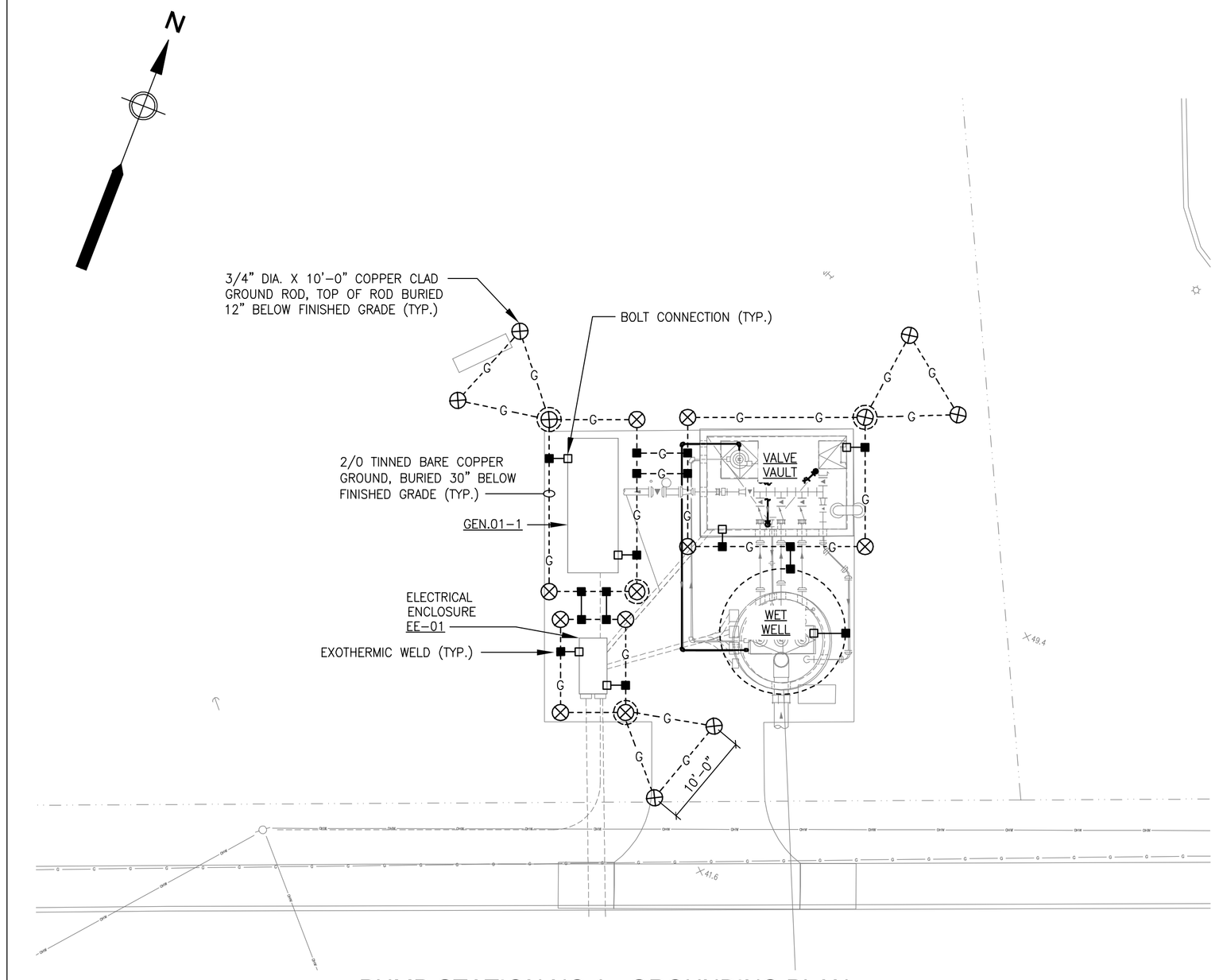
1. PROVIDE ELECTRICAL SERVICE IN ACCORDANCE WITH EVERSOURCE REQUIREMENTS.



PUMP STATION NO.1 - ELECTRICAL SITE PLAN

(SCALE: 1"= 10'-0")

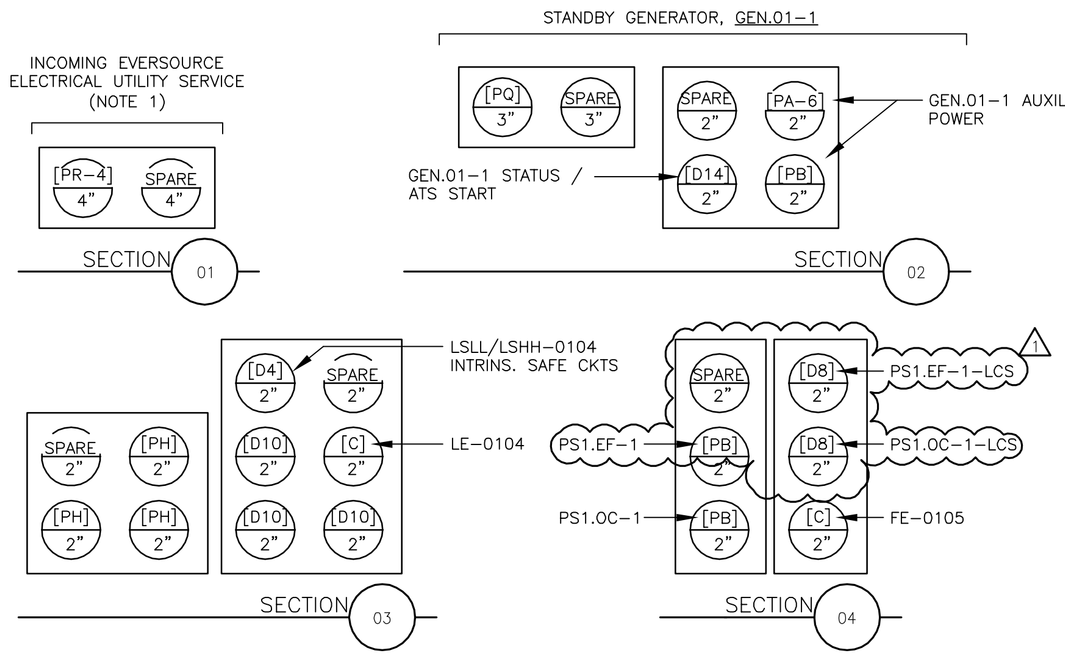
0 10 20 30
1" = 10' SCALE FEET



PUMP STATION NO.1 - GROUNDING PLAN

(SCALE: 1"= 10'-0")

0 10 20 30
1" = 10' SCALE FEET



PUMP STATION NO.1 - DUCT BANK SECTIONS

(SCALE:NTS)

AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

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REGISTRATION

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Designed By:	A. ABRAHAM
Drawn By:	A. ABRAHAM
Dept Check:	Y, RIZK
Proj Check:	T. PARECE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

ELECTRICAL

SHEET TITLE

PUMP STATION NO.1 - ELECTRICAL SITE PLAN

SHEET NUMBER

01 E-001

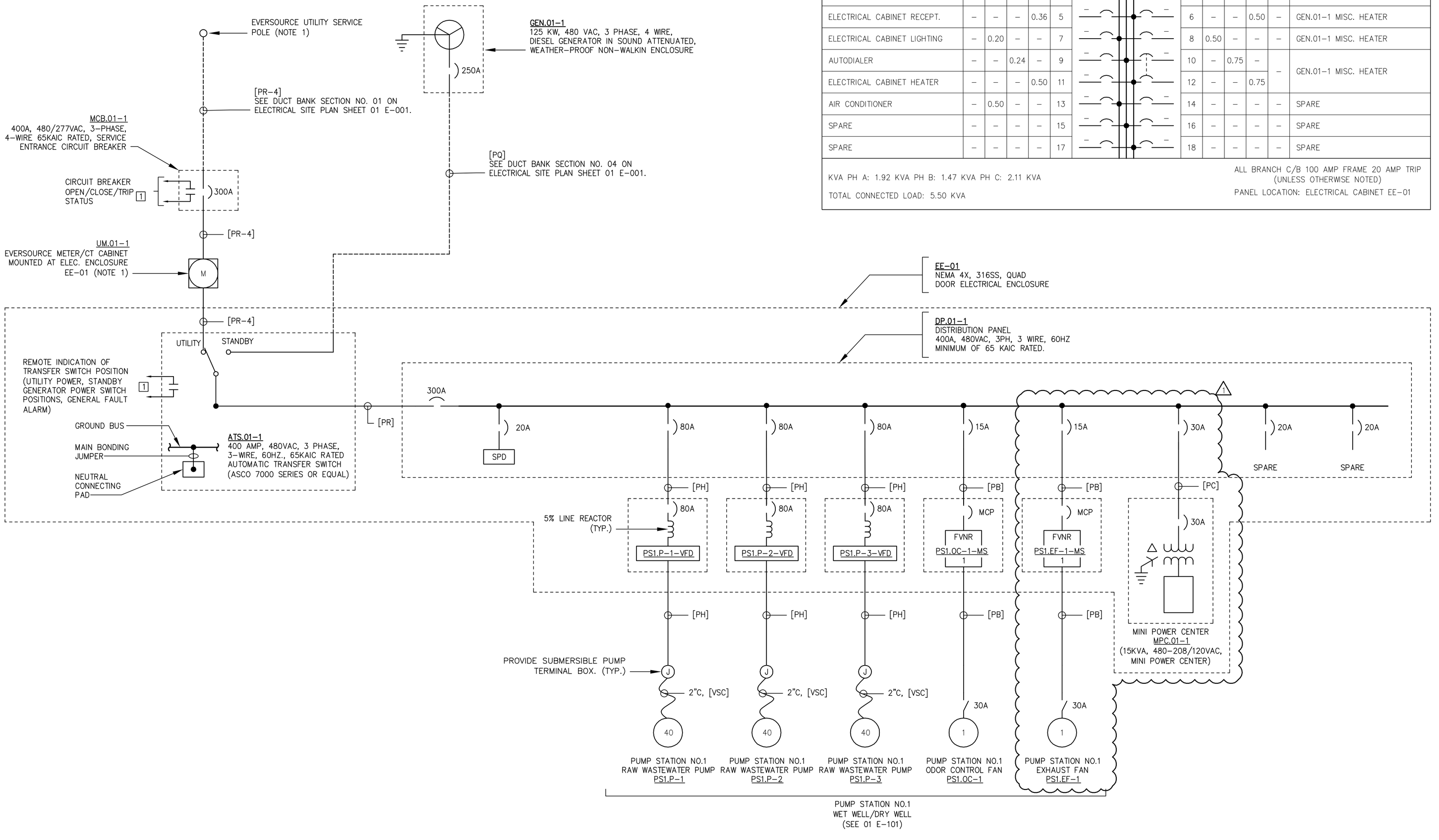
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LEGEND:

[1] PUMP STATION NO.1 PLC

NOTES

1. PROVIDE ELECTRICAL UTILITY SERVICE IN ACCORDANCE WITH EVERSOURCE REQUIREMENTS.



PANELBOARD "MPC.01-1"

PRIMARY: 480VAC, 3PH, 60HZ
TRANSFORMER: 15KVA
SECONDARY: 208/120V, 3PH, 4W, 60HZ

MAIN CIRCUIT BREAKER: 30A TRIP
SHORT CIRCUIT BRACING: 10,000 AMPS
CABINET: NEMA 1

GROUND BUS

LOCATION	HP	KVA A	KVA B	KVA C	CIR. NO.	NEUTRAL A B C	CIR. NO.	KVA A	KVA B	KVA C	HP	LOCATION
WW.PS-1-PLC	–	0.60	–	–	1		2	0.12	–	–	–	ELECTRICAL CABINET FLOOD LIGHT
FLOW METER FIT-0105	–	–	0.12	–	3		4	–	0.36	–	–	GEN.01-1 BATTERY CHARGER
ELECTRICAL CABINET RECEPT.	–	–	–	0.36	5		6	–	–	0.50	–	GEN.01-1 MISC. HEATER
ELECTRICAL CABINET LIGHTING	–	0.20	–	–	7		8	0.50	–	–	–	GEN.01-1 MISC. HEATER
AUTODIALER	–	–	0.24	–	9		10	–	0.75	–	–	GEN.01-1 MISC. HEATER
ELECTRICAL CABINET HEATER	–	–	–	0.50	11		12	–	–	0.75		
AIR CONDITIONER	–	0.50	–	–	13		14	–	–	–	–	SPARE
SPARE	–	–	–	–	15		16	–	–	–	–	SPARE
SPARE	–	–	–	–	17		18	–	–	–	–	SPARE

KVA PH A: 1.92 KVA PH B: 1.47 KVA PH C: 2.11 KVA

TOTAL CONNECTED LOAD: 5.50 KVA

ALL BRANCH C/B 100 AMP FRAME 20 AMP TRIP (UNLESS OTHERWISE NOTED)

PANEL LOCATION: ELECTRICAL CABINET EE-01

PUMP STATION NO.1 – SINGLE LINE DIAGRAM

AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

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DISCIPLINE

ELECTRICAL

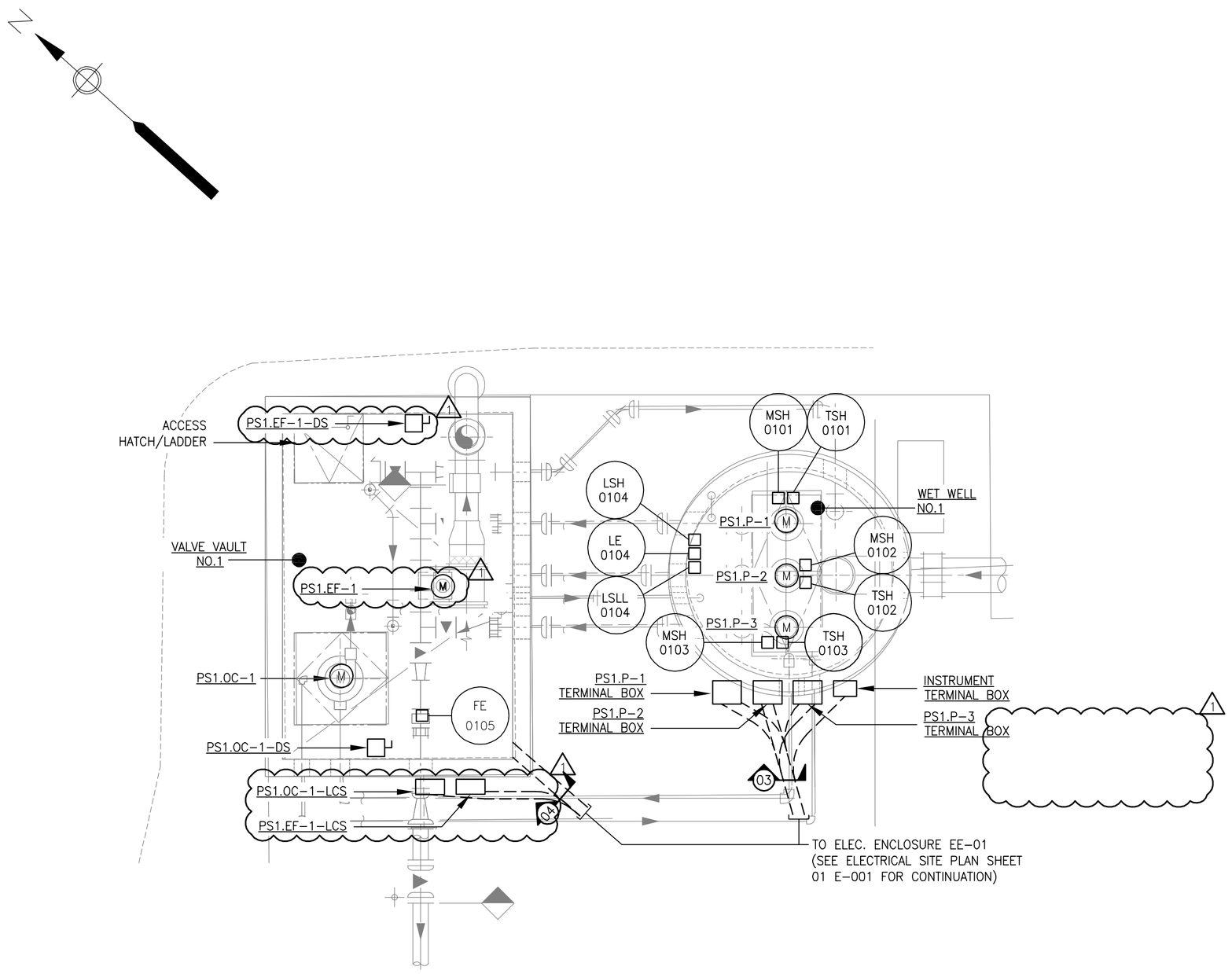
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PUMP STATION NO.1 - ELECTRICAL SINGLE LINE DIAGRAM

SHEET NUMBER

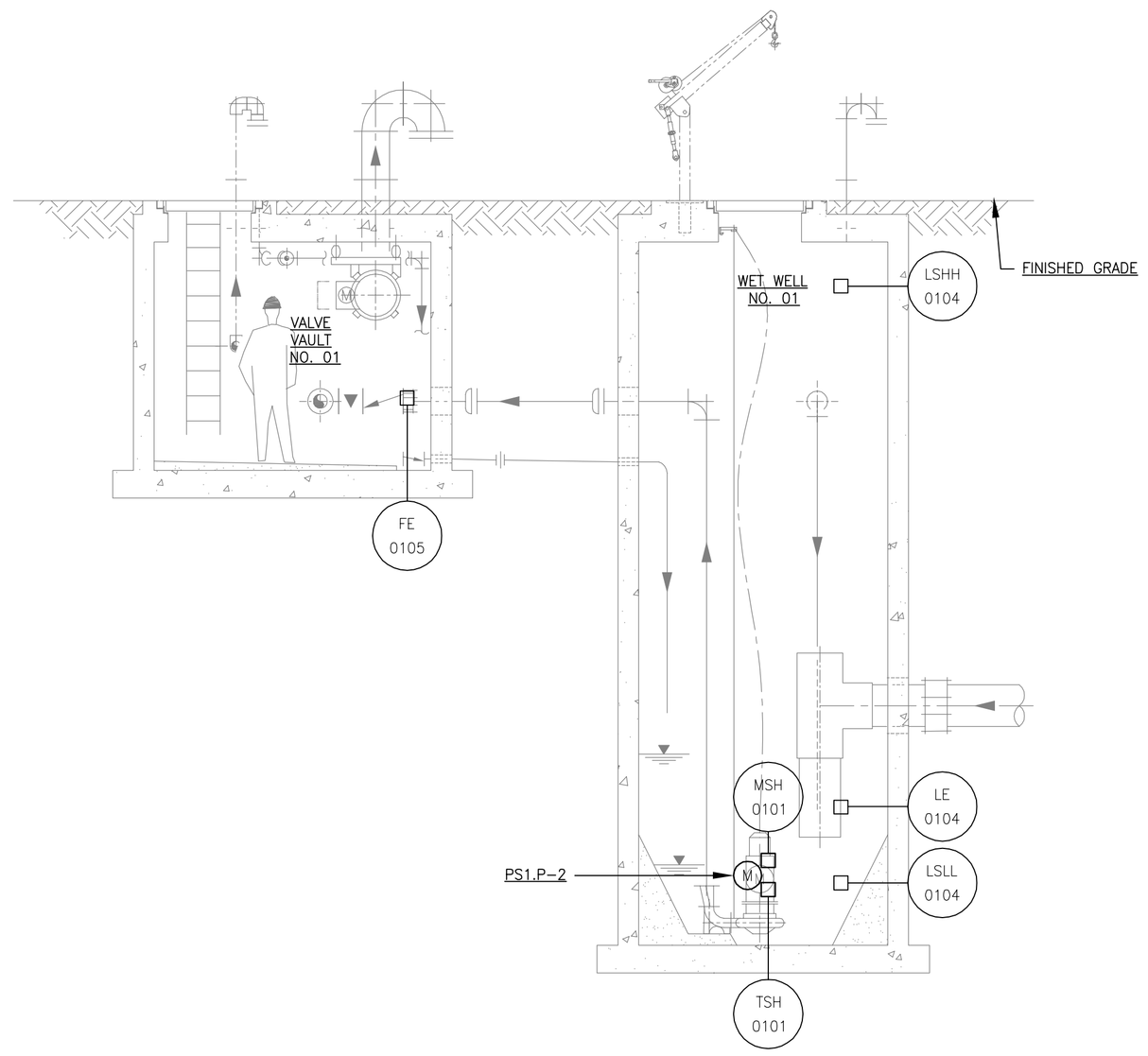
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PUMP STATION NO.1 - PLAN VIEW

(SCALE: 1/4" = 1'-0")



PUMP STATION NO.1 - SECTION VIEW

(SCALE: 1/4" = 1'-0")

1/4"=1'-0" SCALE 0 4 8 12 FEET

AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

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Proj Check:	T. PARECE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

ELECTRICAL

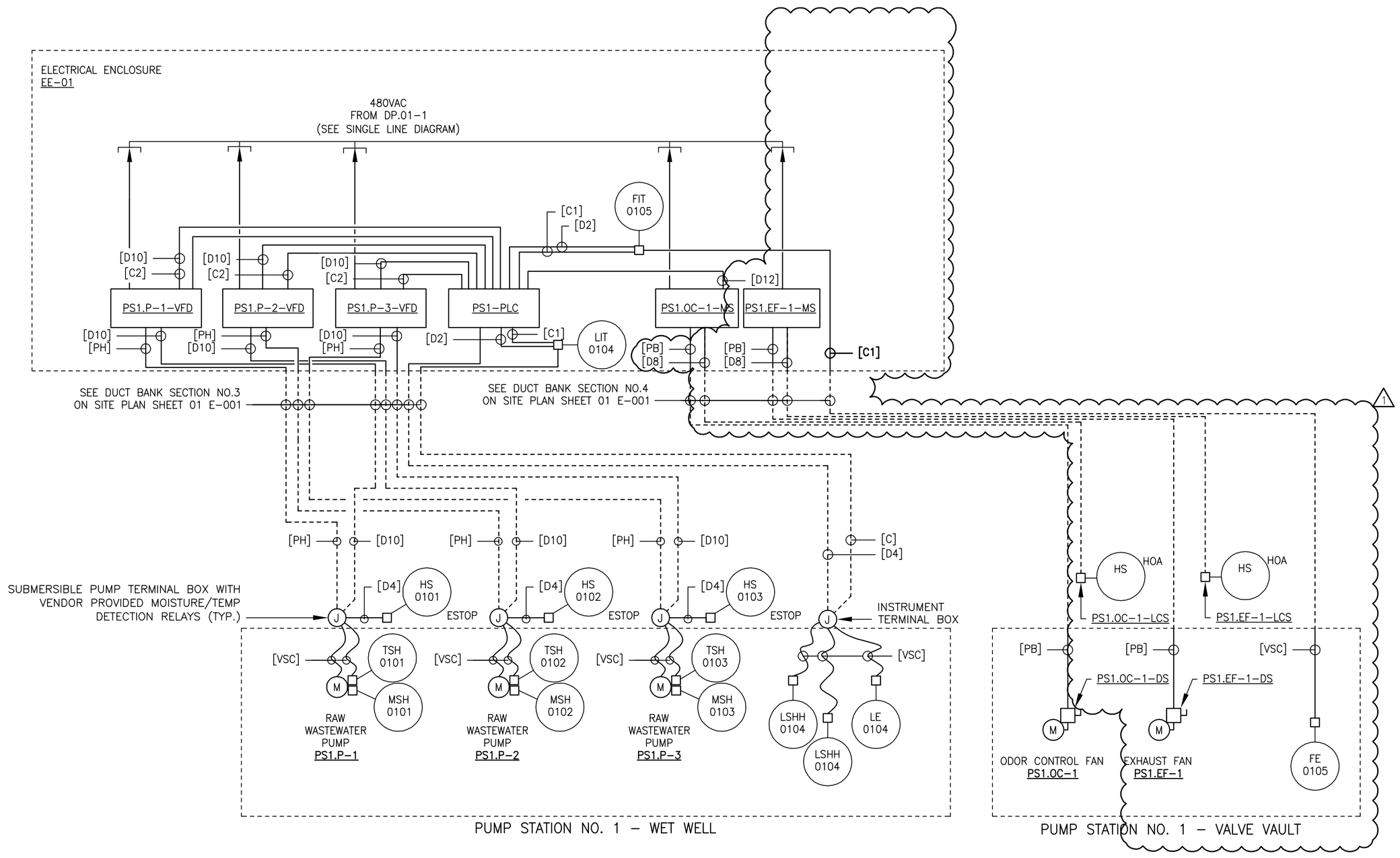
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PUMP STATION NO.1 - ELECTRICAL POWER PLAN

SHEET NUMBER

01 E-101

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PUMP STATION NO.1 – WET WELL AND VALVE VAULT – RISER DIAGRAMS

SCALE: NTS

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AECOM

PROJECT

DOWNTOWN AREA
COLLECTION SYSTEM
AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

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Proj Check:	T. PARECE
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Scale:	AS NOTED

DISCIPLINE

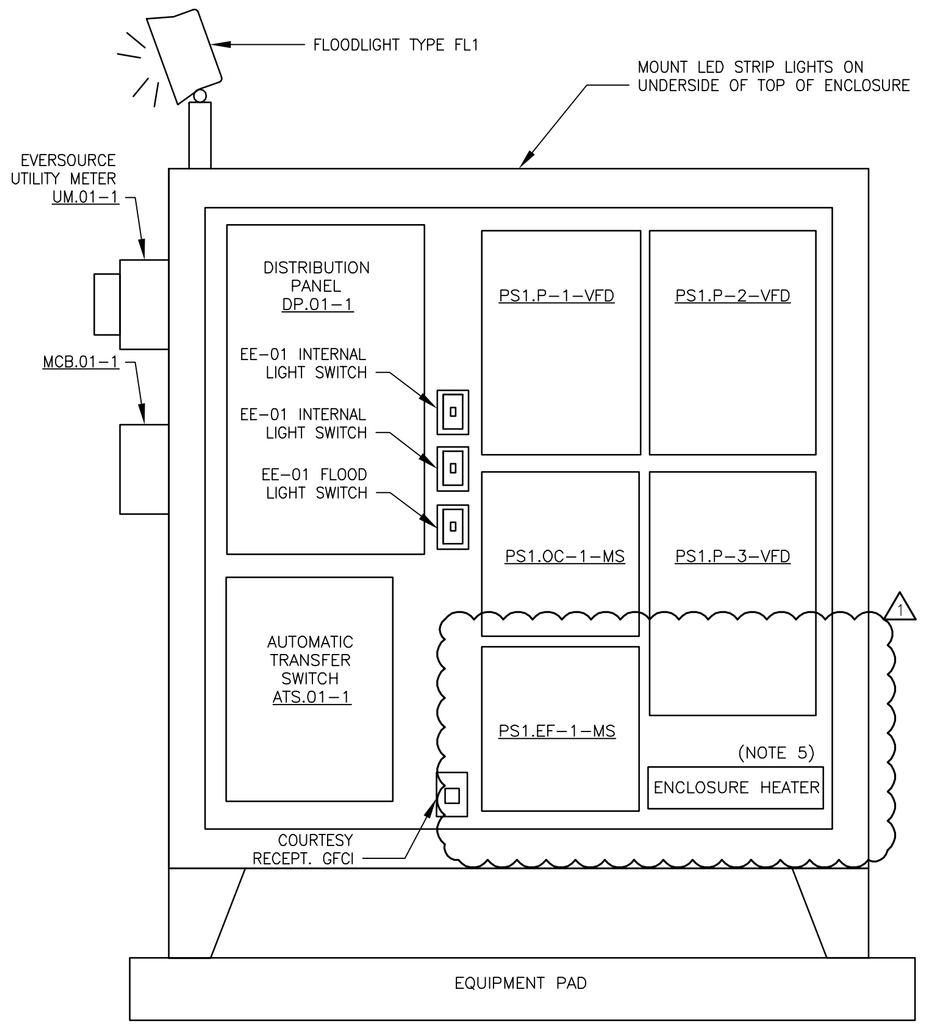
ELECTRICAL

SHEET TITLE

PUMP STATION NO.1 - ELECTRICAL RISER DIAGRAMS

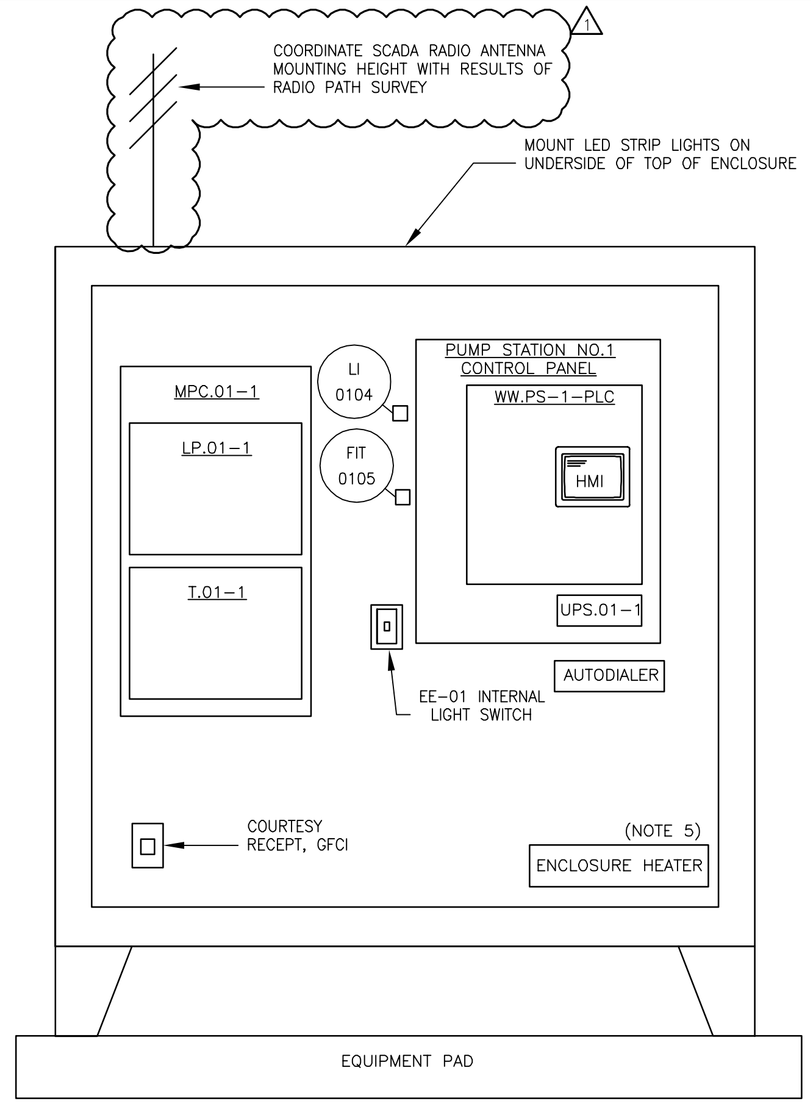
SHEET NUMBER

01 E-601



EE-01 – ENCLOSURE LAYOUT – FRONT

SCALE: NTS



EE-01 – ENCLOSURE LAYOUT – BACK

SCALE: NTS

NOTES:

1. PROVIDE ENCLOSURE CONSTRUCTED OF 316 STAINLESS STEEL.
2. COMPONENT LAYOUT IS FOR FUNCTIONAL PURPOSES ONLY. LAYOUT AND ENCLOSURE SIZE SHALL BE FINALIZED BY ELECTRICAL CONTRACTOR BASED ON SPECIFIC EQUIPMENT MANUFACTURERS AND MODELS SELECTED.
3. SYSTEM INTEGRATOR TO PURCHASE RADIO EQUIPMENT, PLC AND INSTRUMENTS. ELECTRICAL CONTRACTOR SHALL INSTALL EQUIPMENT IN ACCORDANCE WITH MANUFACTURER REQUIREMENTS.
4. PANEL LAYOUT SHOWN WITH DOORS REMOVED.
5. PROVIDE HEATER SIZED TO MAINTAIN MINIMUM TEMPERATURE AS REQUIRED BY ALL COMPONENTS INSIDE ELECTRICAL ENCLOSURE. PROVIDE HEATER CONTROLLED BY AN ADJUSTABLE THERMOSTAT.
6. PROVIDE CONNECTION FOR GENERATOR IN ACCORDANCE WITH THE CITY OF MIDDLETOWN STANDARDS. COORDINATE WITH THE WATER DEPARTMENT ELECTRICIAN.
7. PROVIDE CLOSED LOOP AIR CONDITIONING AS NEEDED TO MAINTAIN TEMPERATURE WITHIN EQUIPMENT RATINGS. AIR CONDITIONER SHALL BE NEMA 4X STAINLESS STEEL WITH CORROSION PACKAGE.

EE-01 – ENCLOSURE LAYOUTS

SCALE: NTS

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AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

OWNER

TOWN OF ORLEANS, MA
19 SCHOOL ROAD
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Drawn By:	A. ABRAHAM
Dept Check:	Y, RIZK
Proj Check:	T. PARECE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

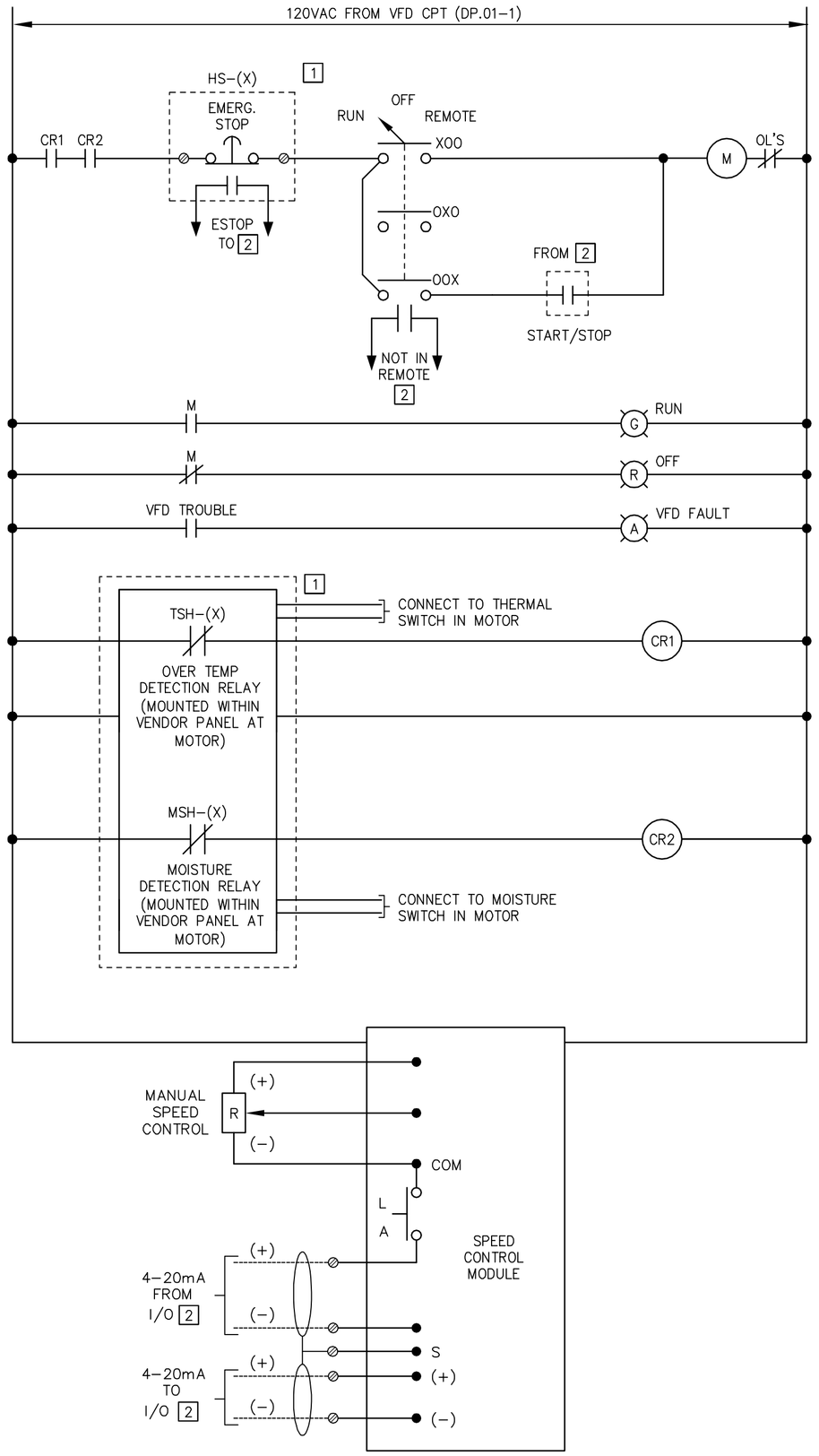
ELECTRICAL

SHEET TITLE

PUMP STATION NO.1 - EE-01 ELEVATION

SHEET NUMBER

01 E-602



PUMP STATION NO.1
RAW WASTEWATER PUMP VFD
WIRING DIAGRAM
PS1.P-1-VFD

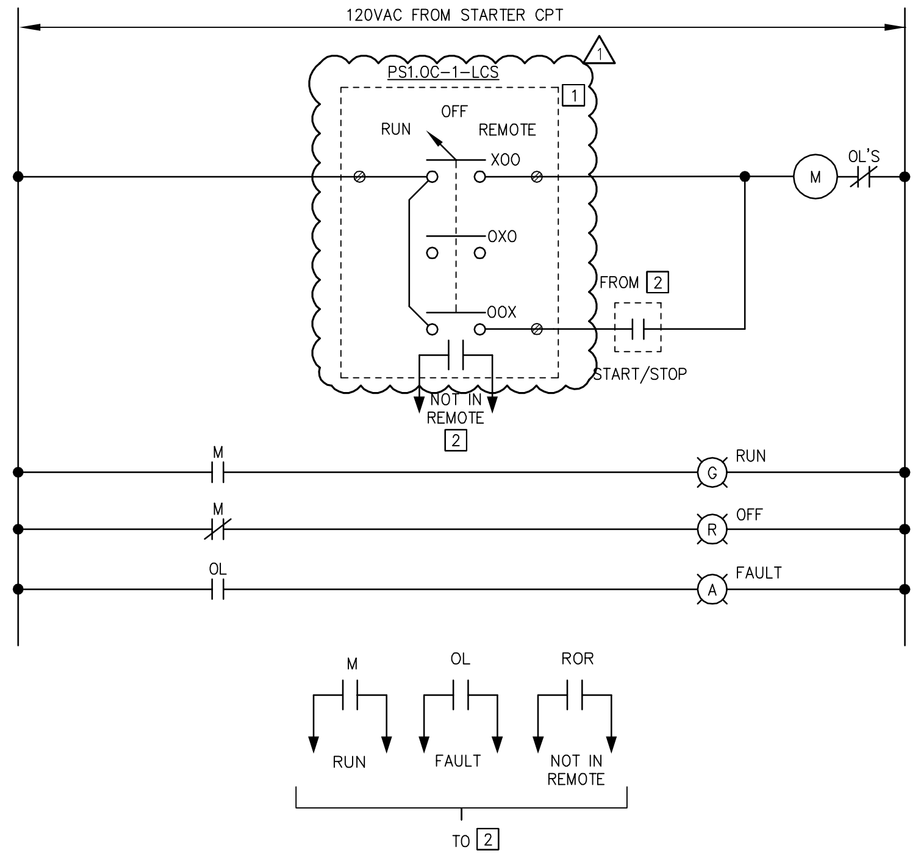
(ALL COMPONENTS LOCATED AT VFD UNLESS OTHERWISE NOTED)
(TYPICAL OF PS1.P-2, PS1.P-3)

EQUIP. TAG (X)	HS-(X)	TSH-(X)	MSH-(X)
PS1.P-1-VFD	0101	0101	0101
PS1.P-2-VFD	0102	0102	0102
PS1.P-3-VFD	0103	0103	0103

LEGEND

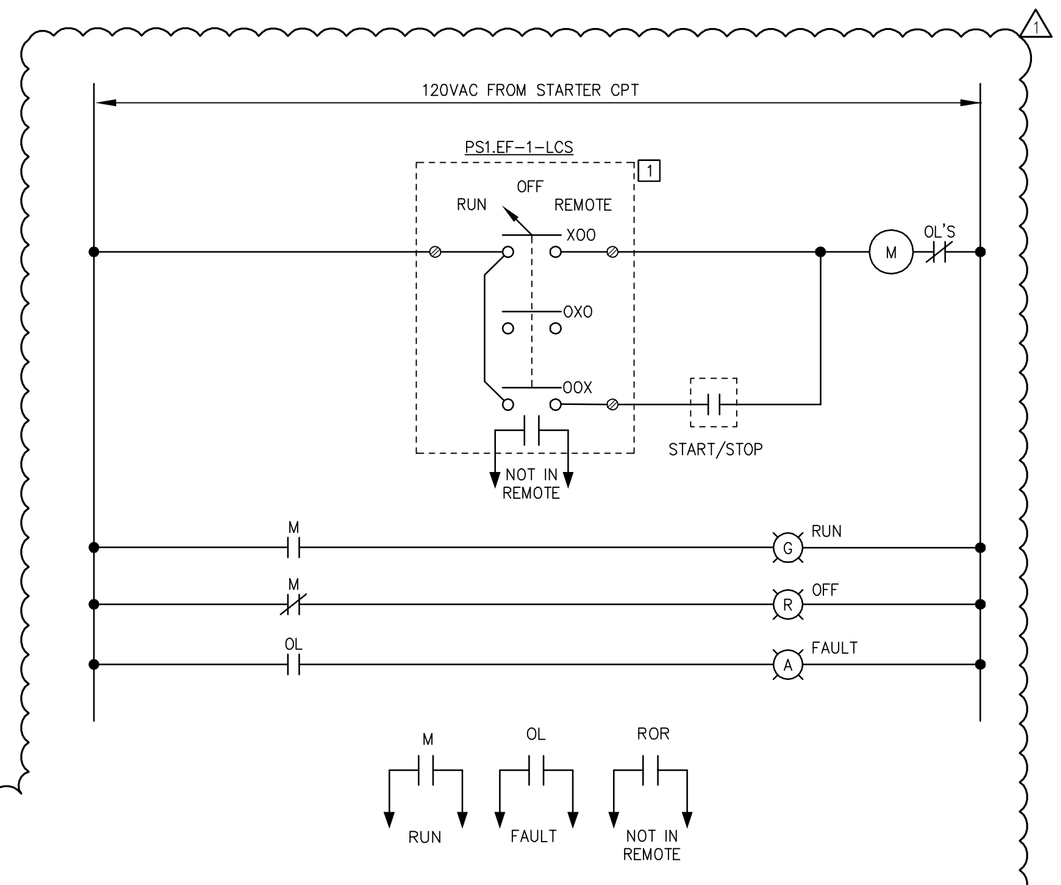
1 DEVICE LOCATED AT EQUIPMENT

2 FROM/TO WW.PS-1-PLC



ODOR CONTROL FAN PS1.OC-1
MOTOR STARTER WIRING DIAGRAM

(ALL COMPONENTS LOCATED AT STARTER UNLESS OTHERWISE NOTED)



EXHAUST FAN PS1.EF-1
MOTOR STARTER WIRING DIAGRAM

(ALL COMPONENTS LOCATED AT STARTER UNLESS OTHERWISE NOTED)

AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

OWNER

TOWN OF ORLEANS, MA
19 SCHOOL ROAD
ORLEANS, MA 02653
(508) 240-3700

ENGINEER

AECOM TECHNICAL SERVICES, INC.
9 JONATHAN BOURNE DRIVE
POCASSET, MA 02559
PHONE: (508) 833-6950
www.aecom.com

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	04-08-2020	ADDENDUM 10

PROJECT NUMBER

60587515

Designed By:	A. ABRAHAM
Drawn By:	A. ABRAHAM
Dept Check:	Y., RIZK
Proj Check:	T. PARECE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

ELECTRICAL

SHEET TITLE

PUMP STATION NO.1 - WIRING SCHEMATICS

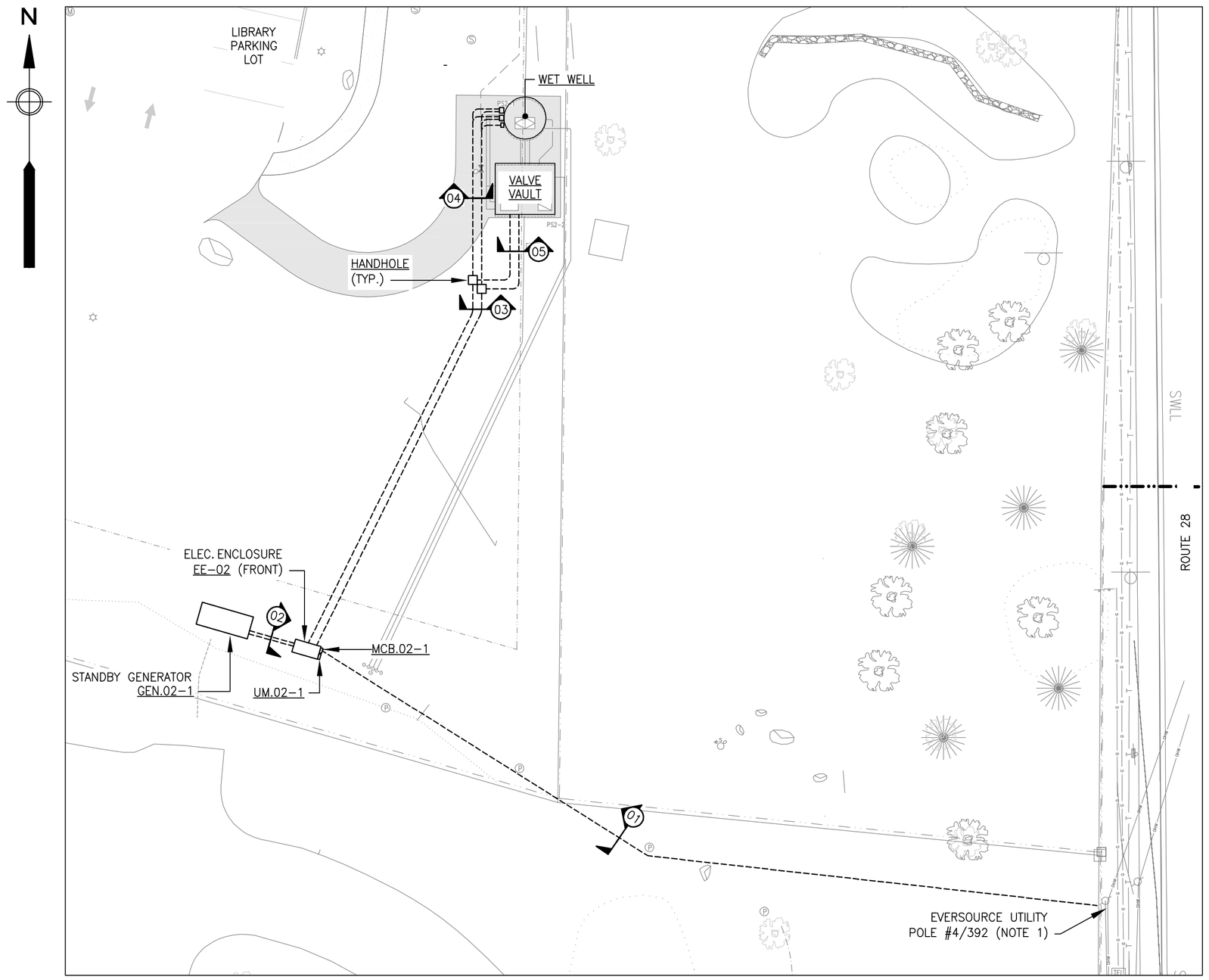
SHEET NUMBER

01 E-603

Last saved by: ABRAHAMA(2020-04-06) Last Plotted: 2020-04-09
Filename: \\USCHLLFP001\DATA\PROJECTS\WAKEFIELD\DATA_3\PROJ\60476644 - ORLEANS DOWNTOWN PUMP STATION\SHEETS\IE\01 E-603.DWG

NOTES:

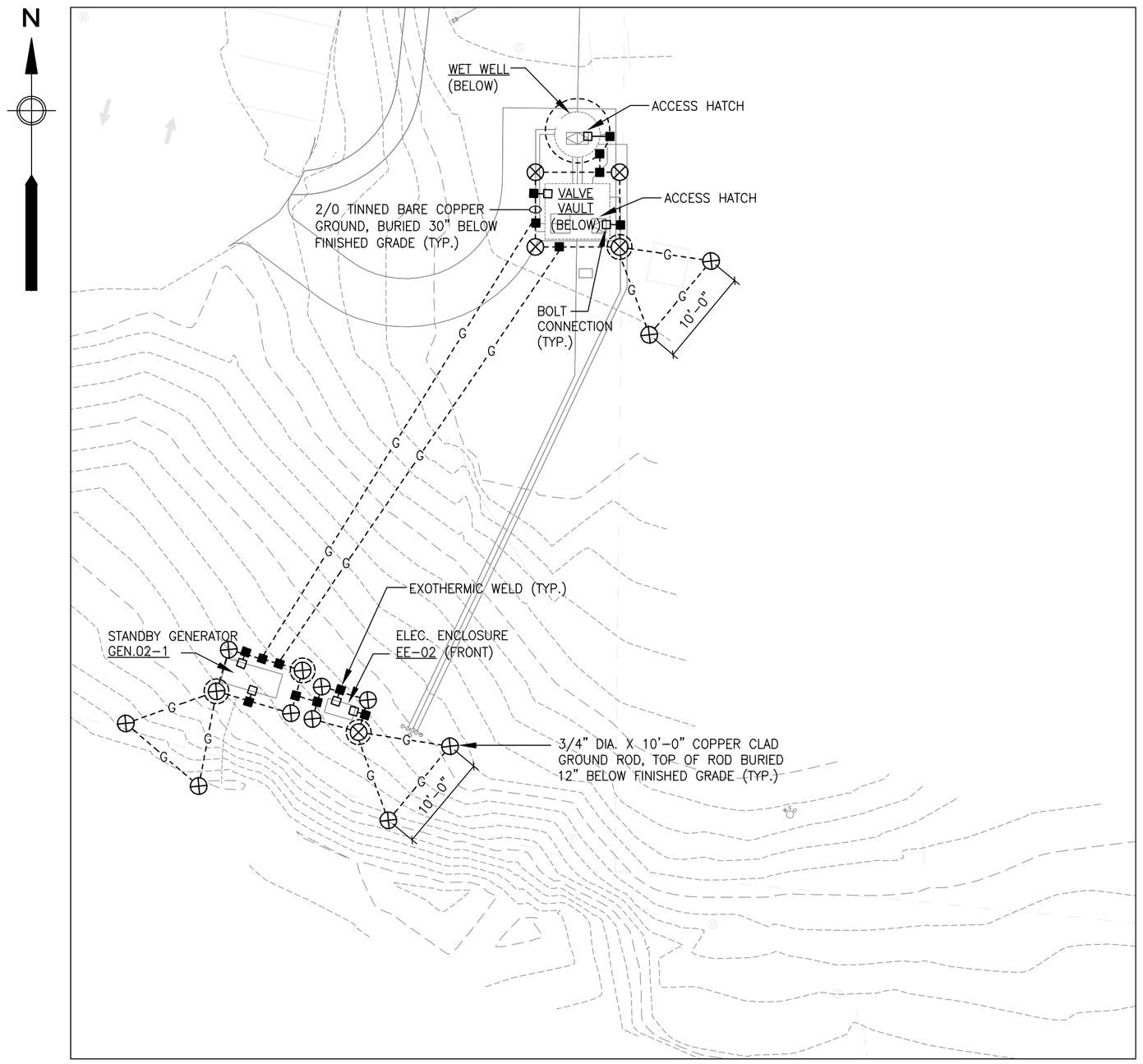
1. PROVIDE ELECTRICAL UTILITY SERVICE IN ACCORDANCE WITH EVERSOURCE REQUIREMENTS.



PUMP STATION NO.2 - ELECTRICAL SITE PLAN

(SCALE: 1"= 20'-0")

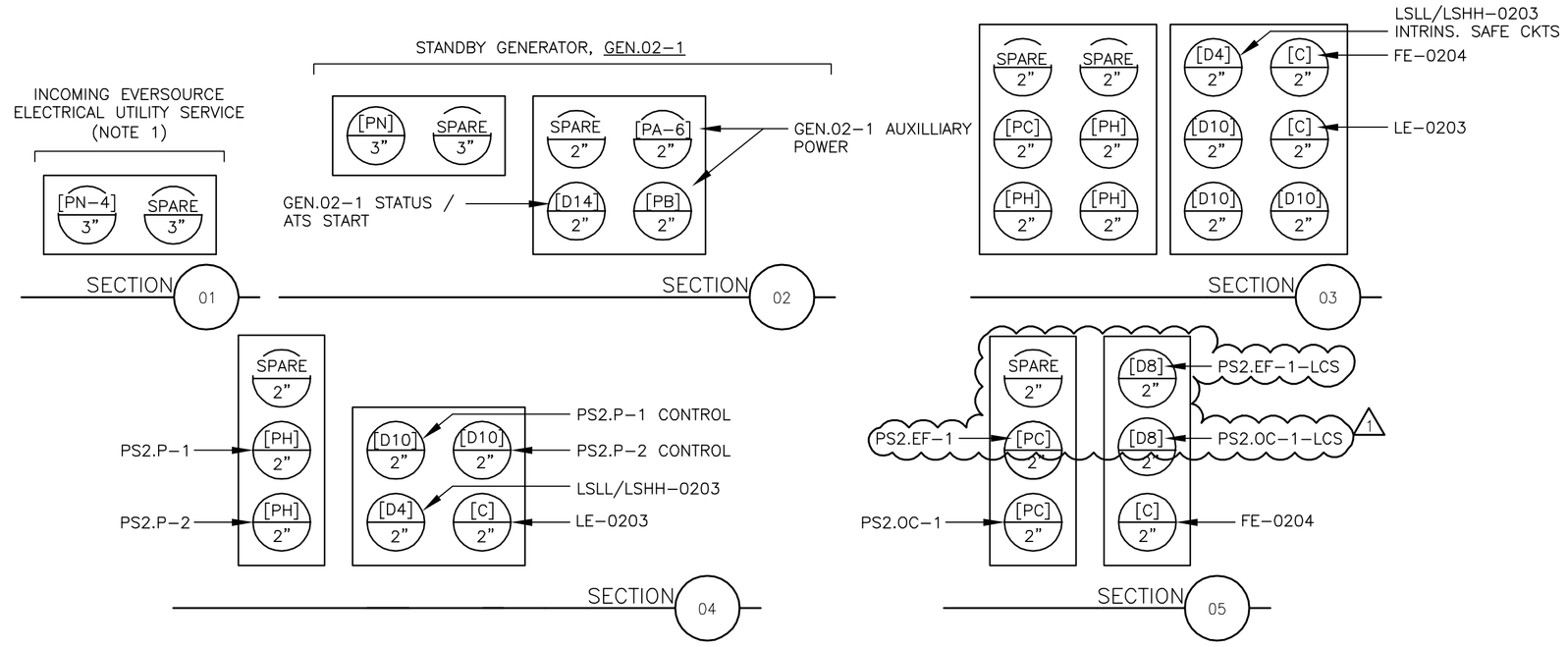
1" = 20' SCALE 0 20 40 60 FEET



PUMP STATION NO.2 - ELECTRICALGROUNDING PLAN

(SCALE: 1"= 20'-0")

1" = 20' SCALE 0 20 40 60 FEET



PUMP STATION NO.2 - DUCT BANK SECTIONS

(SCALE:NTS)

AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

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SRF No. 4486

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Drawn By:	A. ABRAHAM
Dept Check:	Y. RIZK
Proj Check:	T. PARECE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

ELECTRICAL

SHEET TITLE

PUMP STATION NO.2 - ELECTRICAL SITE PLAN

SHEET NUMBER

02 E-001

Last saved by: ABRAHAMA(2020-04-08) Last Plotted: 2020-04-09
Filename: \\USCHL1FP001\DATA\PROJECTS\WAKEFIELD\DATA_3\PROJ\60476644 - ORLEANS DOWNTOWN PUMP STATIONS\SHEETS\E\02 E-001.DWG

LEGEND:

[1] PUMP STATION NO.2 PLC

NOTES

1. PROVIDE ELECTRICAL UTILITY SERVICE AND METERING EQUIPMENT IN ACCORDANCE WITH EVERSOURCE REQUIREMENTS.

PRIMARY: 480VAC, 3PH, 60HZ
TRANSFORMER: 15KVA
SECONDARY: 208/120V, 3PH, 4W, 60HZ

PANELBOARD "MPC.02-1"

MAIN CIRCUIT BREAKER: 30A TRIP
SHORT CIRCUIT BRACING: 10,000 AMPS
CABINET: NEMA 1

GROUND BUS

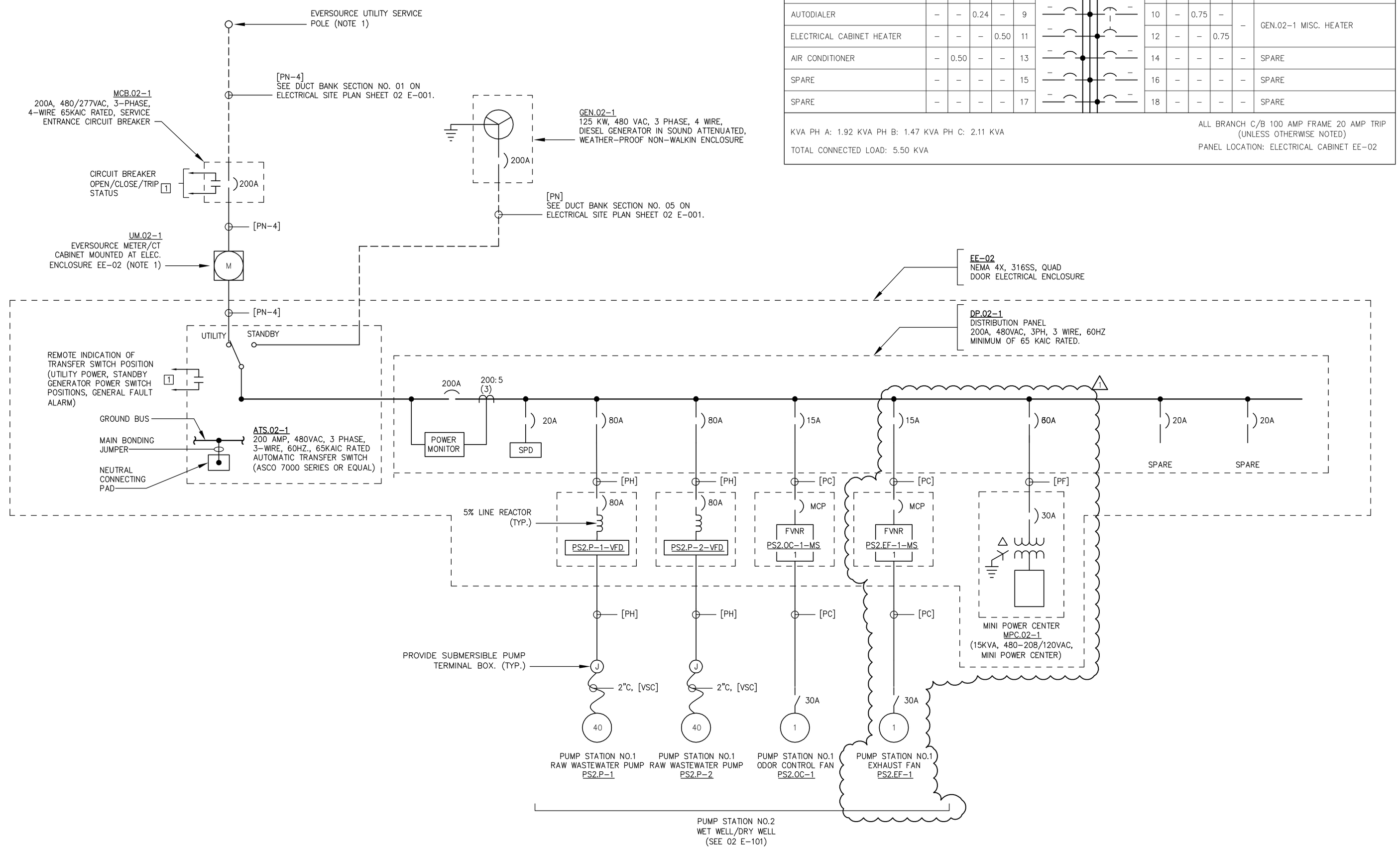
LOCATION	HP	KVA A	KVA B	KVA C	CIR. NO.	NEUTRAL A B C	CIR. NO.	KVA A	KVA B	KVA C	HP	LOCATION
WW.PS-2-PLC	–	0.60	–	–	1		2	0.12	–	–	–	ELECTRICAL CABINET FLOOD LIGHT
FLOW METER FIT-0204	–	–	0.12	–	3		4	–	0.36	–	–	GEN.02-1 BATTERY CHARGER
ELECTRICAL CABINET RECEPT.	–	–	–	0.36	5		6	–	–	0.50	–	GEN.02-1 MISC. HEATER
ELECTRICAL CABINET LIGHTING	–	0.20	–	–	7		8	0.50	–	–	–	GEN.02-1 MISC. HEATER
AUTODIALER	–	–	0.24	–	9		10	–	0.75	–	–	GEN.02-1 MISC. HEATER
ELECTRICAL CABINET HEATER	–	–	–	0.50	11		12	–	–	0.75		
AIR CONDITIONER	–	0.50	–	–	13		14	–	–	–	–	SPARE
SPARE	–	–	–	–	15		16	–	–	–	–	SPARE
SPARE	–	–	–	–	17		18	–	–	–	–	SPARE

KVA PH A: 1.92 KVA PH B: 1.47 KVA PH C: 2.11 KVA

TOTAL CONNECTED LOAD: 5.50 KVA

ALL BRANCH C/B 100 AMP FRAME 20 AMP TRIP (UNLESS OTHERWISE NOTED)

PANEL LOCATION: ELECTRICAL CABINET EE-02



PUMP STATION NO.2 – SINGLE LINE DIAGRAM

AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

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Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

ELECTRICAL

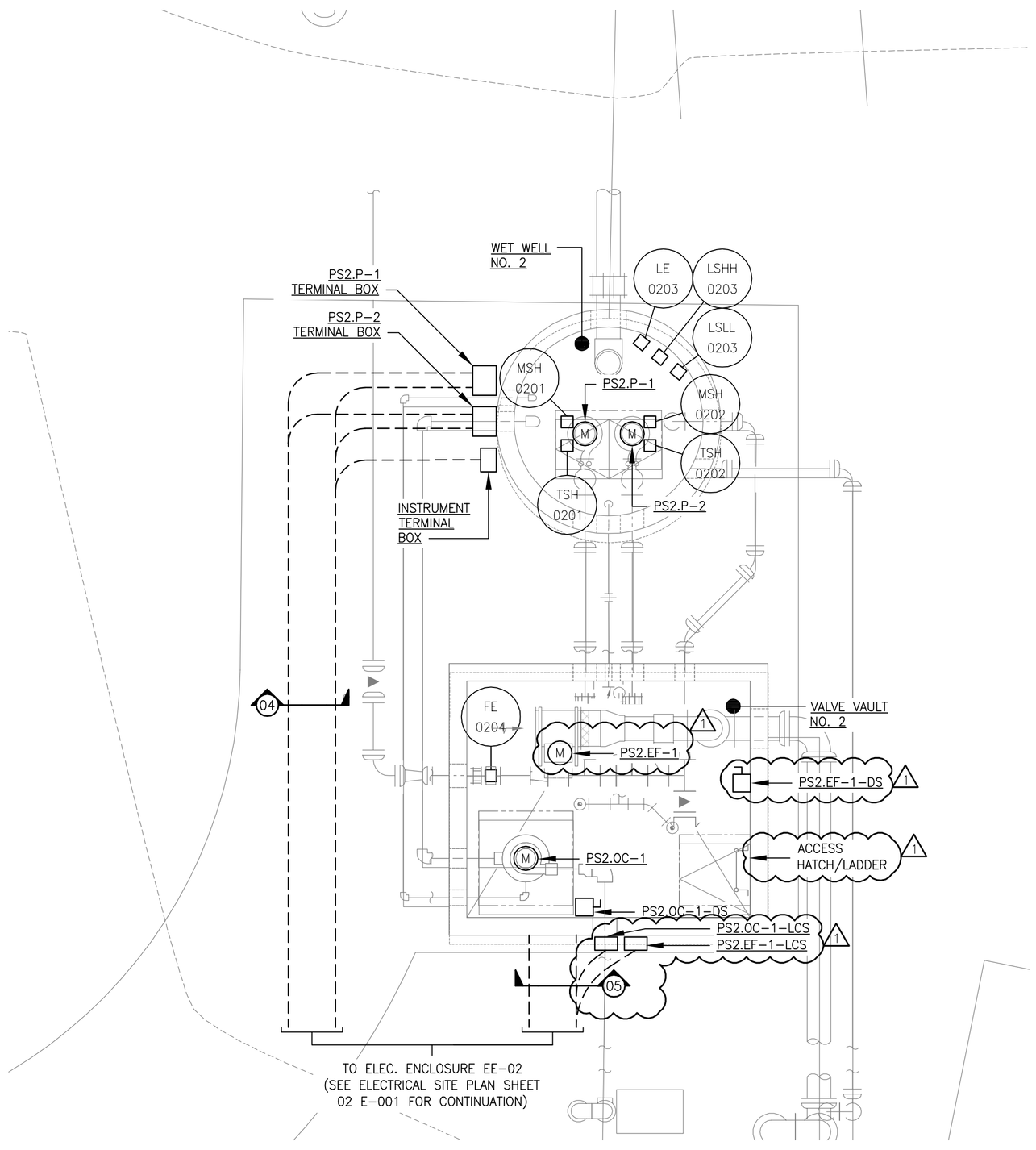
SHEET TITLE

PUMP STATION NO.2 - ELECTRICAL SINGLE LINE DIAGRAM

SHEET NUMBER

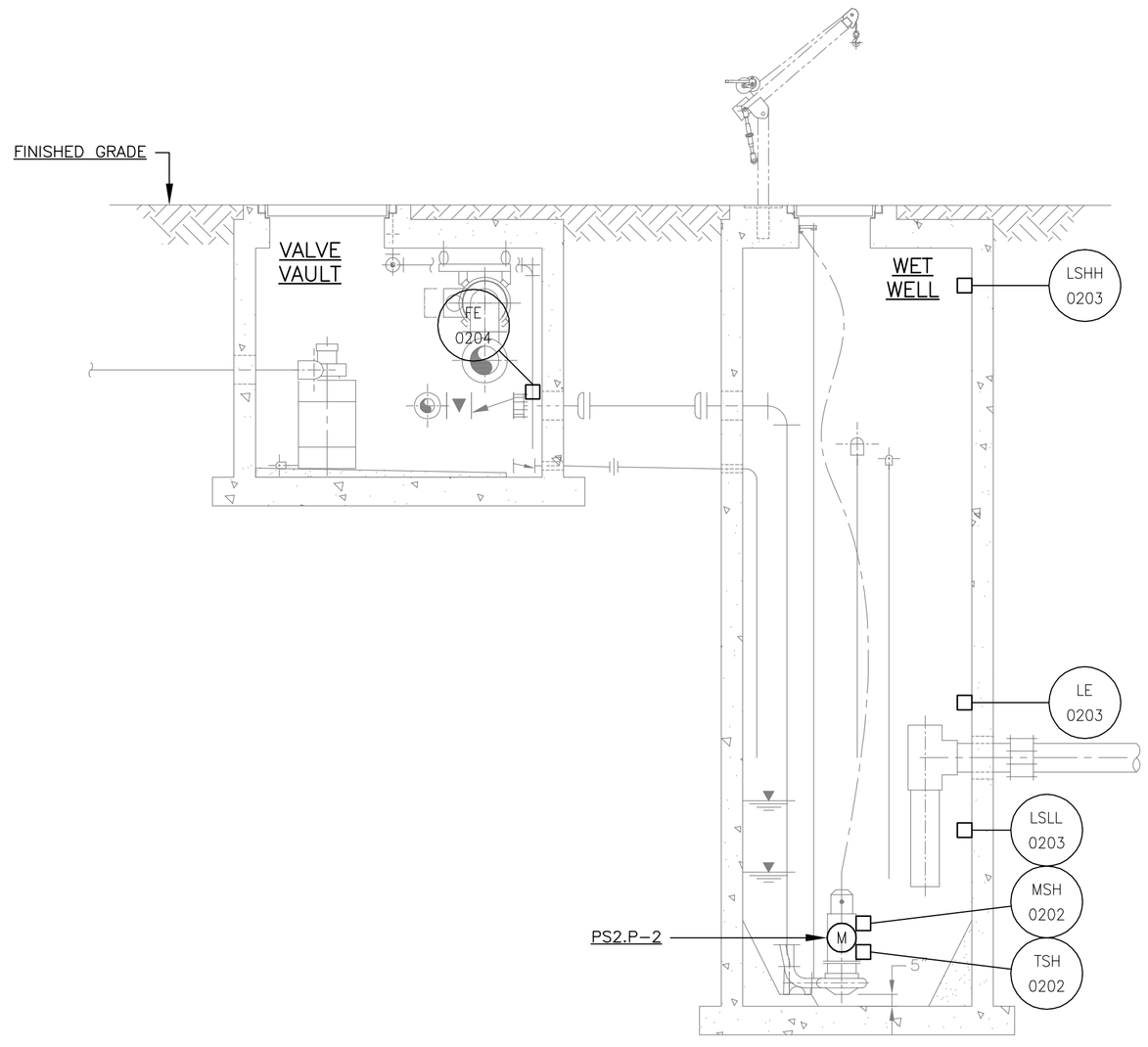
02 E-002

Last saved by: ABRAHAMA(2020-04-09) Last Plotted: 2020-04-09
Filename: \\USCHLLTFP001\DATA\PROJECTS\WAKEFIELD\DATA_3\PROJ\60476644 - ORLEANS DOWNTOWN PUMP STATIONS\SHEETS\E02 E-002.DWG



PUMP STATION NO.2 - PLAN VIEW

(SCALE: 1/4" = 1'-0")



PUMP STATION NO.2 - SECTION VIEW

(SCALE: 1/4" = 1'-0")

1/4"=1'-0" SCALE 0 4 8 12 FEET

Last saved by: ABRAHAMA(2020-04-08) Last Plotted: 2020-04-09
Filename: \\USCHL1FP001\DATA\PROJECTS\WAKEFIELD\DATA_3\PROJ\60476644 - ORLEANS DOWNTOWN PUMP STATIONS\SHEETS\E02 E-101.DWG

AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

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Drawn By:	A. ABRAHAM
Dept Check:	Y. RIZK
Proj Check:	T. PARECE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

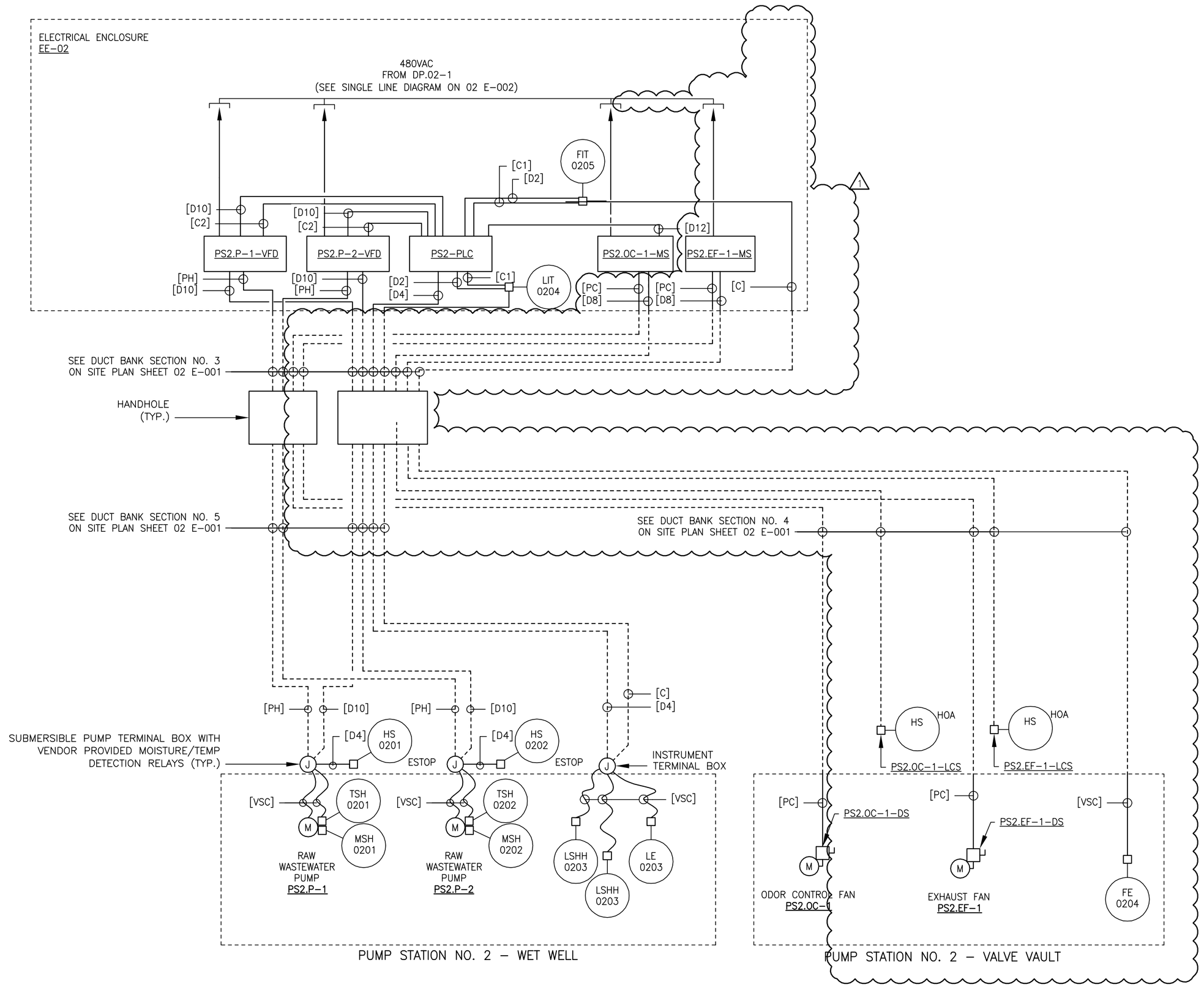
ELECTRICAL

SHEET TITLE

PUMP STATION NO.2 - ELECTRICAL POWER PLAN

SHEET NUMBER

02 E-101



PUMP STATION NO.1 – WET WELL AND VALVE VAULT – RISER DIAGRAMS

SCALE: NTS

Last saved by: ABRAHAMA(2020-04-08) Last Plotted: 2020-04-09
Filename: \\USCHLLFP001\DATA\PROJECTS\WAKEFIELD\DATA_3\PROJ\60476644 - ORLEANS DOWNTOWN PUMP STATIONS\SHEETS\E\02 E-601.DWG

AECOM

PROJECT

DOWNTOWN AREA
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AND PUMP STATIONS

CONTRACT No. 2019-02
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Proj Check:	T. PARECE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

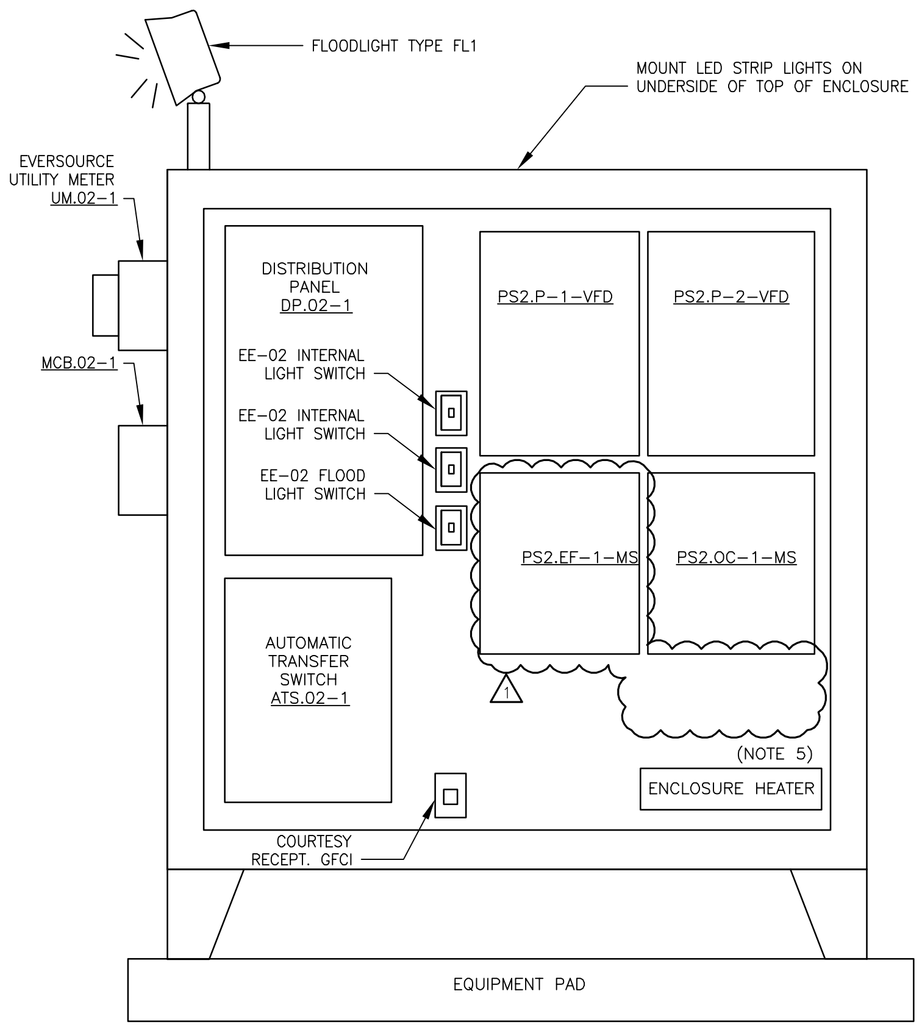
ELECTRICAL

SHEET TITLE

PUMP STATION NO.2 - ELECTRICAL RISER DIAGRAMS

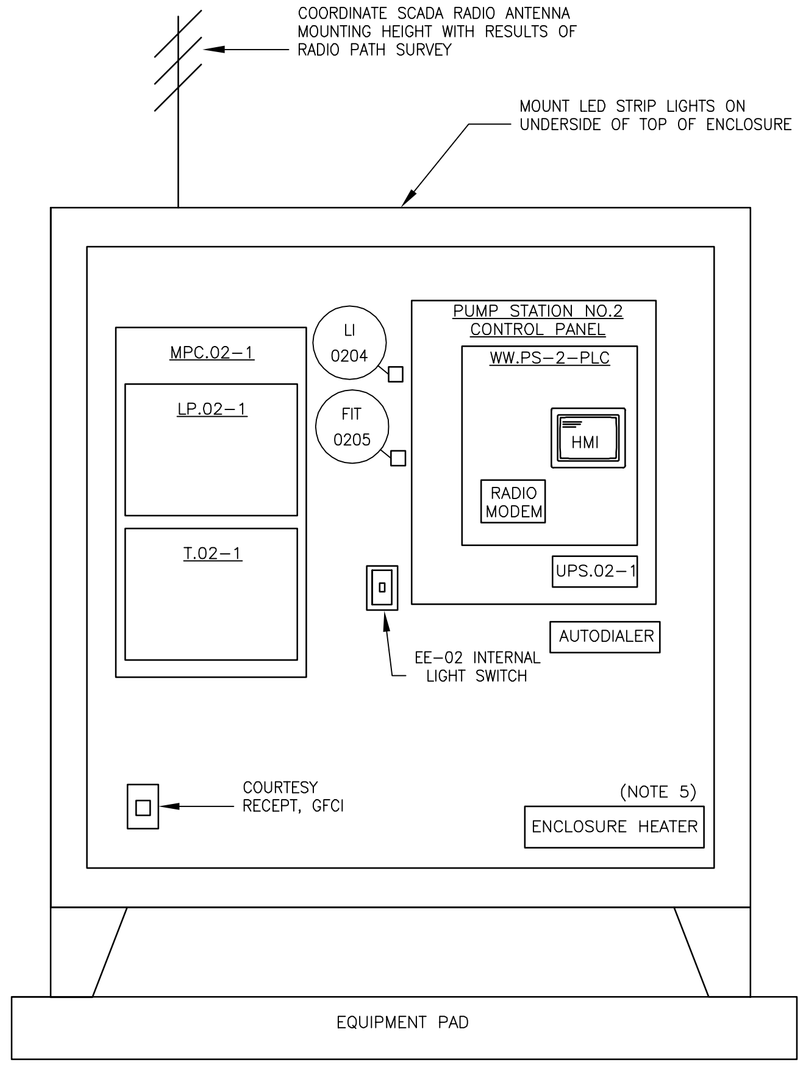
SHEET NUMBER

02 E-601



EE-02 – ENCLOSURE LAYOUT – FRONT

SCALE: NTS



EE-02 – ENCLOSURE LAYOUT – BACK

SCALE: NTS

NOTES:

1. PROVIDE ENCLOSURE CONSTRUCTED OF 316 STAINLESS STEEL.
2. COMPONENT LAYOUT IS FOR FUNCTIONAL PURPOSES ONLY. LAYOUT AND ENCLOSURE SIZE SHALL BE FINALIZED BY ELECTRICAL CONTRACTOR BASED ON SPECIFIC EQUIPMENT MANUFACTURERS AND MODELS SELECTED. 1
3. SYSTEM INTEGRATOR TO PURCHASE RADIO EQUIPMENT, PLC AND INSTRUMENTS. ELECTRICAL CONTRACTOR SHALL INSTALL EQUIPMENT IN ACCORDANCE WITH MANUFACTURER REQUIREMENTS.
4. PANEL LAYOUT SHOWN WITH DOORS REMOVED.
5. PROVIDE HEATER SIZED TO MAINTAIN MINIMUM TEMPERATURE AS REQUIRED BY ALL COMPONENTS INSIDE ELECTRICAL ENCLOSURE. PROVIDE HEATER CONTROLLED BY AN ADJUSTABLE THERMOSTAT.
6. PROVIDE CONNECTION FOR GENERATOR IN ACCORDANCE WITH THE CITY OF MIDDLETOWN STANDARDS. COORDINATE WITH THE WATER DEPARTMENT ELECTRICIAN.
7. PROVIDE CLOSED LOOP AIR CONDITIONING AS NEEDED TO MAINTAIN TEMPERATURE WITHIN EQUIPMENT RATINGS. AIR CONDITIONER SHALL BE NEMA 4X STAINLESS STEEL WITH CORROSION PACKAGE.

EE-02 – ENCLOSURE LAYOUTS

SCALE: NTS

AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

OWNER

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ENGINEER

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Proj Check:	T. PARECE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

ELECTRICAL

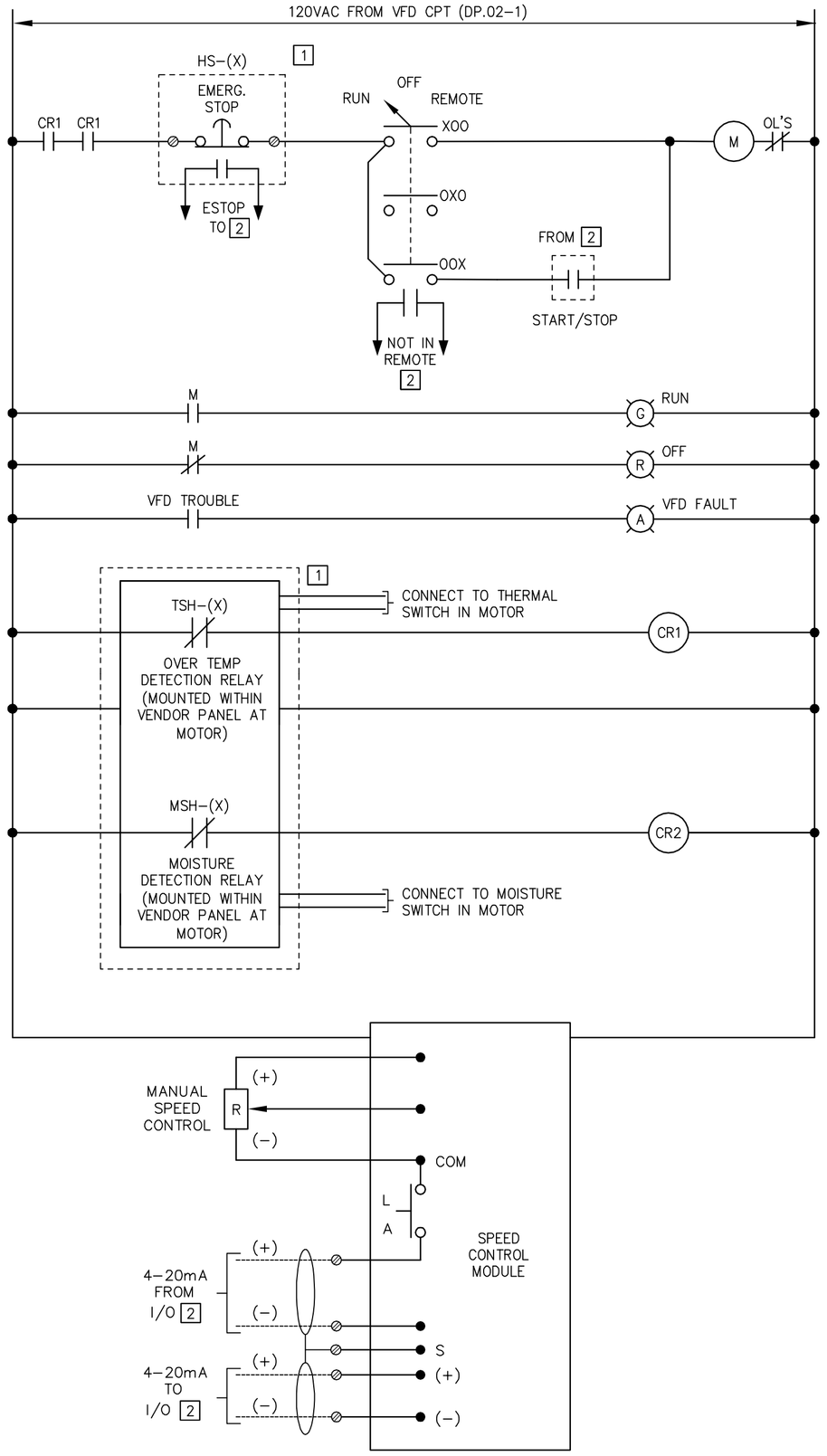
SHEET TITLE

PUMP STATION NO.2 - EE-02 ELEVATION

SHEET NUMBER

02 E-602

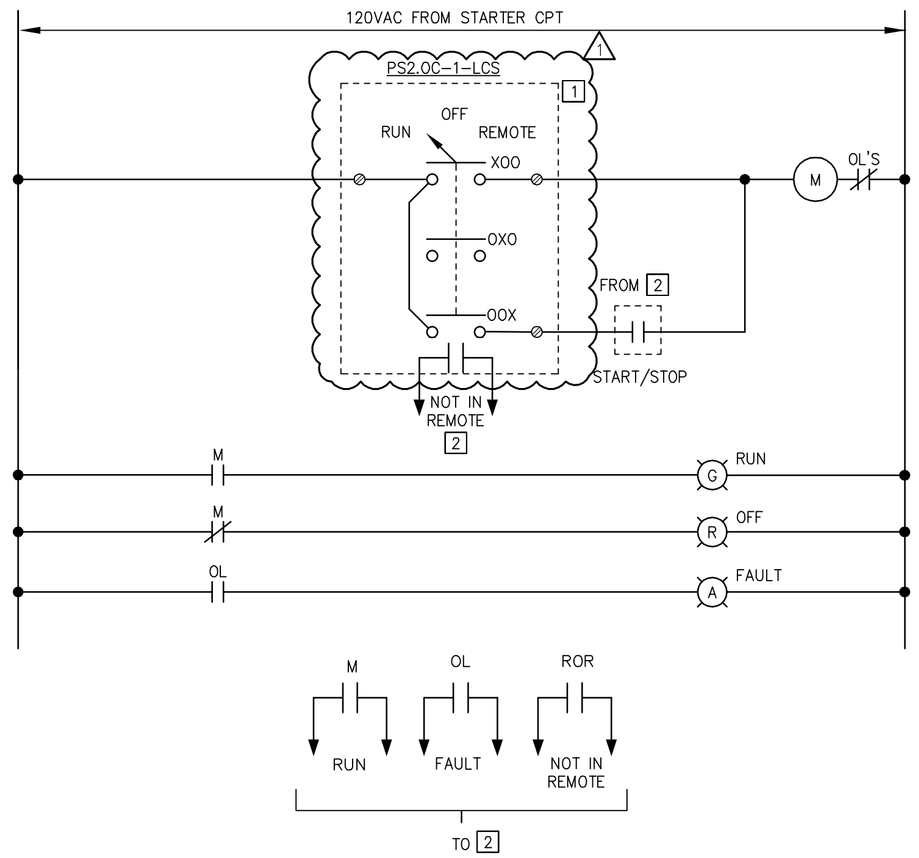
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Filename: \\USCHL1FP001\DATA\PROJECTS\WAKEFIELD\DATA_3\PROJ\60476644 - ORLEANS DOWNTOWN PUMP STATIONS\SHEETS\E\02 E-602.DWG



PUMP STATION NO.2 RAW WASTEWATER PUMP WIRING DIAGRAM PS2.P-1

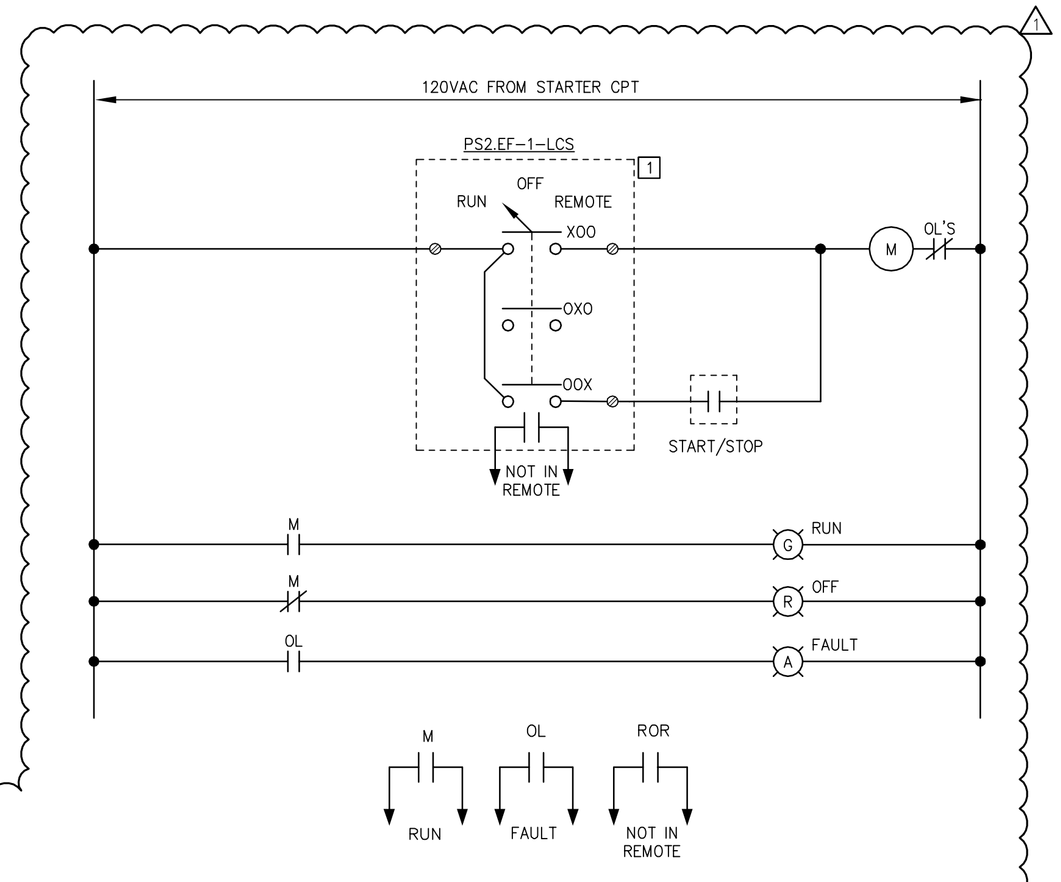
(ALL COMPONENTS LOCATED AT VFD UNLESS OTHERWISE NOTED)
(TYPICAL OF PS2.P-2)

EQUIP. TAG (X)	HS-(X)	TSH-(X)	MSH-(X)
PS2.P-1-VFD	0201	0201	0201
PS2.P-2-VFD	0202	0202	0202



ODOR CONTROL FAN PS2.OC-1 MOTOR STARTER WIRING DIAGRAM

(ALL COMPONENTS LOCATED AT THE STARTER UNLESS OTHERWISE NOTED)



EXHAUST FAN PS2.EF-1 MOTOR STARTER WIRING DIAGRAM

(ALL COMPONENTS LOCATED AT STARTER UNLESS OTHERWISE NOTED)

LEGEND

[1] DEVICE LOCATED AT EQUIPMENT

[2] FROM/TO WW.PS-2-PLC

Last saved by: ABRAHAMA(2020-04-07) Last Plotted: 2020-04-09
Filename: \\USCHLLFP001\DATA\PROJECTS\WAKEFIELD\DATA_3\PROJ\60476644 - ORLEANS DOWNTOWN PUMP STATION\SHEETS\IE\02 E-603.DWG

AECOM

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DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

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DISCIPLINE

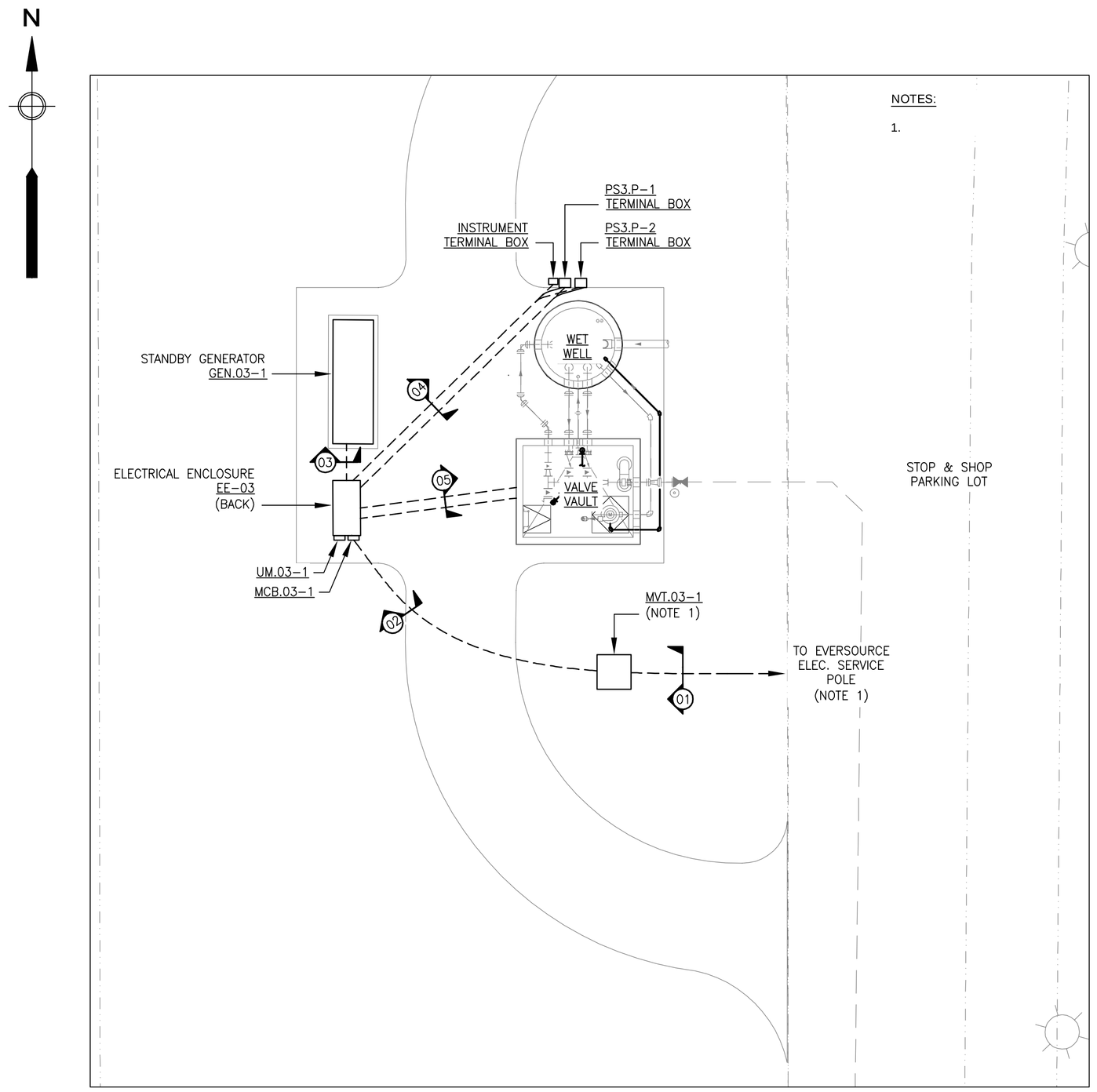
ELECTRICAL

SHEET TITLE

PUMP STATION NO.2 - WIRING SCHEMATICS

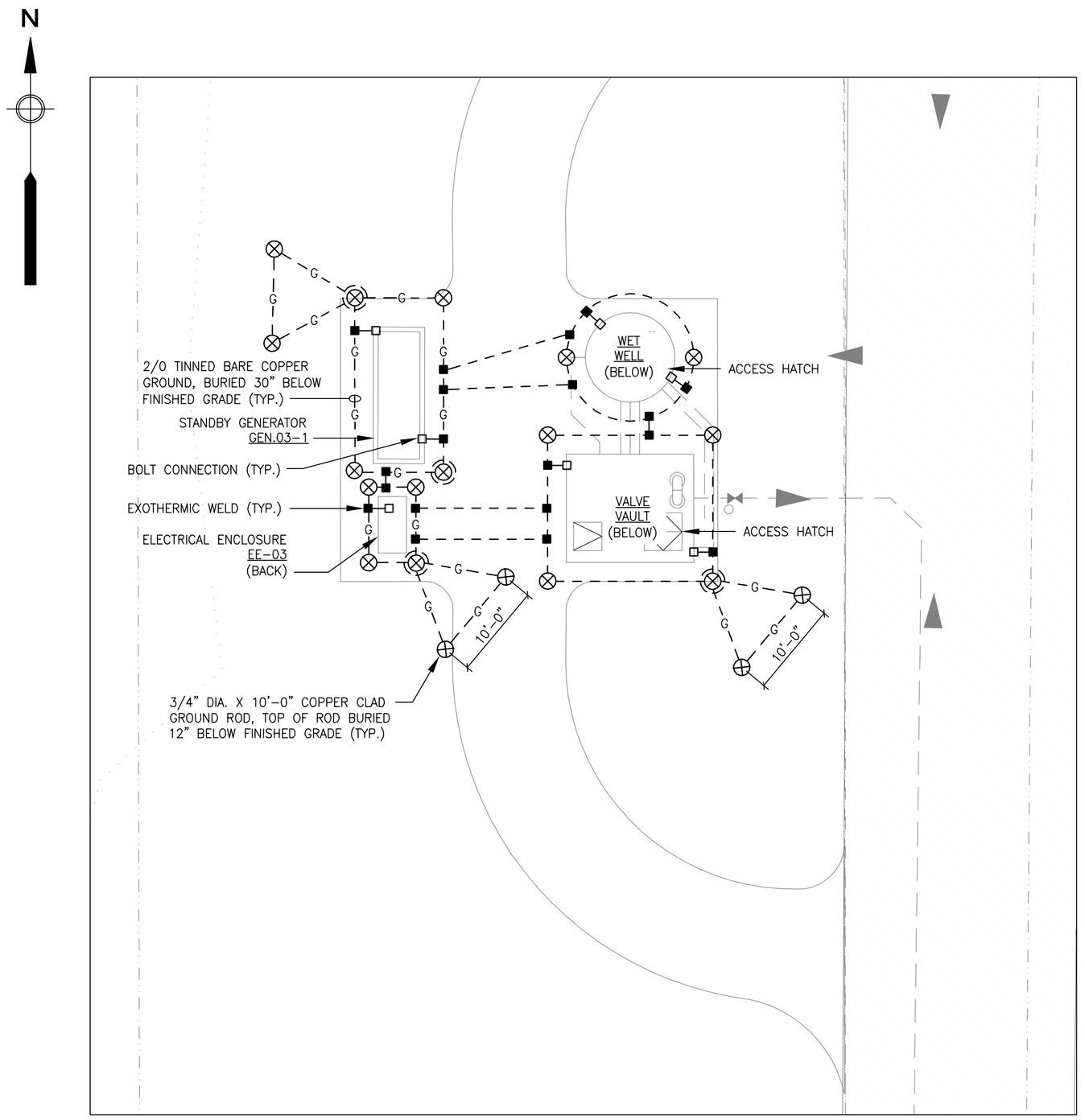
SHEET NUMBER

02 E-603



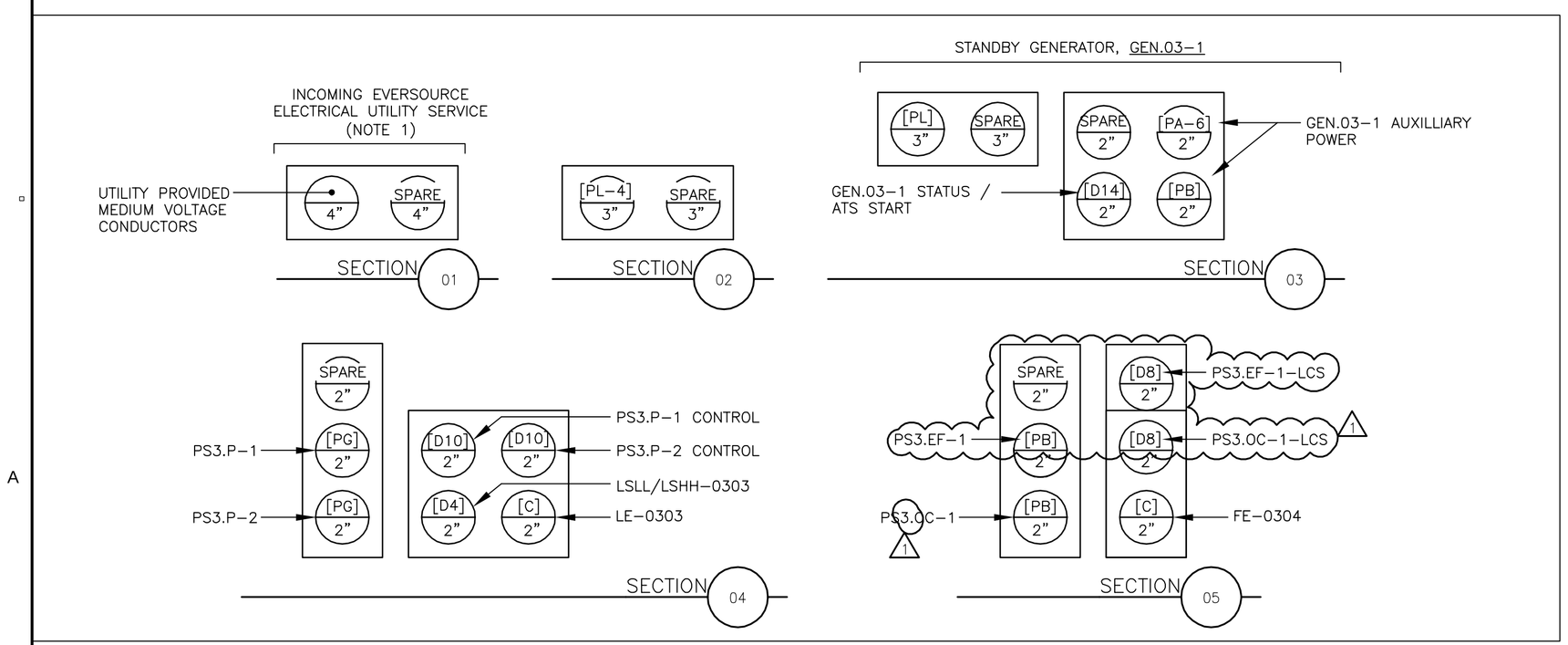
PUMP STATION NO. 3 - ELECTRICAL SITE PLAN

(SCALE: 1"= 10'-0")



PUMP STATION NO. 3 - ELECTRICAL SITE GROUNDING PLAN

(SCALE: 1"= 10'-0")



PUMP STATION NO. 3 - DUCT BANK SECTIONS

(SCALE:NTS)

AECOM

PROJECT

DOWNTOWN AREA
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Proj Check:	T. PARECE
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Scale:	AS NOTED

DISCIPLINE

ELECTRICAL

SHEET TITLE

PUMP STATION NO.3 - ELECTRICAL SITE PLAN

SHEET NUMBER

03 E-001

Last saved by: ABRAHAMA(2020-04-09) Last Plotted: 2020-04-09
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LEGEND:

[1] PUMP STATION NO.3 PLC

NOTES

1. PROVIDE ELECTRICAL UTILITY SERVICE AND METERING EQUIPMENT IN ACCORDANCE WITH EVERSOURCE REQUIREMENTS.

PRIMARY: 480VAC, 3PH, 60HZ
TRANSFORMER: 15KVA
SECONDARY: 208/120V, 3PH, 4W, 60HZ

PANELBOARD "MPC.03-1"

MAIN CIRCUIT BREAKER: 30A TRIP
SHORT CIRCUIT BRACING: 10,000 AMPS
CABINET: NEMA 1

GROUND BUS

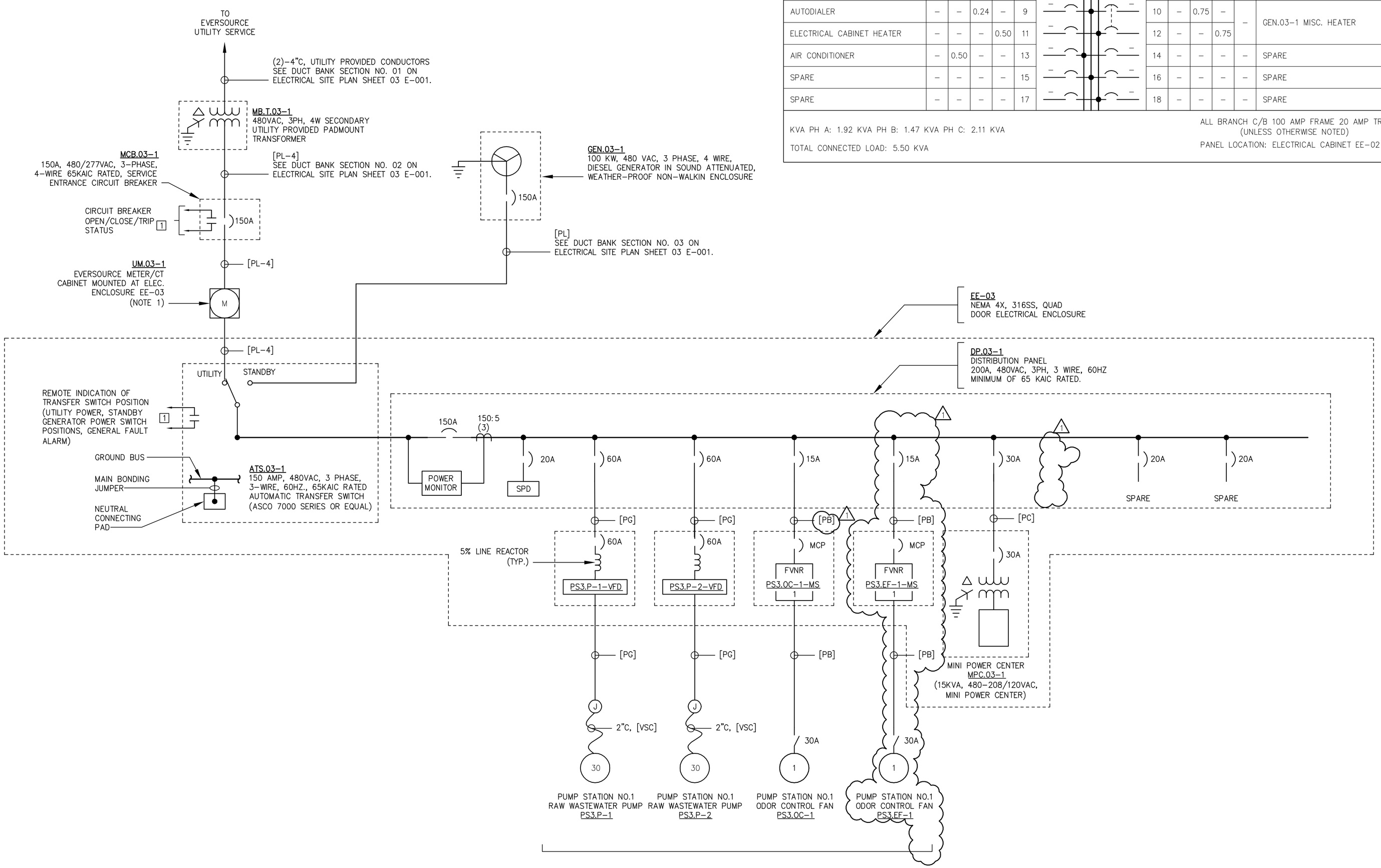
LOCATION	HP	KVA A	KVA B	KVA C	CIR. NO.	NEUTRAL A B C	CIR. NO.	KVA A	KVA B	KVA C	HP	LOCATION
WW.PS-3-PLC	–	0.60	–	–	1		2	0.12	–	–	–	ELECTRICAL CABINET FLOOD LIGHT
FLOW METER FIT-0304	–	–	0.12	–	3		4	–	0.36	–	–	GEN.03-1 BATTERY CHARGER
ELECTRICAL CABINET RECEPT.	–	–	–	0.36	5		6	–	–	0.50	–	GEN.03-1 MISC. HEATER
ELECTRICAL CABINET LIGHTING	–	0.20	–	–	7		8	0.50	–	–	–	GEN.03-1 MISC. HEATER
AUTODIALER	–	–	0.24	–	9		10	–	0.75	–	–	GEN.03-1 MISC. HEATER
ELECTRICAL CABINET HEATER	–	–	–	0.50	11		12	–	–	0.75		
AIR CONDITIONER	–	0.50	–	–	13		14	–	–	–	–	SPARE
SPARE	–	–	–	–	15		16	–	–	–	–	SPARE
SPARE	–	–	–	–	17		18	–	–	–	–	SPARE

KVA PH A: 1.92 KVA PH B: 1.47 KVA PH C: 2.11 KVA

TOTAL CONNECTED LOAD: 5.50 KVA

ALL BRANCH C/B 100 AMP FRAME 20 AMP TRIP (UNLESS OTHERWISE NOTED)

PANEL LOCATION: ELECTRICAL CABINET EE-02



PUMP STATION NO. 3 – SINGLE LINE DIAGRAM

AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

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Proj Check:	T. PARECE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

ELECTRICAL

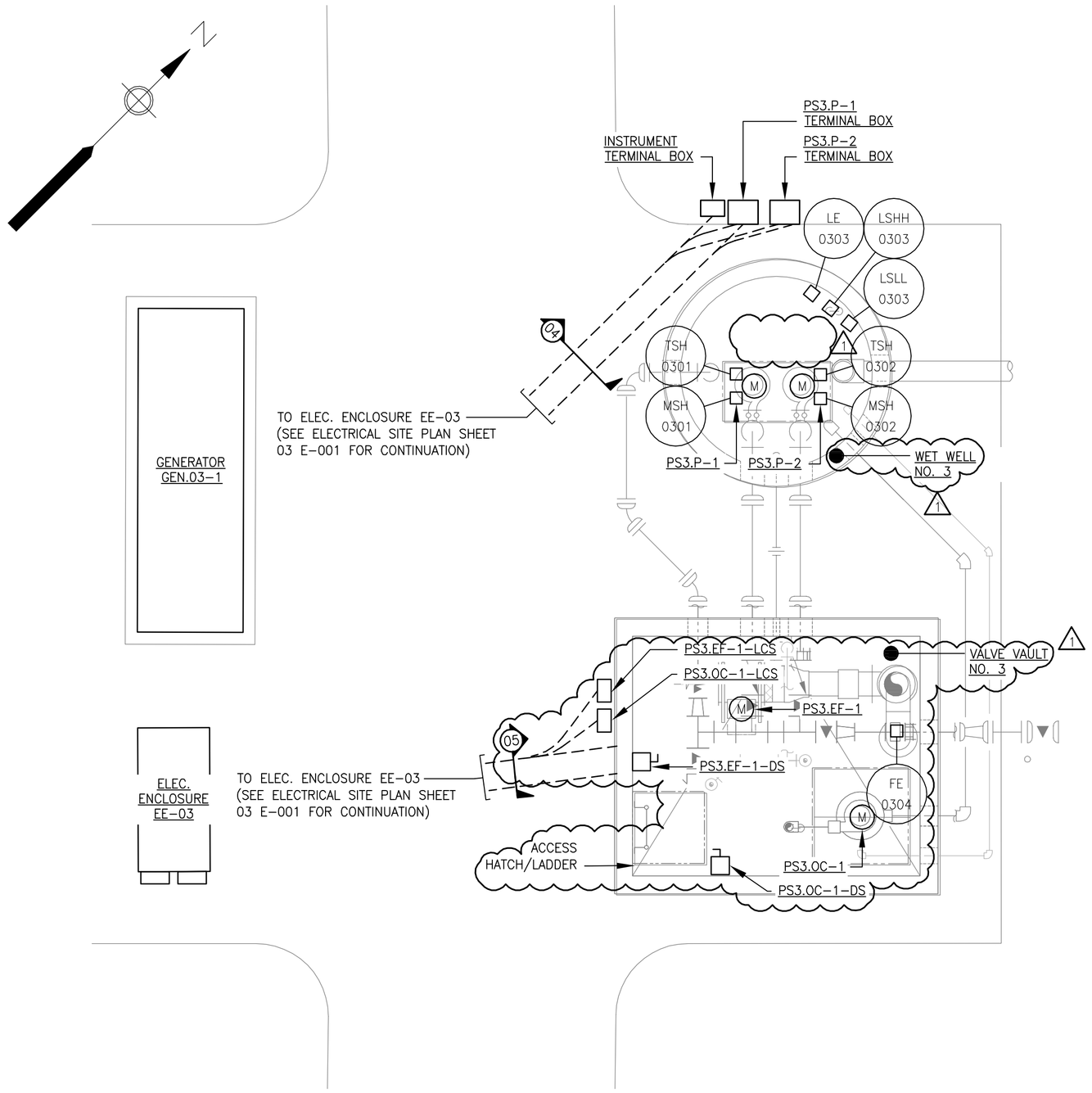
SHEET TITLE

PUMP STATION NO.3 - ELECTRICAL SINGLE LINE DIAGRAM

SHEET NUMBER

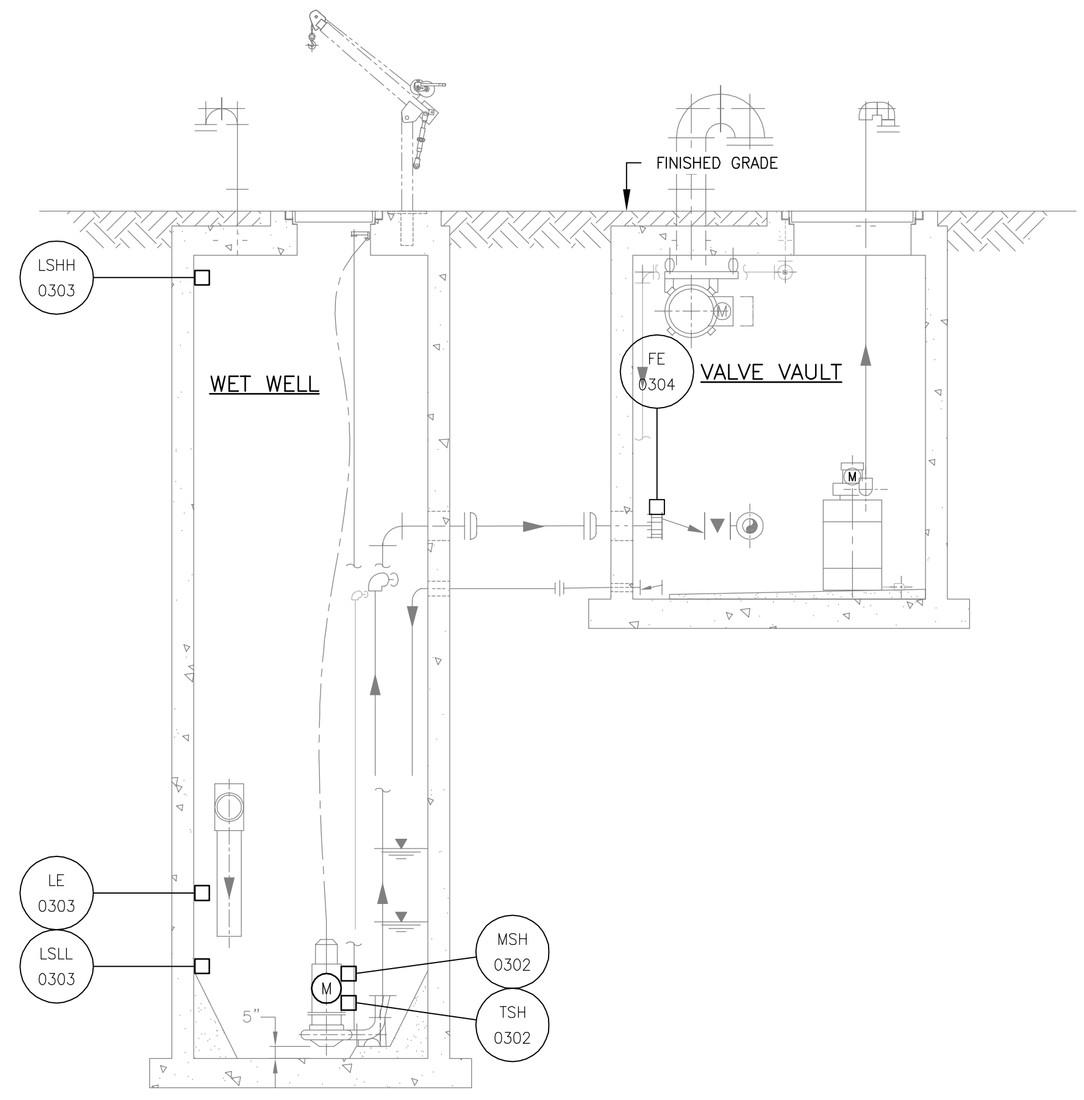
03 E-002

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PUMP STATION NO. 3 - PLAN VIEW

(SCALE: 1/4" = 1'-0")



PUMP STATION NO. 3 - SECTION VIEW

(SCALE: 1/4" = 1'-0")

0 4 8 12

1/4"=1'-0" SCALE FEET

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AECOM

PROJECT

DOWNTOWN AREA
COLLECTION SYSTEM
AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

OWNER

TOWN OF ORLEANS, MA

19 SCHOOL ROAD
ORLEANS, MA 02653
(508) 240-3700

ENGINEER

AECOM TECHNICAL SERVICES, INC.
9 JONATHAN BOURNE DRIVE
POCASSET, MA 02559
PHONE: (508) 833-6950
www.aecom.com

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	04-08-2020	ADDENDUM 10

PROJECT NUMBER

60587515

Designed By:	A. ABRAHAM
Drawn By:	A. ABRAHAM
Dept Check:	Y. RIZK
Proj Check:	T. PARECE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

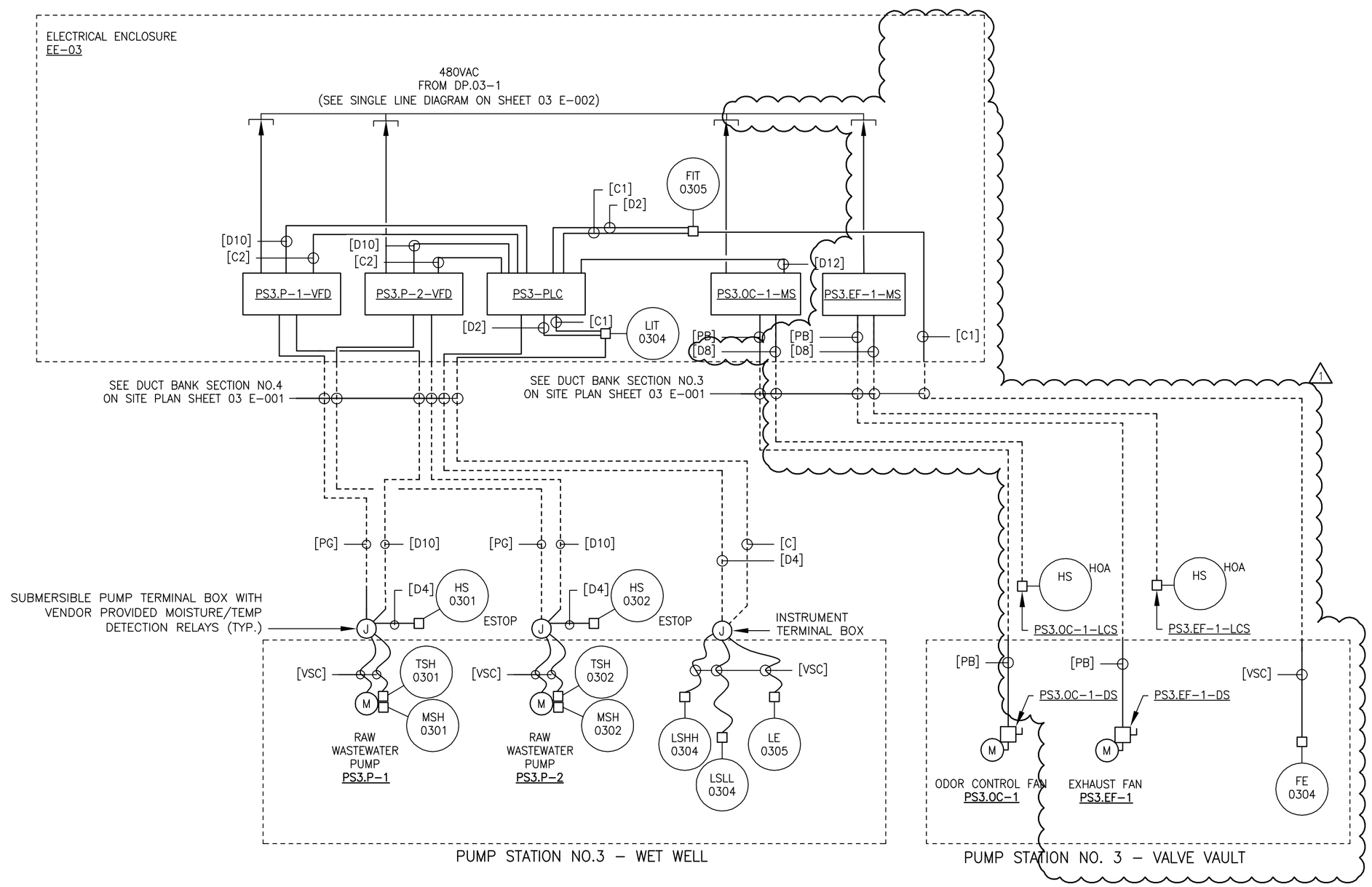
ELECTRICAL

SHEET TITLE

PUMP STATION NO.3 - ELECTRICAL POWER PLAN

SHEET NUMBER

03 E-101



PUMP STATION NO.3 – WET WELL AND VALVE VAULT – RISER DIAGRAMS

SCALE: NTS

AECOM

PROJECT

DOWNTOWN AREA
COLLECTION SYSTEM
AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

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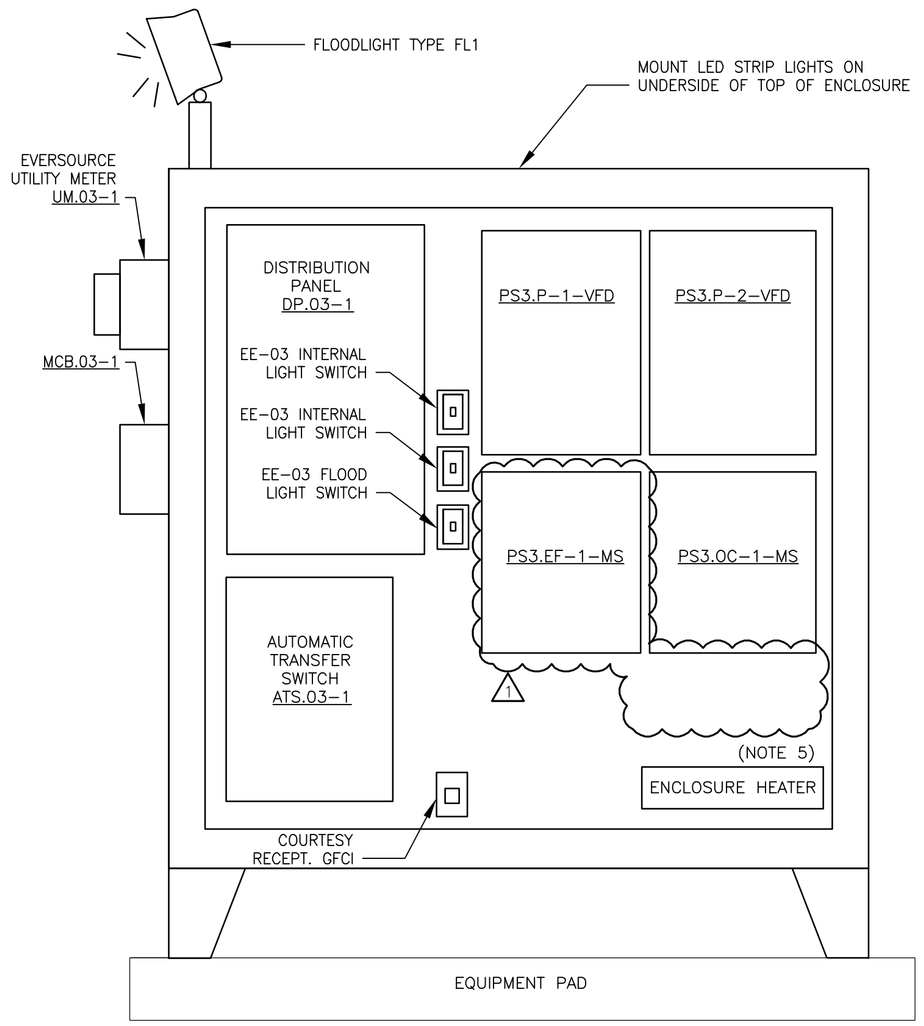
SHEET TITLE

PUMP STATION NO.3 - ELECTRICAL RISER DIAGRAMS

SHEET NUMBER

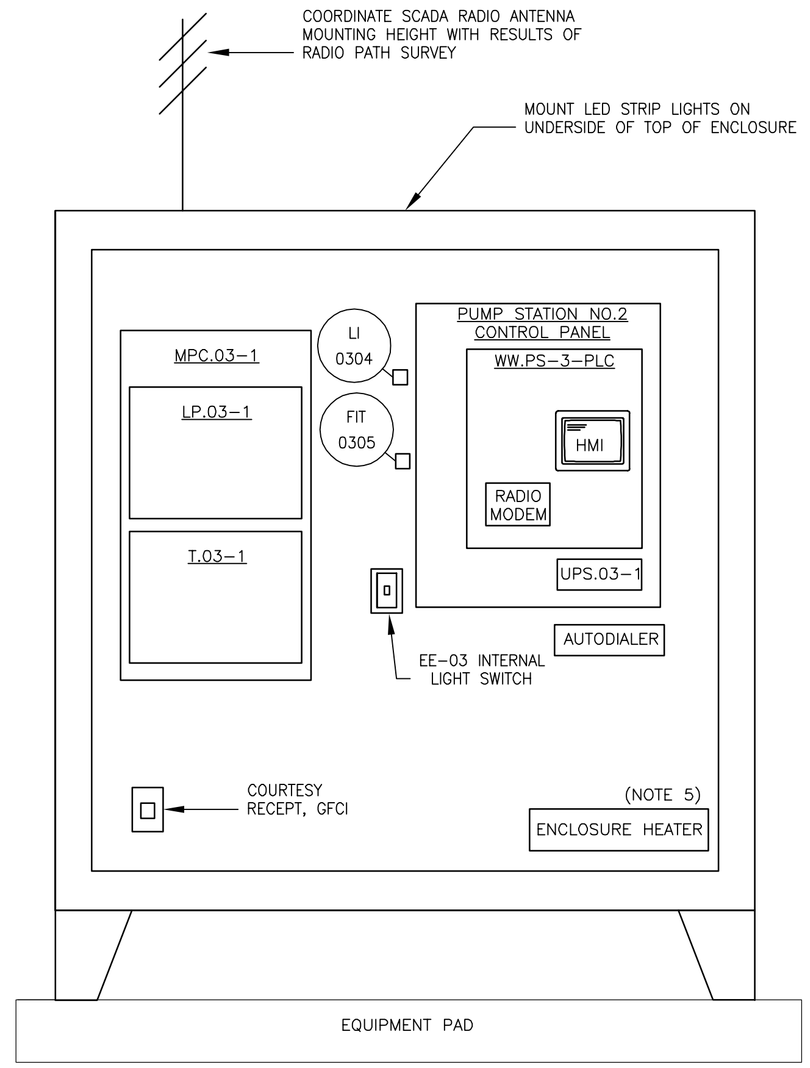
03 E-601

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EE-03 – ENCLOSURE LAYOUT – FRONT

SCALE: NTS



EE-03 – ENCLOSURE LAYOUT – BACK

SCALE: NTS

NOTES:

1. PROVIDE ENCLOSURE CONSTRUCTED OF 316 STAINLESS STEEL.
2. COMPONENT LAYOUT IS FOR FUNCTIONAL PURPOSES ONLY. LAYOUT AND ENCLOSURE SIZE SHALL BE FINALIZED BY ELECTRICAL CONTRACTOR BASED ON SPECIFIC EQUIPMENT MANUFACTURERS AND MODELS SELECTED. (1)
3. SYSTEM INTEGRATOR TO PURCHASE RADIO EQUIPMENT, PLC AND INSTRUMENTS. ELECTRICAL CONTRACTOR SHALL INSTALL EQUIPMENT IN ACCORDANCE WITH MANUFACTURER REQUIREMENTS.
4. PANEL LAYOUT SHOWN WITH DOORS REMOVED.
5. PROVIDE HEATER SIZED TO MAINTAIN MINIMUM TEMPERATURE AS REQUIRED BY ALL COMPONENTS INSIDE ELECTRICAL ENCLOSURE. PROVIDE HEATER CONTROLLED BY AN ADJUSTABLE THERMOSTAT.
6. PROVIDE CONNECTION FOR GENERATOR IN ACCORDANCE WITH THE CITY OF MIDDLETOWN STANDARDS. COORDINATE WITH THE WATER DEPARTMENT ELECTRICIAN.
7. PROVIDE CLOSED LOOP AIR CONDITIONING AS NEEDED TO MAINTAIN TEMPERATURE WITHIN EQUIPMENT RATINGS. AIR CONDITIONER SHALL BE NEMA 4X STAINLESS STEEL WITH CORROSION PACKAGE.

EE-03 – ENCLOSURE LAYOUTS

SCALE: NTS

AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

OWNER

TOWN OF ORLEANS, MA
19 SCHOOL ROAD
ORLEANS, MA 02653
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REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	**04-08-2020**	**ADDENDUM 10**

PROJECT NUMBER

60587515

Designed By:	**A. ABRAHAM**
Drawn By:	**A. ABRAHAM**
Dept Check:	**Y. RIZK**
Proj Check:	**T. PARECE**
Date:	**JANUARY 2020**
Scale:	**AS NOTED**

DISCIPLINE

ELECTRICAL

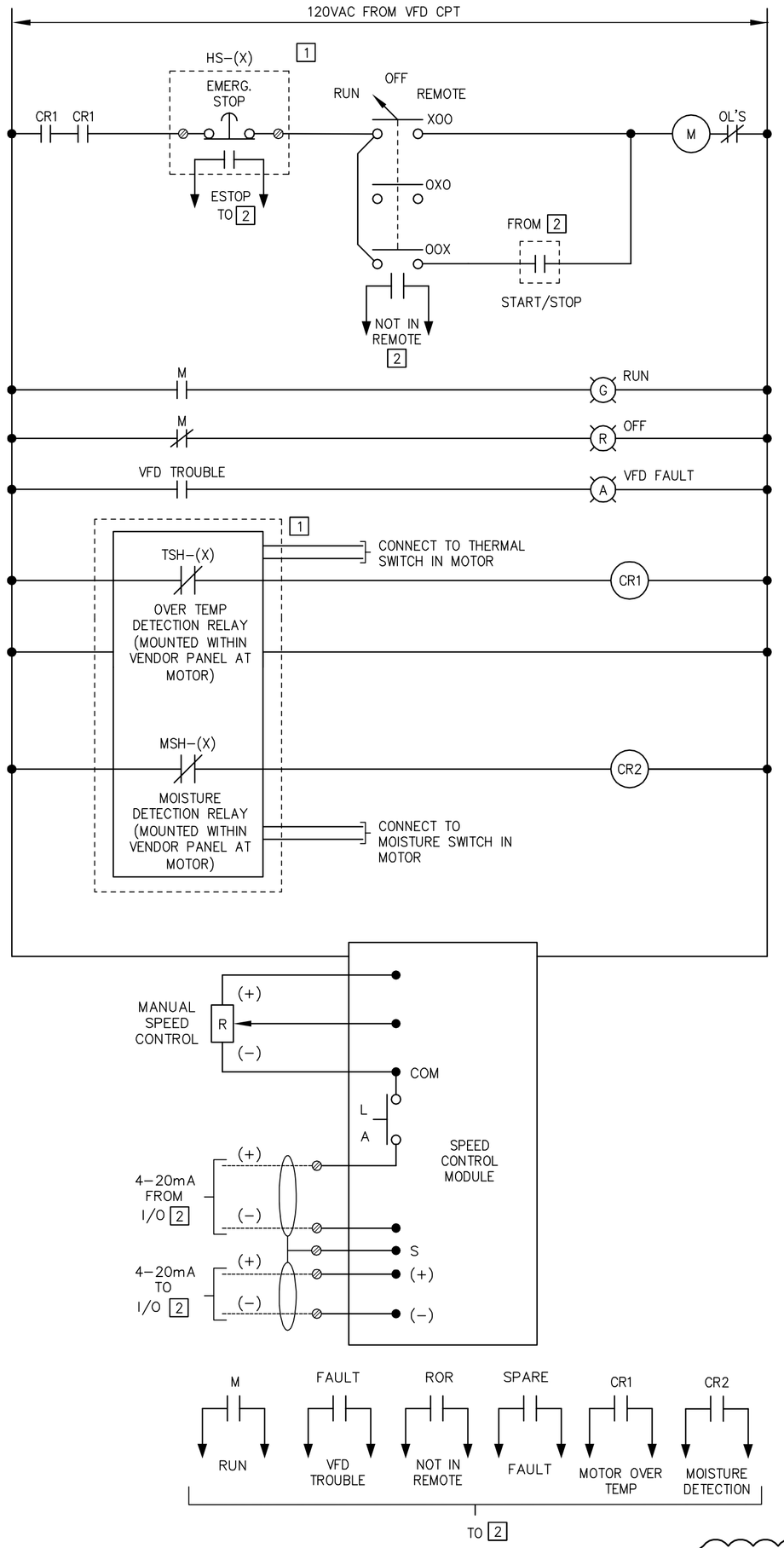
SHEET TITLE

PUMP STATION NO.3 - EE-03 ELEVATION

SHEET NUMBER

03 E-602

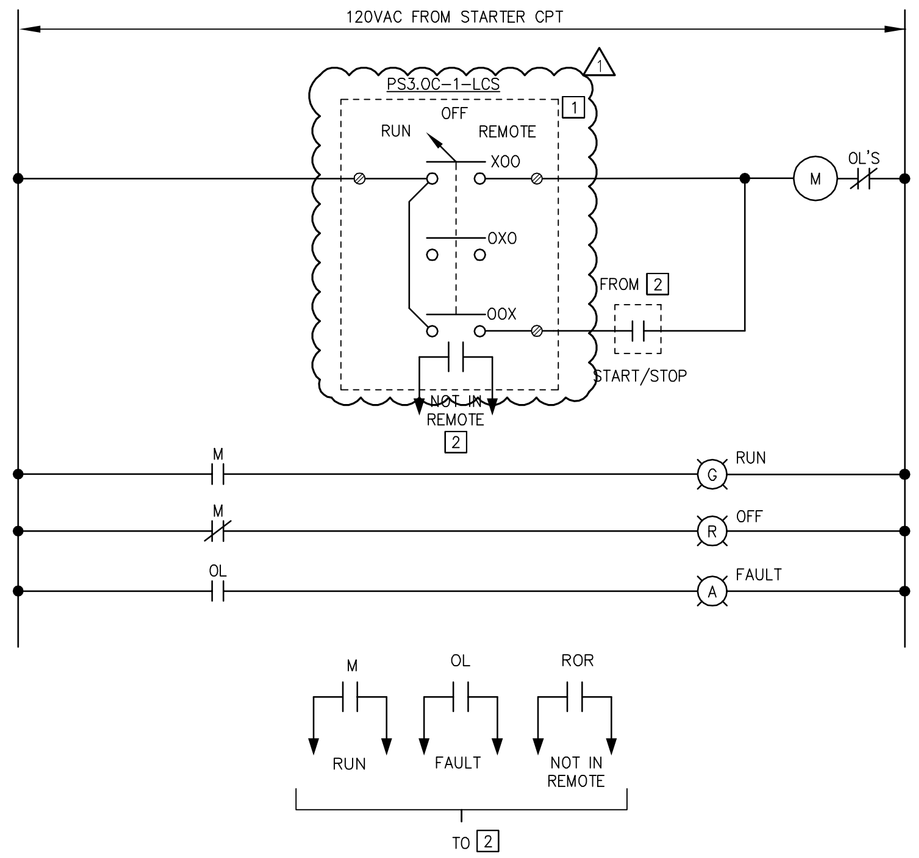
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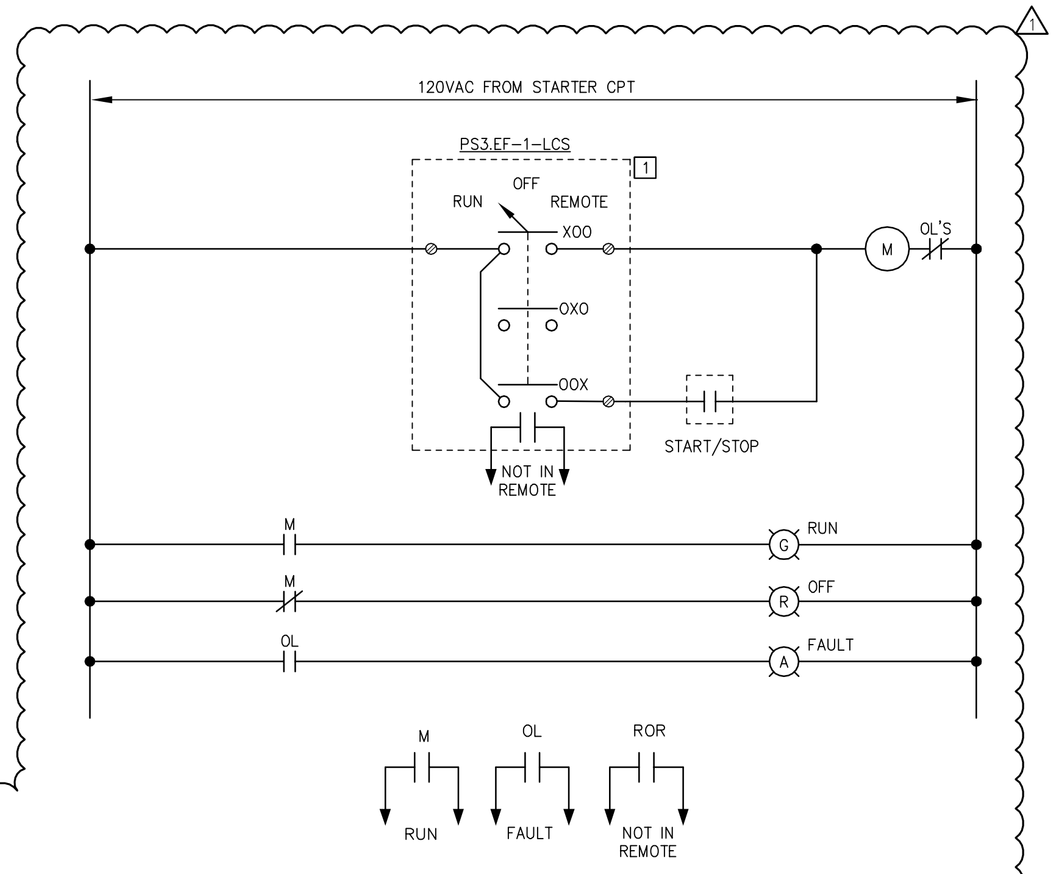
PUMP STATION NO.3
RAW WASTEWATER PUMP
WIRING DIAGRAM
PS3.P-1

~~(ALL COMPONENTS LOCATED AT VFD UNLESS OTHERWISE NOTED)~~
(TYPICAL OF PS3.P-2)

EQUIP. TAG (X)	HS-(X)	TSH-(X)	MSH-(X)
PS3.P-1-VFD	0301	0301	0301
PS3.P-2-VFD	0302	0302	0302



ODOR CONTROL FAN PS3.OC-1
MOTOR STARTER WIRING DIAGRAM
(ALL COMPONENTS LOCATED AT THE STARTER UNLESS OTHERWISE NOTED)



EXHAUST FAN PS3.EF-1
MOTOR STARTER WIRING DIAGRAM
(ALL COMPONENTS LOCATED AT STARTER UNLESS OTHERWISE NOTED)

LEGEND

1 DEVICE LOCATED AT EQUIPMENT

2 FROM/TO WW.PS-3-PLC

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AECOM

PROJECT

DOWNTOWN AREA COLLECTION SYSTEM AND PUMP STATIONS

CONTRACT No. 2019-02
SRF No. 4486

OWNER

TOWN OF ORLEANS, MA
19 SCHOOL ROAD
ORLEANS, MA 02653
(508) 240-3700

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I/R	DATE	DESCRIPTION
1	04-08-2020	ADDENDUM 10

PROJECT NUMBER

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Designed By:	A. ABRAHAM
Drawn By:	A. ABRAHAM
Dept Check:	Y. RIZK
Proj Check:	T. PARECE
Date:	JANUARY 2020
Scale:	AS NOTED

DISCIPLINE

ELECTRICAL

SHEET TITLE

PUMP STATION NO.3 - WIRING SCHEMATICS

SHEET NUMBER

03 E-603

April 30, 2020

ADDENDUM NO. 11

TO

DOCUMENTS AND SPECIFICATIONS

FOR

Downtown Area Collection System and Pumping Stations

Contract No. 2019-02 and SRF No. 4486

Town of Orleans, MA

Department of Public Works & Natural Resources

This Addendum No. 11 forms a part of the Contract Documents and modifies the Bidding Documents dated January 2020 as noted below. Acknowledge receipt of this Addendum in the space provided in SECTION 00410, FORM OF GENERAL BID. Failure to do so may subject the Bidder to disqualification.

This Addendum consists of 4 pages and 45 pages of attachments for a total of 49 pages.

ATTACHMENTS

1. Section 00410, Form of General Bid, Page 1
2. Orleans_MA-2019-02-Bid Form_Add_11-04-30-20
3. Section 02446, Horizontal Directional Drilling
4. Typical Trench Repair & Pavement Section Detail

CHANGES TO BE MADE TO THE CONTRACT SPECIFICATIONS

1. GENERAL

   A. General Bid Opening – May 6, 2020 at 2:00 p.m.

      General Bids will be received outside of Orleans' Town Hall. The Owner and/or their representatives will be outside the building to receive General Bids on May 6, 2020 starting at 8:00 a.m. The General Bids will be taken inside to be opened at 2:00 p.m. Access to the Orleans' Town Hall is restricted to the Owner and their representatives. The General Bid Opening will be broadcasted live on Channel 18. The Channel 18 feed is also sent to the Owner's livestream on the Owner's webpage. Anyone can access the live feed using the link below.

      https://www.town.orleans.ma.us/orleans-18/pages/ch-18-vod-and-live-streaming-player

   B. PDF copies of the General Bids received, but not including documents not allowed by law, will be available on the Owner's website within 7 calendar days of the bid opening.

2. SECTION 00410, FORM OF GENERAL BID

   A. Page, delete the page in its entirety and replace with the new page as attached.

   B. Delete "Orleans_MA-2019-02-Bid Form_Add_10-04-10-20" in its entirety and replace with the attached new "Orleans_MA-2019-02-Bid Form_Add_11-04-30-20" in both hard copy and Microsoft Excel format.

C. The Bid Forms in Excel Format may be downloaded from the Tighe & Bond website. You must click on the "pre-qualified" button to access the Forms. Once obtained, in most cases a yellow bar will appear on the top of the screen labeled as "Security Warning". If this occurs, you must select the "Enable Content" button in order to properly utilize the file.

3. SECTION 01025, MEASUREMENT AND PAYMENT

A. Page 01025-10, ITEM 15 - PAVEMENT RESTORATION, delete Paragraph B.1. in its entirety and replace with the following new subparagraph:

1. Bituminous Concrete Trench Pavement in State Roadways

a. Measurement for Temporary Bituminous Concrete Trench Pavement in State Roadways shall be based on the horizontal measured length of main line trench defined as the length of roadway disturbed by the main line Work from centerline of manhole to centerline of manhole. Measurement shall be by the linear foot with no deductions made for manholes, fittings or valves.

b. Measurement for Permanent Bituminous Concrete Trench Pavement in State Roadways shall be based on the horizontal measured length of service trench defined as the length of roadway surface disturbed by the service line Work less three (3) feet from the centerline of the main sewer or water pipeline trench. Measurement shall be by the linear foot with no deductions made for fittings or valves.

c. Measurement for Permanent Bituminous Concrete Trench Pavement in State Roadway for trenches with more than one (1) pipe laid in the same trench shall be treated as a common trench, unless otherwise approved by the Engineer.

4. SECTION 01030, SPECIAL REQUIREMENTS

A. Page 01030-5, ARTICLE 1.11 - SCOPE OF WORK AND SEQUENCE OF CONSTRUCTION,

1. Paragraph F, subparagraph 9.a., delete the subparagraph in its entirety and replace with the following new subparagraph:

a. Method A - Permanent Surfacing of State Roadways

(1) Prior to the start of construction, the Contractor and Contractor's paving subcontractor shall meet with the Owner, MassDOT and the Engineer to review roadway restoration.

(2) Temporary Trench Pavement - Furnish and place a 4-inch bituminous concrete trench width pavement. The Temporary trench pavement shall be placed at the end of each workday unless otherwise approved by MassDOT and the Engineer.

(3) Permanent Trench Pavement - Cut back each side of trenches by a minimum of 1-foot. Furnish and place 7-inch permanent superpave bituminous concrete trench width pavement (3-inch base course and 4-inch intermediate course or 7-inch intermediate course). The 7-inch permanent superpave bituminous concrete trench width pavement shall be laid in two layers. Permanent trench pavement shall occur between 90 to 180 days after pipeline installation subject to OWNER and MassDOT approval.

(4) Overlay - Mill 2-inches and furnish and place 2-inch permanent superpave bituminous concrete full width pavement (top course). Overlay shall be placed the following construction season, allowing the trench to settle over a winter freeze thaw cycle. Mill and overlay shall occur following the completion of the permanent trench pavement subject to OWNER and MassDOT approval.

Permanent Bituminous Concrete Trench Pavement and Permanent Bituminous Concrete Full Width Pavement of State Roadways shall occur in the following locations:

Location	Drawing Number	Manhole or Station *	
		From	To
Cranberry Highway	01 C-110	SMH G-04-02	SMH G-03-11
Cranberry Highway	02 C-101 thru 02 C-102	SMH G-04-03	SMH F-04-54
Cranberry Highway	02 C-103	SMH F-04-14	SMH E-04-30
Cranberry Highway	03 C-112	SMH E-04-10	SMH E-04-01
South Orleans Road	03 C-112 thru 03 C-114	SMH E-04-01	SMH D-05-03
South Orleans Road	02 C-106	Exist. SMH F-04-31	SMH E-04-06
South Orleans Road	03 C-116	SMH E-04-01	SMH E-04-06

* Note: Final location to be determined in the field.

5. SECTION 02446, HORIZONTAL DIRECTIONAL DRILLING

   A. Add new SECTION 02446, HORIZONTAL DIRECTIONAL DRILLING as attached.

CHANGES TO BE MADE TO THE CONTRACT DRAWINGS

1. DRAWING 99 C-507, DETAILS VII

   A. Typical Trench Repair & Pavement Section Detail, delete the detail in its entirety and replace with the detail, as attached.

CHANGES TO BE MADE TO THE CONTRACT ATTACHMENTS

None

END OF ADDENDUM NO. 11

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SECTION 00410

FORM OF GENERAL BID

1. Proposal of _____ (hereinafter called "Bidder")*

   (_) a corporation, organized and existing under the laws of the State of _____

   (_) a partnership

   (_) a joint venture

   (_) a limited liability company

   (_) an individual doing business as _____

   *Check corporation, partnership, joint venture, LLC or individual as applicable.

2. To the Town of Orleans, MA (hereinafter called "Owner") regarding: Downtown Area Collection System and Pumping Stations, Contract No. 2019-02 and SRF No. 4486.

   The Bidder, in compliance with your invitation for bids for Downtown Area Collection System and Pumping Stations having examined the plans and specifications with related documents and the site of the proposed work, attended the mandatory pre-bid conference, and being familiar with all of the conditions surrounding the construction of the proposed project including the availability of materials and labor, hereby proposes to furnish all superintendence, labor, services, materials, equipment, plant, machinery, apparatus, appliances, tools, supplies, bailing, shoring, removal, and all other things necessary to construct the project in accordance with the contract documents, within the time set forth below, and at the prices stated below. These prices are to cover all expenses incurred in performing the work required under the contract documents, of which this bid is a part.

   The Bidder hereby agrees that if selected as the Contractor it will commence work under this contract on or before a date to be fixed in the written “Notice to Proceed” given by the Owner to the Contractor and to fully complete the project within 751 calendar days, using not more than 304 working days split into 6 phases.

   The Bidder further agrees to pay as liquidated damages the sum of $9,700 for each consecutive calendar day and/or working day thereafter during which the work as not been fully completed, as provided in the “Liquidated Damages” provisions of SECTION 00800 - SUPPLEMENTARY CONDITIONS.

3. Bidder acknowledges receipt of the following addenda:

No.	Dated	No.	Date
1		7	
2		8	
3		9	
4		10	
5		11	
6		12	

4. Bidder agrees to perform all the work, including all incidental labor, materials and equipment necessary for the satisfactory completion of the work and in full compliance with the contents and intent of the Specifications and/or Drawings of the work.

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - BASE BID			
1.	For Mobilization/Demobilization, as specified (maximum of five (5) percent of System Expansion bid), the sum of $ -	l.s.	1	$ -
2.A.	For furnishing and installing 1-1/2-inch through 2-inch, inclusive, Polyvinyl Chloride/High Density Polyethylene Low Pressure Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	930	$ -
2.B.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Less Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	3,930	$ -
2.C.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Greater Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	5,310	$ -
2.D.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	930	$ -

Company's Name		Date
Company's Address	**Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.**	

Item	Description	Unit of Measure	Quantity	Extended Total
2.E.	For furnishing and installing 12-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	2,410	$ -
2.F.	For furnishing and installing 18-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,900	$ -
2.G.	For furnishing and installing 6-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	450	$ -
2.H.	For furnishing and installing 8-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	710	$ -
2.I.	For furnishing and installing 8-inch PVC Effluent Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	3,590	$ -
2.J.	For furnishing and installing 1-1/4-inch Polyvinyl Chloride Low-Pressure Sewer Service Connections and Associated Fittings from main line to property line, All Depths, as specified, the sum of $ -	per l.f.	170	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.K.	For furnishing and installing 6-inch Polyvinyl Chloride Service Connections and Associated Fittings from main line to property line as specified, the sum of $ -	per l.f.	3,270	$ -
2.L.	For furnishing and installing LPS Wyes, All Depths, as specified, the sum of $ -	per each	8	$ -
2.M.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	95	$ -
2.N.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	11	$ -
2.O.	For furnishing and installing 12-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	11	$ -
2.P.	For furnishing and installing 18-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	18	$ -
2.Q.	For furnishing and installing Low Pressure Sewer Main Line Valves, All Sizes and Depths, as specified, the sum of $ -	per each	2	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
3.A.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Less Than 10 feet in Depth, the sum of $ -	per each	11	$ -
3.B.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Greater Than 10 feet in Depth, the sum of $ -	per each	50	$ -
3.C.	For furnishing and installing 5-foot Diameter Precast Concrete Sewer Manholes, All Depths, as specified, the sum of $ -	per each	7	$ -
3.D.	For furnishing and installing 6-foot Diameter Precast Concrete Low Pressure Sewer Terminal Flushing Manholes, All Depths, as specified, the sum of $ -	per each	2	$ -
3.E.	For furnishing and installing 6-foot Diameter Precast Concrete Effluent Force Main In-Line Flushing Manholes, All Depths, as specified, the sum of $ -	per each	1	$ -
3.F.	For furnishing and installing 6-foot Diameter Precast Concrete Leaching Catch Basins with Grates, All Depths, as specified, the sum of $ -	per each	4	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
4.A.	For furnishing and installing Standard Manhole Frames and Covers, as specified, the sum of $ -	per each	72	$ -
4.B.	For furnishing and installing Bolted and Gasketed Manhole Frames and Covers, as specified, the sum of $ -	per each	3	$ -
5.	For furnishing and installing Interior Manhole Drop Connections, as specified, the sum of $ -	per v.f.	60	$ -
6.	For furnishing and installing chimneys, as specified, the sum of $ -	per v.f.	150	$ -
7.	For furnishing and placing miscellaneous cement concrete, as specified, the sum of $ -	per c.y.	240	$ -
8.	For Rock and Boulder Excavation including Replacement with Suitable Fill Material, as specified, the sum of * $ - * Minimum Bid = $80/c.y.	per c.y.	300	$ -
9.A.	For Replacement of Unsuitable Material Below Trench Grade and/or Subgrade, as specified, the sum of $ -	per c.y.	420	$ -

Company's Name		Date
Company's Address	**Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.**	

Item	Description	Unit of Measure	Quantity	Extended Total
9.B.	For Replacement of Unsuitable Material Above Trench Grade, as specified, the sum of $ -	per c.y.	840	$ -
10.	For Experimental Excavation, as specified, the sum of $ -	per c.y.	240	$ -
11	Fill for embankments – Not Used			
12.	Sheeting and/or shoring ordered left in place – Not Used			
13.	For performing Soil Compaction Tests, as specified, the sum of $ -	per each	80	$ -
14.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	5,580	$ -
15.A.	For furnishing and placing 4-inch Temporary Bituminous Concrete Trench Pavement (base course) in State Roadways, as specified, the sum of $ -	per l.f.	6,200	$ -
15.B.	For furnishing and placing 7-inch Permanent Bituminous Concrete Trench Width Pavement (3-inch base course and 4-inch intermediate course or 7-inch intermediate course) in State Roadways, as specified, the sum of $ -	per l.f.	6,200	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.C.	Milling and 2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in State Roadways - Not Used			
15.D.	Not Used			
15.E.	1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways - Not Used			
15.F.	For furnishing and placing Dense Graded Gravel, as specified, the sum of $ -	per c.y.	350	$ -
15.G.	For furnishing and placing 4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways, as specified, the sum of * $ -	per l.f.	17,000	$ -
15.H.	Milling and 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways - Not Used			
15.I.	For Miscellaneous Restoration of State and Town Roadways, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	450	$ -
15.J.	For furnishing and placing Miscellaneous Bituminous Concrete Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	230	$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.K.	For repair and/or replacement of the Vehicle Loop Detectors, as specified, the sum of $ -	per each	10	$ -
15.L.	For repainting of Traffic Markings - Lines, Symbols and Wording, as specified, the sum of Twenty Five Thousand Dollars and No Cents $ 25,000.00	Allowance	1	$ 25,000.00
16.A.	For removal and relaying and/or replacement of Existing Water Mains, associated fittings, valves and services, as specified, the sum of $ -	per inch-foot	6,000	$ -
16.B.	For removal and relaying and/or replacement of Existing Storm Drains, as specified, the sum of $ -	per inch-foot	10,000	$ -
16.C.	For removal and relaying and/or replacement of Existing Gas Mains and services, as specified, the sum of Fifty Thousand Dollars and No Cents $ 50,000.00	Allowance	1	$ 50,000.00
16.D.	For removal and relaying and/or replacement of Existing Miscellaneous Utilities, as specified, the sum of Fifty Thousand Dollars and No Cents $ 50,000.00	Allowance	1	$ 50,000.00
16.E.	For furnishing and removal of 6-inch Water Main Line Stops, as specified, the sum of $ -	per each	1	$ -

Company's Name

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Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
16.F.	For furnishing and removal of 8-inch Water Main Line Stops, as specified, the sum of $ -	per each	11	$ -
16.G.	10-inch Water Main Line Stops - Not Used			
17.	Uniformed Traffic Police Officers - Paid by Owner			
18.A.	For furnishing, installing, and removing Engineer's Field Office, as specified, the sum of $ -	per l.s.	1	$ -
18.B.	For maintaining Engineer's Field Office, as specified, the sum of $ -	per week	49	$ -
19.	Environmental Protection - Not Used			
20.	Trench Dewatering System - Not Used			
21.	Temporary By-pass Pumping - Not Used			
22.A.	For furnishing and installing Highway Crossing via Horizontal Directional Drilling, as specified, the sum of $ -	per l.s.	1	$ -
22.B.	For MassDOT Inspections, as specified, the sum of Ten Thousand Dollars and No Cents $ 10,000.00	Allowance	1	$ 10,000.00

Company's Name

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
23.A.	For furnishing and installing Pumping Station No. 1, as specified, the sum of $ -	per l.s.	1	$ -
23.B.	For furnishing and installing Pumping Station No. 2, as specified, the sum of $ -	per l.s.	1	$ -
23.C.	Pumping Station No. 3 - Not Used			
23.D.	For Electric Company Connection/Service Fee, as specified, the sum of One Hundred Thousand Dollars and No Cents $ 100,000.00	Allowance	1	$ 100,000.00
23.E.	For Telephone Company Connection/Service Fee, as specified, the sum of Twenty Thousand Dollars and No Cents $ 20,000.00	Allowance	1	$ 20,000.00
23.F.	For Planting Operations, as specified, the sum of Twenty Thousand Dollars and No Cents $ 20,000.00	Allowance	1	$ 20,000.00
24.	For furnishing and installing Tracer Wire in State Roadways, All Depths, as specified, the sum of $ -	l.f.	8,300	$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF INELIGIBLE BID ITEMS - BASE BID			
B-1.	Replacement of Water Services			
		$		-
B-2.	Replacement of Canal Road Water Main			
		$		-
B-3.	Water Quality Improvements			
		$		-

Note: **Funding for the SRF Ineligible Bid Items - Base Bid (Bid Items B-1. through B-3., inclusive) is anticipated to be obtained at the Annual Town Meeting proposed to be held in June 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

TOTAL AMOUNT OF BASE BID (SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) PLUS SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B-3., inclusive) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF

$ -

Company's Name	Date
Company's Address	**Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.**

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
A-1.	Pavement Restoration in Town Roadways			
		$		-
A-2.	Pumping Station No. 3 Tributary Area			
		$		-
A-3.	Fiber Optic Conduits, Associated Fittings and Handholes			
		$		-
A-4.	Tracer Wire in Town Roadways			
		$		-
A-5.	Highway Crossing Using Jacking			
		$		-

Company's Name

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
BASIS OF AWARD				

BASIS OF AWARD - The OWNER's goal is to accomplish the work identified in SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B-3., inclusive) plus as many of the SRF ELIGIBLE BID ITEMS - ALTERNATIVES as its funding constraints will allow. The BASIS OF AWARD, therefore, is the lowest bid for the sum of SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B-3., inclusive) plus the cost of the greatest number of SRF ELIGIBLE BID ITEMS - ALTERNATIVES not exceeding its funding constraints. The SRF ELIGIBLE BID ITEMS - ALTERNATIVES are listed in the order of their priority for award. Bidders must provide a bid figure for each alternative required regardless of the cost. Additional Funding may be obtained at the Annual Town Meeting proposed to be held in June 2020.

TOTAL AMOUNT OF BASE BID BASED ON ENGINEER'S ESTIMATE OF QUANTITIES: SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B-3., inclusive)	**$**	-
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B-3., inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Item A-1.)	**$**	-
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B-3., inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Items A-1 through A-2., inclusive.)	**$**	-
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B-3., inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Items A-1 through A-3., inclusive.)	**$**	-
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B-3., inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Items A-1 through A-4., inclusive.)	**$**	-
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B-3., inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Items A-1 through A-5., inclusive.)	**$**	-

Company's Name

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF INELIGIBLE BID ITEMS			
Item B-1 - Replacement of Water Services				
B-1A.	For furnishing and installing 1-inch Polyvinyl Chloride Water Services and Associated Fittings from water main to property line as specified, the sum of $ -	per l.f.	2,040	$ -
B-1B.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	480	$ -
B-1C.	For furnishing and placing Permanent Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	100	$ -
	Item B-1 - Replacement of Water Services (Bid Items B-1A. through B-1C., inclusive)			**$ -**

Note: **Funding for the SRF Ineligible Bid Items is anticipated to be obtained at the Annual Town Meeting proposed to be held in June 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF INELIGIBLE BID ITEMS			
Item B-2 - Replacement of Canal Road Water Main				
B-2A.	For furnishing and installing 8-inch DI water main and Associated Fittings, as specified, the sum of $ -	per l.f.	2,060	$ -
B-2B.	For furnishing and installing 1-inch Polyvinyl Chloride Water Services and Associated Fittings from water main to property line as specified, the sum of $ -	per l.f.	320	$ -
B-2C.	For furnishing and installing 6-inch Gate Valves and Boxes, as specified, the sum of $ -	per each	6	$ -
B-2D.	For furnishing and installing 8-inch Gate Valves and Boxes, as specified, the sum of $ -	per each	7	$ -
B-2E.	For furnishing and installing Fire Hydrants, as specified, the sum of $ -	per each	6	$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
B-2F.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	560	$ -
B-2G.	For furnishing and placing Permanent Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	120	$ -
	Item B-2 - Replacement of Canal Road Water Main (Bid Items B-2A. through B-2G., inclusive)			**$** -

Note: **Funding for the SRF Ineligible Bid Items is anticipated to be obtained at the Annual Town Meeting proposed to be held in June 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF INELIGIBLE BID ITEMS			
Item B-3 - Water Quality Improvements				
B-3A.	For Brewster Cross Road Water Quality Improvements, as specified, the sum of			
	$ -	per l.s.	1	$ -
B-3B.	For Locust Road Water Quality Improvements, as specified, the sum of			
	$ -	per l.s.	1	$ -
	Item B-3 - Water Quality Improvements (Bid Items B-3A. through B-3B., inclusive)			**$** -

Note: **Funding for the SRF Ineligible Bid Items is anticipated to be obtained at the Annual Town Meeting proposed to be held in June 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
Item A-1- Pavement Restoration in Town Roadways				
1.	For Mobilization/Demobilization, as specified (maximum of five (5) percent of System Expansion bid), the sum of $ -	l.s.	1	$ -
2.	Sewer Pipelines and Associated Fittings - Not Used			
3.	Precast Concrete Manholes and Structures - Not Used			
4.	Manhole Frames, Covers and Grates - Not Used			
5.	Interior Manhole Drop Connections - Not Used			
6.	Chimneys - Not Used			
7.	Miscellaneous Cement Concrete - Not Used			
8.	Rock and Boulder Excavation - Not Used			
9.	Replacement of Unsuitable Material - Not Used			
10.	Experimental Excavation - Not Used			

Company's Name

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
11.	Fill for embankments – Not Used			
12.	Sheeting and/or shoring ordered left in place – Not Used			
13.	Soil Compaction Tests - Not Used			
14.	Road Gravel Material - Not Used			
15.A.	4-inch Temporary Bituminous Concrete Trench Pavement (base course) in State Roadways - Not Used			
15.B.	7-inch Permanent Bituminous Concrete Trench Width Pavement (3-inch base course and 4-inch intermediate course or 7-inch intermediate course) in State Roadways - Not Used			
15.C.	For milling and furnishing and placing 2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in State Roadways, as specified, the sum of *			
	$ -	per ton	2,500	$ -
	* Minimum Bid = $80/ton			
15.D.	Not Used			
15.E.	For furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	200	$ -
	* Minimum Bid = $80/ton			
15.F.	Dense Graded Gravel - Not Used			
15.G.	4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways - Not Used			

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.H.	For milling and furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	3,000	$ -
	* Minimum Bid = $80/ton			
15.I.	For Miscellaneous Restoration of Town Roadways, as specified, the sum of *			
	$ -	per ton	50	$ -
	* Minimum Bid = $80/ton			
15.J.	For furnishing and placing Miscellaneous Bituminous Concrete Pavement, as specified, the sum of *			
	$ -	per ton	240	$ -
	* Minimum Bid = $80/ton			
15.K.	For repair and/or replacement of the Vehicle Loop Detectors, as specified, the sum of			
	$ -	per each	20	$ -
15.L.	For repainting of Traffic Markings - Lines, Symbols and Wording, as specified, the sum of			
	Twenty Five Thousand Dollars and No Cents			
	$ 25,000.00	Allowance	1	$ -
16.	Remove and Relaying and/or Replace Existing Utilities - Not Used			
17.	Uniformed Traffic Police Officers - Paid by Owner			
18..	Engineer's Field Office - Not Used			
19.	Environmental Protection - Not Used			
20.	Trench Dewatering Equipment - Not Used			

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
21.	Temporary By-pass Pumping - Not Used			
22.	Highway Crossing - Not Used			
23.	Pumping Stations - Not Used			
24.	Tracer Wire in State Roadways - Not Used			
	Item A-1 - Pavement Restoration in Town Roadways (Bid Item 1. through 24., inclusive)	**$**		-

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
Item A-2 - Pumping Station No. 3 Tributary Area				
1.	For Mobilization/Demobilization, as specified (maximum of five (5) percent of System Expansion bid), the sum of $ -	l.s.	1	$ -
2.A.	For furnishing and installing 1-1/2-inch through 2-inch, inclusive, Polyvinyl Chloride/High Density Polyethylene Low Pressure Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,100	$ -
2.B.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Less Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	3,070	$ -
2.C.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Greater Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	8,440	$ -
2.D.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,020	$ -
2.E.	12-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths - Not Used			
2.F.	18-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths - Not Used			

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.G.	For furnishing and installing 6-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	2,610	$ -
2.H.	8-inch PVC Force Main and Associated Fittings, All Depths - Not Used			
2.I.	8-inch PVC Effluent Force Main and Associated Fittings, All Depths - Not Used			
2.J.	For furnishing and installing 1-1/4-inch Polyvinyl Chloride Low-Pressure Sewer Service Connections and Associated Fittings from main line to property line, All Depths, as specified, the sum of $ -	per l.f.	430	$ -
2.K.	For furnishing and installing 6-inch Polyvinyl Chloride Service Connections and Associated Fittings from main line to property line as specified, the sum of $ -	per l.f.	2,830	$ -
2.L.	For furnishing and installing LPS Wyes, All Depths, as specified, the sum of $ -	per each	13	$ -
2.M.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	95	$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.N.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	3	$ -
2.O.	12-inch Polyvinyl Chloride Sewer Wyes, All Depths - Not Used			
2.P.	18-inch Polyvinyl Chloride Sewer Wyes, All Depths - Not Used			
2.Q.	For furnishing and installing Low Pressure Sewer Main Line Valves, All Sizes and Depths, as specified, the sum of $ -	per each	2	$ -
3.A.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Less Than 10 feet in Depth, the sum of $ -	per each	13	$ -
3.B.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Greater Than 10 feet in Depth, the sum of $ -	per each	52	$ -
3.C.	For furnishing and installing 5-foot Diameter Precast Concrete Sewer Manholes, All Depths, as specified, the sum of $ -	per each	2	$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
3.D.	For furnishing and installing 6-foot Diameter Precast Concrete Low Pressure Sewer Terminal Flushing Manholes, All Depths, as specified, the sum of			
	$ -	per each	3	$ -
3.E.	6-foot Diameter Precast Concrete Effluent Force Main In-Line Flushing Manholes, All Depths - Not Used			
3.F.	6-foot Diameter Precast Concrete Leaching Catch Basins with Grates, All Depths - Not Used			
4.A.	For furnishing and installing Standard Manhole Frames and Covers, as specified, the sum of			
	$ -	per each	36	$ -
4.B.	For furnishing and installing Bolted and Gasketed Manhole Frames and Covers, as specified, the sum of			
	$ -	per each	34	$ -
5.	For furnishing and installing Interior Manhole Drop Connections, as specified, the sum of			
	$ -	per v.f.	20	$ -
6.	For furnishing and installing chimneys, as specified, the sum of			
	$ -	per v.f.	340	$ -
7.	For furnishing and placing miscellaneous cement concrete, as specified, the sum of			
	$ -	per c.y.	200	$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
8.	For Rock and Boulder Excavation including Replacement with Suitable Fill Material, as specified, the sum of *			
	$ -	per c.y.	250	$ -
	* Minimum Bid = $80/c.y.			
9.A.	For Replacement of Unsuitable Material Below Trench Grade and/or Subgrade, as specified, the sum of			
	$ -	per c.y.	400	$ -
9.B.	For Replacement of Unsuitable Material Above Trench Grade, as specified, the sum of			
	$ -	per c.y.	790	$ -
10.	For Experimental Excavation, as specified, the sum of			
	$ -	per c.y.	200	$ -
11	Fill for embankments – Not Used			
12.	Sheeting and/or shoring ordered left in place – Not Used			
13.	For performing Soil Compaction Tests, as specified, the sum of			
	$ -	per each	70	$ -
14.	For furnishing and placing Road Gravel Material, as specified, the sum of			
	$ -	per c.y.	5,160	$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.A.	For furnishing and placing 4-inch Temporary Bituminous Concrete Trench Pavement (base course) in State Roadways, as specified, the sum of $ -	per l.f.	6,600	$ -
15.B.	For furnishing and placing 7-inch Permanent Bituminous Concrete Trench Width Pavement (3-inch base course and 4-inch intermediate course or 7-inch intermediate course) in State Roadways, as specified, the sum of $ -	per l.f.	6,600	$ -
15.C.	For milling and furnishing and placing 2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in State Roadways, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	1,970	$ -
15.D.	Not Used			
15.E.	For furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	325	$ -
15.F.	For furnishing and placing Dense Graded Gravel, as specified, the sum of $ -	per c.y.	350	$ -
15.G.	For furnishing and placing 4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways, as specified, the sum of * $ -	per l.f.	12,200	$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.H.	For milling and furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	2,000	$ -

* Minimum Bid = $80/ton

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.I.	For Miscellaneous Restoration of State and Town Roadways, as specified, the sum of *			
	$ - * Minimum Bid = $80/ton	per ton	190	$ -
15.J.	For furnishing and placing Miscellaneous Bituminous Concrete Pavement, as specified, the sum of *			
	$ - * Minimum Bid = $80/ton	per ton	210	$ -
15.K.	For repair and/or replacement of the Vehicle Loop Detectors, as specified, the sum of			
	$ -	per each	10	$ -
15.L.	For repainting of Traffic Markings - Lines, Symbols and Wording, as specified, the sum of			
	Twenty Five Thousand Dollars and No Cents $ 25,000.00	Allowance	1	$ -
16.A.	For removal and relaying and/or replacement of Existing Water Mains, associated fittings, valves and services, as specified, the sum of			
	$ -	per inch-foot	6,000	$ -
16.B.	For removal and relaying and/or replacement of Existing Storm Drains, as specified, the sum of			
	$ -	per inch-foot	10,000	$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
16.C.	For removal and relaying and/or replacement of Existing Gas Mains and services, as specified, the sum of Fifty Thousand Dollars and No Cents $ 50,000.00	Allowance	1	$ -
16.D.	For removal and relaying and/or replacement of Existing Miscellaneous Utilities, as specified, the sum of Twenty Five Thousand Dollars and No Cents $ 25,000.00	Allowance	1	$ -
16.E.	6-inch Water Main Line Stops - Not Used			
16.F.	For furnishing and removal of 8-inch Water Main Line Stops, as specified, the sum of $ -	per each	7	$ -
16.G.	For furnishing and removal of 10-inch Water Main Line Stops, as specified, the sum of $ -	per each	1	$ -
17.	Uniformed Traffic Police Officers - Paid by Owner			
18.A.	For furnishing, installing, and removing Engineer's Field Office, as specified, the sum of $ -	per l.s.	1	$ -
18.B.	For maintaining Engineer's Field Office, as specified, the sum of $ -	per week	42	$ -
19.	For furnishing, installing, maintaining and removing Environmental Protection, as specified, the sum of $ -	per l.f.	2,830	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
20.	For furnishing, installing, maintaining and removing Trench Dewatering System, as specified, the sum of			
	$ -	per l.f.	11,220	$ -
21.	Temporary By-pass Pumping - Not Used			
22.A.	Highway Crossing via Horizontal Directional Drilling - Not Used			
22.B.	MassDOT Inspections - Not Used			
23.A.	Pumping Station No. 1 - Not Used			
23.B.	Pumping Station No. 2 - Not Used			
23.C.	For furnishing and installing Pumping Station No. 3, as specified, the sum of			
	$ -	per l.s.	1	$ -
23.D.	For Electric Company Connection/Service Fee, as specified, the sum of			
	Twenty Five Thousand Dollars and No Cents			
	$ 25,000.00	Allowance	1	$ -
23.E.	For Telephone Company Connection/Service Fee, as specified, the sum of			
	Ten Thousand Dollars and No Cents			
	$ 10,000.00	Allowance	1	$ -
23.F.	For Planting Operations, as specified, the sum of			
	Ten Thousand Dollars and No Cents			
	$ 10,000.00	Allowance	1	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
24.	For furnishing and installing Tracer Wire in State Roadways, All Depths, as specified, the sum of			
	$ -	l.f.	6,700	$ -
	Item A-2 - Pump Station No. 3 Tributary Area (Bid Item 1. through 24., inclusive)			**$ -**

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
	Item A-3 - Fiber Optic Conduits, Associated Fittings and Handholes			
A-3A.	For furnishing and installing 4-inch Fiber Optic Conduits and Associated Fittings, All Depths, as specified, the sum of $ -	l.f.	3,590	$ -
A-3B.	For furnishing and installing Fiber Optic Handholes, All Depths, as specified, the sum of $ -	ea.	10	$ -
	Item A-3 - Fiber Optic Conduits, Associated Fittings and Handholes (Bid Item A-3A. through A-3B., inclusive)			**$** -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
Item A-4 - Tracer Wire in Town Roadways				
A-4A.	For furnishing and installing Tracer Wire in Town Roadways All Depths, as specified, the sum of $ -	l.f.	28,100	$ -
	Item A-4 -Tracer Wire in Town Roadways (Bid Item A-4A., inclusive)		**$**	**-**

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
Item A-5 - Highway Crossing Using Jacking				
A-4A.	For Additional Cost to furnish and install the Highway Crossing Using Jacking versus furnishing and installing the Highway Crossing Using Horizontal Directional Drilling , as specified, the sum of $ -	l.s.	1	$ -
	Item A-5 - Highway Crossing Using Jacking (Bid Item A-5A., inclusive)			**$ -**

SECTION 02446

HORIZONTAL DIRECTIONAL DRILLING

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PART 1 - GENERAL

1.01 - SCOPE

A. The work of this section includes furnishing all labor, tools, equipment and materials, testing, restoration of underground utilities and environmental protection and restoration, and performing all operations in connection with the Horizontal Directional Drilling of the force mains and conduits and other related items, as specified herein and in the location shown on the drawings.

B. Horizontal Directional Drilling is required to install the High Density Polyethylene (HDPE) force mains and conduits under Route 6, (Mid Cape Highway) that is owned by the Massachusetts Department of Transportation (MassDOT) as shown on the Drawings and as specified herein, performing all testing and paying all MassDOT fees and all other work required to complete the Horizontal Directional Drilling operation as specified and in the location shown on the Drawings.

C. The 48-inch Casing Pipe shown on the drawings is not required to be provided as part of this section.

D. The Owner has obtained a MassDOT permit for the Highway Crossing via Jacking in accordance with SECTION 02150, HIGHWAY CROSSING (JACKING). If the Highway Crossing is provided via the Horizontal Directional Drilling, the Owner will prepare and request a modification to the MassDOT Permit to complete the Highway Crossing via Horizontal Directional Drilling.

E. The Contractor is responsible to maintain the existing condition of the existing drainage pipe in the State highway Layout. Any damage to the existing drainage pipe shall be repaired by the Contractor at no cost to the MassDOT or the Owner. The Contractor is responsible to provide all labor, materials and equipment as well to coordinate and obtain all necessary permits from the federal, state and/or local regulatory agencies for such substitution at no cost to the MassDOT and/or Owner.

F. The Contractor shall make all necessary arrangements with the MassDOT for the complete installation of the work prior to mobilization and shall do all work required to protect and maintain the roadway and its safe operation. The Contractor shall cooperate fully with the MassDOT and Owner throughout the construction of the work and complete the work as expeditiously as possible.

G. MassDOT fees for the services of an Inspector during the course of the work shall be paid to the MassDOT directly by the Contractor. The Contractor shall include an allowance of ten thousand dollars ($10,000) for these services in the General Bid section of this project.

H. The Contractor shall comply with the MassDOT Permit requirements included in SECTION 00858, SPECIAL CONDITIONS - PERMITS AND LICENSES and the following requirements:

1. The Contractor shall fully inform themselves of all requirements of the MassDOT as it pertains to the specified project and shall conduct all his work accordingly.
2. The Contractor shall make all necessary arrangements with the MassDOT before entering upon MassDOT property.
3. The MassDOT may require inspection personnel during construction. The MassDOT will provide at its sole discretion such personnel, as it deems necessary or advisable for this project.
4. The Contractor shall submit in writing to the Engineer and MassDOT for written approval the method of construction, plans and time schedule for the work to be completed. No work shall be ndertaken until written approval is given.
5. The Contractor shall provide the MassDOT a detailed Horizontal Directional Drilling submittal for review and approval prior to construction.
6. The Contractor shall give ten (10) working days written notice to the Engineer and the MassDOT prior to start of actual work.
7. MassDOT inspection of work shall be permitted at all times and the Contractor shall cooperate fully with the MassDOT's representative.
8. All equipment used by the Contractor on MassDOT property may be inspected by the MassDOT and shall not be used if considered unsatisfactory by the MassDOT representative. Operators of such equipment may be examined by the MassDOT representative to determine their fitness.
9. Route 6 Right-of-Way shall be kept free of obstructions at all times.
10. No work shall occur within the Route 6 Right-of-Way unless specified herein and/or approved in writing by the MassDOT.
11. All work shall be performed and completed in a manner fully satisfactory to the MassDOT's Chief Engineering or his/her authorized representative.
12. The Contractor shall obtain insurance as required by the MassDOT as included in SECTION 00858, SPECIAL CONDITIONS, PERMITS AND LICENSES and DIVISION 00700, GENERAL CONDITIONS.
13. No blasting is permitted under and/or adjacent to Route 6 road surface.
14. The Contractor shall submit a Trench Permit application with the Town of Orleans and comply with the terms of the Trench Permit.

I. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. The Contractor is responsible to obtain and provide a surety bond in the amount of $500,000 to cover the Crossing work located within the MassDOT Roadway identified as Mid Cape Highway (Route 6).

C. An allowance of $10,000 has been identified in the Bid Proposal to cover the salary, subsistence and travel expenses for any inspector appointed by the MassDOT to supervise the work contemplated.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT C-700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT C-700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. WORK PLAN: A general work plan outlining the procedure and schedule to be used to execute the project. The Plan should document the thoughtful planning required to successfully complete the project.

2. EQUIPMENT and MATERIALS: Specifications on directional boring equipment and materials to be used to ensure that the equipment and materials are adequate to complete the project.

(a) Size, capacity and arrangement of equipment.

(b) Location and size of drilling and receiving pits.

(c) Dewatering and methods of removing spoils material.

(d) Method of installing detection wire and pipe.

(e) Type, location and method of installing locator station.

(f) Method of fusion pipe segment and type of equipment.

(g) Type of cutting head.

(h) Method of monitoring and controlling line and grade.

(i) Detection of surface movement.

(j) Bentonite drilling mud for information only:

- Products information, material specifications, and handling procedures.
- Material safety data sheet and special precautions required.
- Method of mixing and application.

3. FIRM: Documentation of contractor's similar experience of at least 10 years. Document shall include, but not be limited to, the owner's name, address, telephone number, contact person, date and duration of work, location, pipe information, and contents handled by pipeline.
4. PERSONNEL: Documentation of contractor's supervisory field personnel similar experience and training of at least 5 years. Document shall include, but not be limited to, the owner's name, address, telephone number, contact person, date and duration of work, location, pipe information, and contents handled by pipeline.

1.05 - PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. The requirements set forth in this document specify a wide range of procedural precautions necessary to ensure that the very basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this specification. Adherence to the specifications contained herein, or the Engineer's approval of any aspect of any directional bore operation covered by this specification, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the Contract.

C. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

D. Complete horizontal directional drilling so as not to interfere with, interrupt, or endanger surface and activity thereon.

E. Experience: The contractor shall be actively engaged in horizontal directional drilling for minimum of 10 years.

F. Field Supervisory Personnel: The contractor's field supervisory personnel shall have a minimum of 5 years' experience in the performance of the work and tasks required. At least one field supervisors listed must be at the site when horizontal directional drilling operations are in progress.

PART 2 - PRODUCTS

2.01 - EQUIPMENT REQUIREMENT

A. General - The directional boring equipment shall consist of a directional boring rig of sufficient capacity to perform the bores and pullback the pipe, a boring fluid mixing and delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

B. Boring System

1. Boring Rig - The directional boring machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the crossing. The hydraulic power system shall be self-contained with sufficient pressure and volume to power boring operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations. The rig shall be grounded during boring and pull-back operations. Sufficient spares shall be kept on hand for any break-down which can be reasonably anticipated.

2. Bore Head - The bore head shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and boring fluid jets.

3. Mud Motors (if required) - Mud motors shall be of adequate power to turn the required boring tools.

4. Drill Pipe - Shall be constructed of high quality 4130 seamless tubing, grade D or better, with threaded box and pins. Tool joints should be hardened to 32-36 RC.

C. Guidance System - The Guidance System shall be of a proven type and shall be setup and operated by personnel trained and experienced with this system. The Operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of the guidance system if using a magnetic system.

D. Boring Fluid (Mud) System

1. Mixing System - A self-contained, closed, boring fluid mixing system shall be of sufficient size to mix and deliver boring fluid composed of bentonite clay, potable water and appropriate additives. Mixing system shall be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping and ensure thorough mixing. Mixing system shall continually agitate the boring fluid during boring operations.

2. Boring Fluids - Drilling fluid shall be composed of clean water and an appropriate additive. Water shall be from a clean source with a pH of 8.5 to 10. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal. The water and additives shall be mixed thoroughly and be absent of any clumps or clods. No hazardous additives may be used. Boring fluid shall be maintained at a viscosity sufficient to suspend cuttings and maintain the integrity of bore wall.

3. Delivery System - The mud pumping system shall be capable of delivering the boring fluid at a constant rate. The delivery system shall have filters in-line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be relatively leak-free. Used boring fluid and boring fluid spilled during boring operations shall be contained and legally disposed of. A berm, minimum of 12-inch high, shall be maintained around boring equipment, boring fluid mixing system, entry and exit pits and boring fluid recycling system (if used) to prevent spills into the surrounding environment. Pumps and or vacuum truck(s) of sufficient size shall be in place to convey excess boring fluid from containment areas to storage facilities.

E. Other Equipment

1. Pipe Rollers - Pipe rollers, if required, shall be of sufficient size to fully support the weight of the pipe while being hydro-tested and during pull-back operations. Sufficient number of rollers shall be used to prevent excess sagging of pipe.

2. Pipe Rammers/Pullers - Hydraulic or pneumatic pipe rammers or pullers may only be used if necessary and with the authorization of Engineer.

F. Other Equipment - Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding sections shall not be used unless approved by the Engineer prior to commencement of the work. Consideration for approval shall be made on an individual basis for each specified location. The proposed device or system shall be evaluated prior to approval or rejection on its potential ability to complete the utility placement satisfactorily without undue stoppage and to maintain line and grade within the tolerances prescribed by the particular conditions of the project.

2.02 - MATERIALS

A. Force Mains and Conduits

1. Force Mains and Conduits shall be in accordance with SECTION 02630, HIGH DENSITY POLYETHYLENE FORCE MAIN.
2. All couplings, fittings, adapters, valves, reducers, and wyes shall be compatible with the type of pipe used.
3. Mechanical Couplings are not permitted for joining of directional drilled pipe sections.

B. Drilling Fluid

1. Bentonite drilling mud compatible with the environment.
2. Waste oil or environmentally non-compatible polymers shall be part of composition.

C. Detection Wire: TW, THW, THWN, or HMWPE insulated copper, 10 gage or thicker wire.

D. Locator Station

1. Underground Flush Mounted
   (a) Tube minimum 15 inches long with minimum inside diameter of 2-1/2-inches made of non-corrosive material, schedule 40 PVC, HDPE, or equal.
   (b) Factory attached cast iron or high-impact plastic collar with ribs to prevent rotation when removing locking lid after locator station is set in concrete.
   (c) Light blue cast iron or high-impact plastic locking lid that will withstand AASHTO H-20 traffic loads and ultra-violet rays.
   (d) Mark locking lid to identify pipeline with a permanent identification such as P.S. Locator.
   (e) Terminal block made of high dielectric material, which is made of phenolic resin, plastic, micarta, Lexan or Bakelite for each locator station.
   (f) Terminal block furnished with two 3/16-inch threaded studs, nuts, and washers made of nickel-plated brass.
   (g) Approved manufacturers: C.P. Test Services, Inc., Model Mini; Handly, Industries, Model T2IS2; or equal.
2. Manhole Mounted
   (a) Waterproof enclosure made from cast aluminum, galvanized steel, high-impact plastic, Lexan, Gyrlyn, or equal.
   (b) Light blue schedule 40 PVC pipe or schedule 40 galvanized steel with outside diameter of at least 3/4-inch to mount enclosure.
   (c) Use similar materials for pipe and enclosure to fasten enclosure onto pipe following manufacturer's instructions.
   (d) Approved manufacturers: Cott Manufacturing Company, Model Finklet or Finkplate, 2 leads; Gerome Manufacturing Company, Inc., Model Testox Series 300, 2 leads; or equal.

PART 3 - EXECUTION

3.01 - GENERAL

A. The Contractor shall give ten (10) working days written notice to the Engineer and the MassDOT prior to start of actual work.

B. The Engineer and the MassDOT must be notified 48 hours in advance of starting work. The Directional Bore shall not begin until the Engineer is present at the job site and agrees that proper preparations for the operation have been made.

C. The Engineer approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the Contract.

3.02 - PERSONNEL REQUIREMENTS

A. All personnel shall be fully trained in their respective duties as part of the directional boring crew and in safety. Training shall be provided specific to the project if any potential hazards may be encountered which has not already been included in personnel's training.

3.03 - BORING PROCEDURE

A. Site Preparation - Prior to any alterations to work-site, contractor shall photograph or video tape entire work area, including entry and exit points. One copy of each shall be given to Engineer and the MassDOT and one copy to remain with contractor for a period of one year following the completion of the project. Work site as indicated on drawings, within right-of-way, shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made. Contractor shall confine all activities to designated work areas.

B. Bore Path Survey - Entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings. If contractor is using a magnetic guidance system, drill path shall be surveyed for any surface geo-magnetic variations or anomalies.

C. Environmental Protection - Contractor shall place silt fence between all boring operations and any drainage, wetland, waterway or other area designated for such protection by con- tract documents, state, federal and local regulations. Additional environmental protection necessary to contain any hydraulic or boring fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. Contractor shall adhere to all applicable environmental regulations. Fuel or oil may not be stored in bulk containers within 200-feet of any waterbody or wetland.

D. Utility Locations - Contractor shall notify all companies with underground utilities in the work area. Once the utilities have been located Contractor shall physically identify (test pit) the exact location of the utilities by vacuum or hand excavation, when possible, in order to determine the actual location and path of any underground utilities which might be within 20 feet of the bore path. Contractor shall not commence boring operations until the location of all underground utilities within the work area have been verified.

E. Safety - Contractor shall adhere to all applicable state, federal and local safety regulations and all operations shall be conducted in a safe manner. Safety meetings shall be conducted at least weekly with a written record of attendance and topic submitted to Engineer.

F. Pipe - Pipe shall be connected together in one length prior to pull-back operations, if space permits. Pipe shall be placed on pipe rollers before pulling into bore hole with rollers spaced close enough to prevent excessive sagging of pipe.

G. Pilot Hole

1. Pilot hole shall be drilled on bore path with no deviations greater than 5 percent of depth over a length of 100-feet. In the event that pilot does deviate from bore path more than 5 percent of depth in 100-feet, contractor shall notify Engineer and Engineer may require contractor to pull-back and re-drill from the location along bore path before the deviation.

2. In the event that a boring fluid fracture, inadvertent returns or returns loss occurs during pilot hole boring operations, contractor shall cease boring, wait at least 30 minutes, inject a quantity of boring fluid with a viscosity exceeding 120 seconds as measured by a March funnel and then wait another 30 minutes. If mud fracture or returns loss continues, contractor shall cease operations and notify Engineer. Engineer and Contractor shall discuss additional options and work shall then proceed accordingly.

H. Reaming - Upon successful completion of pilot hole, Contractor shall ream bore hole to a minimum of 25 percent greater than outside diameter of pipe using the appropriate tools. Contractor shall not attempt to ream at one time more than the boring equipment and mud system are designed to safely handle.

I. Pull-Back

1. After successfully reaming bore hole to the required diameter, contractor shall pull the pipe through the bore hole. In front of the pipe shall be a swivel. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. During pull-back operations contractor shall not apply more than the maximum safe pipe pull pressure at any time.

2. In the event that pipe becomes stuck, contractor shall cease pulling operations to allow any potential hydro-lock to subside and shall commence pulling operations. If pipe remains stuck, contractor shall notify Engineer. Engineer and contractor shall discuss options and then work shall proceed accordingly.

3.04 - PIPE TESTING

A. Following successful pull-back of pipe, contractor shall hydro-test pipe using potable water.

B. The pressure pipe shall be tested in the presence of the Engineer, by water to a pressure equal to 2 times the total dynamic head of the Prefabricated Low-Pressure Sewage Pump Systems to which the pressure pipe is attached, unless the test pressure is greater than the working pressure of the pipe. In that case the pipe shall be tested to the working pressure of the pipe. Testing shall conform to the requirements of the AWWA Standard C600. The Engineer shall provide the test pressure. This pressure shall be held for a period of at least 15 minutes, allowing a maximum pressure drop of 5 psi. Any defective work shown by this test shall be replaced at no additional cost to the Owner.

C. All equipment, labor, water, gauges, and the like for the testing of the force main shall be supplied at no additional cost to the Owner.

D. After successful completion of hydro-test, pipe shall be pigged dry and caps provided at each end of the line.

3.05 - SITE RESTORATION

A. Following boring operations, contractor shall de-mobilize equipment and restore the worksite to original condition. All excavations shall be backfilled and compacted to 95 percent of original density. Landscaping shall be restored to original.

3.06 - RECORD KEEPING

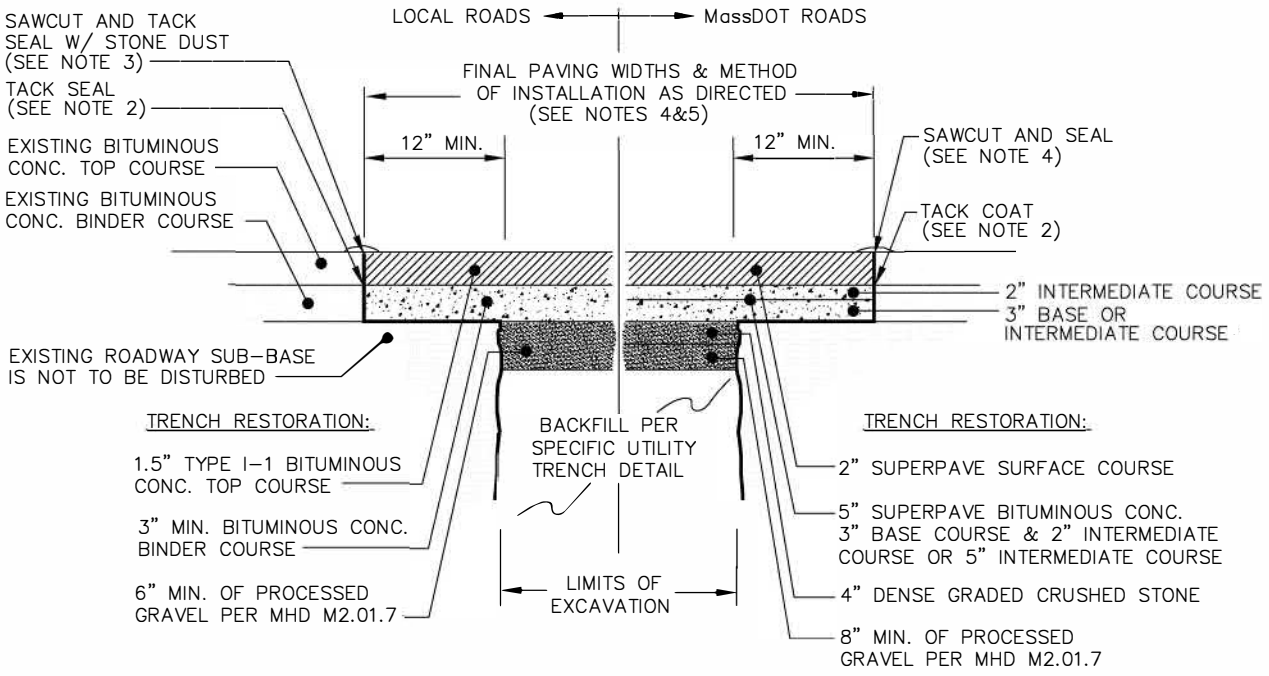
A. Contractor shall maintain a daily project log of boring operations and a guidance system log with a copy given to Engineer at completion of project.

B. As-built drawings shall be certified as to accuracy by contractor.

3.07 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION



1. ALL INSTALLATION AND MATERIAL SPECIFICATIONS PER MASS. HIGHWAY DEPARTMENT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES, 2020 AS AMENDED, AND THE REQUIREMENTS OF THE MASSDOT PERMIT 5-2019-0487.
2. ASPHALT EMULSION TACK COAT (RS-IH) MUST BE PLACED BETWEEN EACH COURSE.
3. ALL EXPOSED JOINTS ARE TO BE SEALED WITH TACK AND STONE DUST.
4. ALL VERTICAL EDGES MUST BE COATED WITH HOT POURED JOINT SEALER
5. FINAL PAVEMENT REPAIR JOINTS MUST BE SQUARE AND PERPENDICULAR TO THE DIRECTION OF TRAVEL.
6. ANY TOP COURSE APPLIED AT A WIDTH OF 6' WIDE OR GREATER IS TO BE PLACED BY MACHINE/BOX SPREADER WHEN & AS DIRECTED BY THE TOWN OF ORLEANS.

TYPICAL TRENCH REPAIR & PAVEMENT SECTION DETAIL

NOT TO SCALE

	Orleans Standard Details TYPICAL TRENCH REPAIR & PAVEMENT SECTION DETAIL		
SHEET REFERENCE: 99 C-507	SCALE: Not to Scale	DATE: April 2020	

PATH/FILENAME: C-DETAILS-ALL.DWG
LAST UPDATE: Thursday, April 02, 2020 8:25:47 AM PLOT DATE: Friday, April 17 2020 7:57:55 AM

SECTION 00100

ADVERTISEMENT FOR BIDS

TOWN OF ORLEANS, MASSACHUSETTS

DOWNTOWN AREA COLLECTION SYSTEM AND PUMPING STATIONS

CONTRACT NO. 2019-02 AND SRF NO. 4486

1. The Town of Orleans, MA acting through the Town of Orleans Town Administrator will receive sealed bids for Downtown Area Collection System and Pumping Stations, Contract No. 2019-02 and SRF No. 4486. The scope of work includes constructing approximately 32,200 linear feet of 8-inch, 10-inch, 12-inch and 18-inch PVC gravity sewer and appurtenances, approximately 11,400 linear feet of 6-inch and 8-inch PVC and HDPE force main and appurtenances, approximately 2,100 linear feet of 2-inch low pressure sewer and appurtenances and 3 Submersible Pumping Stations and appurtenances all to provide wastewater service to the Downtown Area of Orleans, MA.

2. The Work of the Project shall be completed within 751 calendar days following execution of the Contract Document using not more than 304 working days.

3. Sealed bids will be received at the Town Administrator's Office, Orleans Town Hall, 19 School Road, Orleans, Massachusetts, 02653 until 2:00 p.m. prevailing time, on May 6, 2020 at which time and place said bids will be publicly opened and read aloud. Any bid received after this date and time will be returned to the applicant unopened. No exceptions will be made. Faxed/emailed bids will not be accepted.

   Unforeseen Office Closure – if, at the time of the scheduled bid opening, Orleans Town Hall is closed due to uncontrolled events such as fire, snow, ice, wind, or building evacuation, the bid opening will be postponed until 9:00 a.m. on the next normal business day. Bids will be accepted until that date and time.

   Bids must be submitted in a sealed envelope indicating the applicant's name and address and clearly marked "Downtown Area Collection System and Pumping Stations, Contract No. 2019-02 and SRF No. 4486".

4. Bidding Documents may be obtained electronically from the office of the Tighe & Bond, Inc.'s (Owner's Project Manager) website at: http://www.tighebond.com/Projects_Out_to_Bid.php.

   Prospective bidders must complete a one-time registration process on the web site in order to receive log-in credentials. Bidders must log in to the web site to download bidding documents for the project. Bidders will be added to the "plan holders" or prospective bidders list upon downloading the bidding documents for the project. Partial sets of Bidding Documents will not be provided by the Owner, Owner's Project Manager nor Engineer. Neither OWNER, Owner's Project Manager nor Engineer will be responsible for full or partial sets of the Contract Documents, including Addenda, if any, obtained from sources other than the Issuing Office. Contract Documents will be available for distribution on February 5, 2020.

   The Instructions to Bidders, Form of General Bid, Agreement, Plans, Specifications, Performance and Payment Bond, and other Contract Documents may be examined between the hours of 9:00 am and 3:00 pm at AECOM Technical Services, Inc., 9 Jonathan Bourne Drive, Pocasset, Massachusetts 02559.

   Interpretations or clarifications to questions (submitted through Tighe & Bond, Inc.'s website in writing - typed, not handwritten), considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all parties recorded as having received the Bidding Documents. Questions received less than seven days prior to the date for opening of Bids may not be answered.

5. A non-mandatory Pre-bid Conference will be held on February 20, 2020 at the Orleans Town Hall, 19 School Road, Orleans, Massachusetts, 02653 at 9:00 a.m. prevailing time. Bidders will have an opportunity to view the site of the work during the non-mandatory Pre-bid Conference.

6. Each bid must be accompanied by a five (5) Percent Bid Security in the form of a bid bond, cash, certified check, treasurer's or cashier's check payable to the Owner in the amount of five percent of the bid, in accordance with SECTION 00200 - INSTRUCTIONS TO BIDDERS. If, upon acceptance of a Bid, a Bidder fails to enter into a Contract with the Town of Orleans, MA, the bid security shall be forfeited to and become the property of the Town of Orleans, MA.

Contract payment will be by the unit price method and the lump sum price method as indicated on the Bid Proposal. No Bidder may withdraw his/her Bid prior to June 30, 2020 or the date of award whichever shall occur first.

The successful Bidder must furnish a 100 percent Performance Bond and a 100 percent Payment Bond with a surety company satisfactory to the Town of Orleans, MA and conforming to SECTION 00610, PERFORMANCE BOND and SECTION 00615, PAYMENT BOND.

All bids for this project are subject to applicable bidding laws of Massachusetts, including General Laws Chapter 30, Section 39M as amended. This project shall also comply with Sections 39F, 39K, 39N, and 39O of Chapter 30 of the General Laws of the Commonwealth of Massachusetts as last revised.

7. Prevailing Wage Rates as issued by the Department of Labor Standards (DLS) under the provisions of the Massachusetts General Laws Chapter 149, Section 26 to 27D, as amended, apply to this project.

   The Prevailing Wage Rates for those trades people who may be employed for the proposed installation work under this contract is included in the RFP documents. Prevailing Wage Rates for this project were obtain and are included in Document 00830 under Attachment A.

   A weekly certified payroll submittal shall be required of the successful bidder in accordance with MGL C149, S27B. No payments will be made by the Town of Orleans, MA until all payroll information necessary for the Town to determine compliance with prevailing wage law requirements for the time period of the payment request have been submitted.

8. Bidders are not to include in their Bid Proposal sales and compensating use taxes on materials and supplies purchased for this project. All materials used are tax exempt.

9. This Contract to be awarded as the result of this Advertisement for Bids is funded in part through the Massachusetts Department of Environmental Protection, Bureau of Resource Protection, by loans from the Massachusetts Clean Water Trust. This Contract will be subject to the Department of Environmental Protection regulations contained in 310 CMR 44.00, "DEP Selection, Approval and Regulation of Water Pollution Abatement Projects Receiving Financial Assistance from the State Revolving Fund" in effect on the date of issuance of the assistance award (DEP Project Approval Certificate) by the Department.

10. Disadvantaged Business Enterprise (DBE) goals are applicable to the total dollars paid to the construction contract. The goals for this project are a minimum of 4.2 percent D/MBE participation and 4.5 percent D/WBE participation by certified DBEs. The two low bidders shall submit completed DBE forms (EEO-DEP-190C, EEO-DEP-191C and the DBE Certification of United States Citizenship form) by the close of business on the third business day after bid opening. Failure to comply with the requirements of this paragraph may be deemed to render a proposal non-responsive. No waiver of any provision of this section will be granted unless approved by the Department of Environmental Protection (MassDEP)."

11. The project does not require the Contractor to have a DCAM Certification or MassDOT Highway Division Certification.

12. The Project requires compliance with the Massachusetts Diesel Retrofit Program (MDRP) by use of engine emission controls that are EPA certified, or their equivalent, on the off-road (non-registered) diesel vehicles/equipment used at the job site. Bidders must submit a signed and dated Statement of Intent to Comply as part of their Bid Proposal Document. Failure to comply with these MassDEP requirements may be deemed to render a proposal nonresponsive. No waiver of any provision of these MassDEP requirements will be granted unless approved by the MassDEP.

13. The Contractor shall not discriminate about the personnel employed on this project on the basis of race, color, creed, national origin, gender, sexual preference, handicap or age.

14. The Owner reserves the right to award the Project subject to appropriation.

15. The Town of Orleans, MA reserves the right to accept and/or reject any and all bids and to waive any informalities to the extent allowed by law, and to make the award as deemed to be in the best interest of the Town.

Town of Orleans, MA

John F. Kelly, Orleans Town Administrator

END OF DOCUMENT

SECTION 00200

INSTRUCTIONS TO BIDDERS

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1.01 RECEIPT AMD OPENING OF BIDS

A. Town of Orleans, MA herein called the OWNER, will receive sealed Bids for the Downtown Area Collection System and Pumping Stations, Contract No. 2019-02 and SRF No. 4486.

B. Sealed bids will be received by the Owner at the Orleans Town Hall, 19 School Road, Orleans, Massachusetts, 02653 until 2:00 p.m. prevailing time, on April 22, 2020 at which time and place said bids will be publicly opened and read aloud. Any bid received after this date and time will be returned to the applicant unopened. Any bid received from a bidder who did not attend the mandatory pre-bid conference will be returned to the applicant unopened. No exceptions will be made. Faxed/emailed bids will not be accepted.

C. If the building at which bids are to be received is closed for any reason on the date and time that bids are due, receipt of bids by the Owner will be postponed until the next business day at the time originally stated for receipt of bids.

D. Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified will not be considered. By submission of a bid, the bidder agrees that this bid shall be good and may not be withdrawn for the number of days, after the opening of bids, as stipulated in the FORM OF GENERAL BID.

E. A non-mandatory Pre-Bid Conference was held on February 20, 2020 at 9:00 am at the Town of Orleans, 19 School Road, Orleans, MA 02653. Refer to the attached Attendance List and Presentation.

1.02 LOCATION AND WORK TO BE DONE

A. The location, general characteristics, and principal details of the Work are indicated on a set of drawings titled "Downtown Area Collection System and Pumping Stations".

B. Additional drawings showing details in accordance with which the Work is to be done may be furnished by addendum from time to time during the bidding period by the Engineer, and shall then become a part of the Contract Documents.

C. The Contractor shall furnish all superintendence, labor, services, materials, equipment, plant, machinery, apparatus, appliances, tools, supplies, bailing, shoring, removal, and all other things necessary to do all work required for the completion of each item of the Work and as herein specified.

D. The Work to be done and paid for under any item shall not be limited to the exact extent mentioned or described but shall include all incidental work necessary or customarily done for the completion of that item.

1.03 PREPARATION OF BID

A. Each bid must be submitted on the prescribed form in SECTION 00410- FORM OF GENERAL BID. All blank spaces for bid prices must be filled in, in ink or typewritten, in both words and figures.

B. Enclosed with the bid shall be the following:

1) Bid Security (5%);

2) Completed and signed Bid Proposal and Project Reference List;

3) Insurance Requirements for Inclusion in All Specifications and Contracts;

4) Statement of State Tax Compliance;

5) Certificate of Non-Collusion;

6) Acknowledgement of Principal, if a Corporation;

7) Acknowledgement of Principal, if a Partnership; and

8) Certification of OSHA 10-Hour Training.

C. Each bid must be submitted in a sealed envelope bearing on the outside the name of the bidder, its address, and endorsed with the name of the project as specified in Receipt and Opening of Bids, above.

D. If forwarded by mail, the sealed envelope containing the bid must be enclosed in another envelope addressed as specified in Receipt and Opening of Bids, above.

1.04 MODIFICATION OF BIDS

A. Any bidder may modify its bid by email at any time prior to the scheduled closing time for receipt of bids, provided such transmission is received by the OWNER prior to the closing time, and, provided further, the OWNER is satisfied that a written confirmation of the modification over the signature of the bidder was mailed prior to the closing time. Email bid modifications to jkelly@town.orleans.ma.us.

B. The modification communication shall not reveal the bid price but shall provide the addition or subtraction or other modification so that the final prices or terms will not be known by the Owner until the sealed bid is opened. If written confirmation is not received within two days prior to the closing time, no consideration will be given to the email transmission.

1.05 OBLIGATION OF BIDDER

A. At the time of the opening of bids each bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the Contract Documents (including all addenda). The failure or omission of any bidder to examine any form, instrument, or document shall in no way relieve any bidder from any obligation in respect of its bid.

1.06 INFORMATION NOT GUARANTEED

A. All information given in the Contract Documents relating to subsurface and other conditions, natural phenomena, existing pipes, and other structures is from the best sources at present available to the Owner. All such information is furnished only for the information and convenience of bidders and is not guaranteed.

B. It is agreed and understood that the OWNER does not warrant or guarantee that the subsurface or other conditions, natural phenomena, existing pipes, or other structures encountered during construction will be the same as those indicated in the Contract Documents.

C. It is further agreed and understood that no bidder or Contractor shall use or be entitled to use any of the information made available to it or obtained in any examination made by it in any manner as a basis of or grounds for any claim or demand against the Owner or the Engineer, arising from or by reason of any variance which may exist between the information made available and the actual subsurface or other conditions, natural phenomena, existing pipes or other structures actually encountered during the construction work, except as may otherwise be expressly provided for in the Contract Documents.

1.07 BID SECURITY

A. Each bid must be accompanied by a certified check, a bid bond, cash, a treasurer's or cashier's check, payable to the OWNER, in the amount stated in SECTION 00100 - ADVERTISEMENT FOR BIDS. Such deposits will be returned to all except the three lowest responsible and eligible bidders within five days, Saturdays, Sundays, and legal holidays excluded, after the opening of bids, and the remaining deposits will be returned promptly after the OWNER and the accepted bidder have executed the Contract, or if no notice of intent to award has been presented to any bidder within 30 days, Saturdays, Sundays and legal holidays excluded, after the date of the opening of bids, upon demand of the bidder at any time thereafter.

1.08 TIME FOR COMPLETION

A. The bidder must agree to commence work on or before a date to be specified in the written "Notice to Proceed" from the OWNER and to fully complete the project within the time limit stated in Section 00410 - FORM OF GENERAL BID.

1.09 ADDENDA AND INTERPRETATIONS

A. No interpretation of the meaning of the plans, specifications or other pre-bid documents will be made to any bidder orally, and if provided orally, shall not be relied upon by bidders unless confirmed in a written addendum. All information given to bidders other than by means of the plans, specifications, or by addenda, as described below, is given informally and shall not be used as the basis of a claim against the OWNER or the ENGINEER.

B. Every request for such interpretation should be in writing (typed, not handwritten) addressed to AECOM, Attention: Martin "Reggie" Donoghue, P.E.,9 Jonathan Bourne Drive, Pocasset, Massachusetts 02559 or sent via email at Martin.Donoghue@aecom.com and to be given consideration must be received at least ten working days prior to the date fixed for the opening of bids.

C. Addenda will be emailed to all prospective bidders to email addresses furnished by them for such purposes. Bidders picking up sets of bid documents will be given all addenda issued to date and will be required to sign for all documents, acknowledging receipt.

D. Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder from any obligation under its bid as submitted and each bidder must confirm for itself that it has received all addenda. All addenda so issued shall become part of the Contract Documents.

1.10 BID OPENING PROCEDURE

A. The following list of requirements shall be met by each filed bid.

B. Bids shall be filed at the place and before the time specified in Receipt and Opening of Bids, above.

C. The bid and all accompanying documents so required shall be signed by the Bidder or its authorized representative before submission.

D. All bidders shall include with their bids written acknowledgment of receipt of all addenda. Refer to acknowledgment form provided in SECTION 00410, FORM OF GENERAL BID.

E. The total dollar amount of each bid will be read, and the three apparent lowest bids will be selected for further consideration. These three apparent low bids will be read aloud for the benefit of the other bidders and the bid opening procedure will be closed. All those present at the bid opening may examine all bids after the bid opening and after the reading of the three apparent low bids.

1.11 COMPARISON OF BIDS

A. Bids will be compared on the basis of the quantities and unit and lump sum prices stated in the bid forms.

B. In the event that there is a discrepancy in SECTION 00410 - FORM OF GENERAL BID between the lump sum or unit prices written in words and figures, the prices written in words will govern.

C. The Owner agrees to examine and consider each SECTION 00410 - FORM OF GENERAL BID submitted in accordance with the terms and conditions set forth herein and as set forth in SECTION 00410, FORM OF GENERAL BID.

1.12 STATUTES REGULATING COMPETITIVE BIDDING

A. Any bid, which does not comply with the provisions of Massachusetts General Laws Chapter 30, Section 39M as amended, need not be accepted and the OWNER may reject every such bid.

1.13 RIGHT TO REJECT BID

A. The OWNER may consider informal any bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities or reject any and all bids, should the OWNER deem it to be in the public interest to do so.

B. The OWNER may also reject bids which in its sole judgment are either incomplete, conditional, obscure or not responsive or which contain additions not called for, erasures not properly initialed, alterations, or similar irregularities, and may reject bids for any other reason permitted by law, or the OWNER may waive such omissions, conditions or irregularities.

1.14 ABILITY AND EXPERIENCE OF BIDDER

A. No award will be made to any bidder who cannot satisfy the OWNER that he has sufficient ability and experience in this class of work and sufficient capital and plant to enable him to prosecute and complete the work successfully within the time named. The OWNER's decision or judgment on these matters will be final, conclusive, and binding to the fullest extent permitted by law.

B. The OWNER may make such investigations as it deems necessary, and the bidder shall furnish to the OWNER, under oath if so required, all such information and data for this purpose as the OWNER may request.

1.15 CONDITIONS OF WORK

A. Each bidder must inform itself fully of the conditions relating to the construction of the project and the employment of labor thereon. Failure to do so will not relieve a successful bidder of its obligation to furnish all material and labor necessary to carry out the provisions of its contract. Insofar as possible the CONTRACTOR, in carrying out its work, must employ such methods or means as will not cause any interruption of or interference with the work of any other contractor.

1.16 SECURITY FOR FAITHFUL PERFORMANCE

A. Simultaneously with his delivery of the executed Contract, the CONTRACTOR shall furnish a surety bond or bonds as security for faithful performance of this Contract and for the payment of all persons performing labor and materials under this Contract as specified in SECTION - 00700, GENERAL CONDITIONS included herein, each in the amount of 100 percent of its bid. The surety on such bond or bonds shall be a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the OWNER. The bonds shall remain in force for one year after final acceptance of the work by the OWNER, unless the OWNER, in writing, releases the CONTRACTOR from the obligation sooner.

1.17 POWER OF ATTORNEY

A. Attorneys-in-fact who sign Contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

1.18 LAWS AND REGULATIONS

A. Applicable provisions of Massachusetts General Laws and Regulations and/or the United States Code and Code of Federal Regulations govern this Contract and any provision in violation of the foregoing shall be deemed null, void and of no effect. Where conflict between Code of Federal Regulations and State Laws and Regulations exist, the more stringent requirement shall apply

B. The bidder's attention is directed to the fact that all applicable State laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the Contract throughout, and they will be deemed to be included in the Contract the same as though herein written out in full.

C. Attention is directed to SECTION 00830 - STATE REGULATIONS and to other applicable sections of this specification. In the event of any conflict between provisions of law or regulation quoted or paraphrased in the Contract Documents, the actual provisions of law or regulation shall control.

D. Whenever it is written that an equipment manufacturer must have a specified period of experience with its product, equipment which does not meet the specified experience period can be considered, if the equipment supplier or manufacturer is willing to provide an Letter of Credit or cash deposit for the duration of the specified time period which will guarantee replacement of that equipment in the event of failure.

1.19 LIQUIDATED DAMAGES FOR FAILURE TO ENTER INTO CONTRACT

A. The successful bidder, upon its failure or refusal to execute and deliver the Contract, Bonds and Certificates of Insurance required within 10 days after receipt of notice of the acceptance of the bid, shall, except as otherwise provided by applicable law, forfeit to the OWNER, as liquidated damages for such failure or refusal, the security deposited with its bid, provided that the amount forfeited shall not exceed the difference between its bid price and the bid price of the next lowest responsible and eligible bidder.

B. In case of death, disability, bonafide clerical or mechanical error of a substantial nature, or other similar unforeseen circumstances affecting the bidder, its bid deposit will be returned.

1.20 INDETERMINATE ITEMS AND ESTIMATED QUANTITIES

A. The work to be done under this Contract has been divided into parts or items, if applicable, to enable each bidder to bid on different portions of the work in accordance with its estimate of their cost and so that the actual quantity of work executed under each item may be paid for at the price bid for that particular item, even though each bidder may have judged that such quantity may be greater or less than the estimated quantity stated in SECTION 00410 - FORM OF GENERAL BID.

1.21 CONTRACTOR RECORDS

A. The CONTRACTOR shall comply with the provisions of Massachusetts General Laws, Chapter 30, Section 39R, concerning CONTRACTOR records. This section has been reprinted in Section 00830, STATE REGULATIONS.

1.22 MINIMUM WAGE RATES – BIDDER'S RESPONSIBILITY

A. Minimum Wage Rates as determined by the Commissioner of Department of Workforce Development under the provision of the Massachusetts General Laws, Chapter 149, Sections 26 to 27D, as amended, apply to this project. It is the responsibility of the contractor, before bid opening, to request if necessary, any additional information on Minimum Wage Rates for those trades people who may be employed for the proposed work under this contract. Federal Minimum Wage Rates as determined by the United States Department of Labor under the Davis-Bacon Act also apply to this project.

B. It is the responsibility of the Bidder, before bid opening, to request if necessary, any additional information on Minimum Wage Rates for those trades people who may be employed for the proposed work under this contract.

1.23 BIDDER CERTIFICATION – OSHA TRAINING

A. All employees who work on Massachusetts public works construction sites, on projects estimated to cost more than $10,000, must have no less than ten (10) hours of OSHA- approved safety and health training.

B. The Massachusetts Attorney General is authorized to restrain award of construction contracts to any contractor who is in violation of this requirement and to restrain the performance of these contracts by non-complying contractors.

C. Noncompliance with this law will disqualify contractors from bidding on public contracts.

1.24 SALES TAX EXEMPTION

A. Materials and equipment purchased for permanent installation in this project will be exempt from the Massachusetts Sales and Use Tax. The exemption certificate number will be furnished to the Contractor. Each bidder shall take exemption into account in calculating his/her bid for the work.

1.25 GUARANTEE

A. The Contractor guarantees that the Work and Services to be performed under the Contract, and all workmanship, materials and equipment performed, furnished, used or installed in the construction of the same shall be free from defects and flaws, and shall be performed and furnished in strict accordance with the Drawings, Specifications, and other contract documents, that the strength of all parts of all manufactured equipment shall be adequate and as specified and that the performance test requirements of the Contract shall be fulfilled. This guarantee shall be for a period of one year from and after the date of completion and acceptance of the Work as stated in the final estimate. If part of the Work is accepted in accordance with that subsection of this AGREEMENT titled "Partial Acceptance", the guarantee for that part of the Work shall be for a period of one year from the date fixed for such acceptance.

B. If at any time within the said period of guarantee any part of the Work requires repairing, correction or replacement, the Owner may notify the Contractor in writing to make the required repairs, correction or replacements. If the Contractor neglects to commence making such repairs, corrections or replacements to the satisfaction of the Owner within seven (7) days from the date of receipt of such notice, or having commenced fails to prosecute such Work with diligence, the Owner may employ other persons to make said repairs, correction or replacements, and charge the costs, including compensation for additional professional services, to the Contractor.

C. It is expressly understood, however, that these guarantee provisions shall not absolve the Contractor from any liability to the Owner arising out of a failure to substantially complete the work in accordance with the Drawings and Specifications.

1.26 BONDING AND INSURANCE

A. The Contractor must furnish Performance and Payment Bonds, each of which shall be in an amount not less than one hundred (100) percent of the contract price. Contractors should obtain such construction insurance (e.g., Fire and Extended Coverage, Workmen's Compensation, Public Liability and Property Damage, and "All Risk" Builder's Risk) as indicated in the Supplemental Conditions (Section 00800).

1.27 HEALTH AND SAFETY REGULATIONS

A. This project is subject to all the Health and Safety Regulations (CFR 29 Part 1926 and all subsequent amendments) as promulgated by the U.S. Department of Labor on June 24, 1974. Contractors are urged to become familiar with the requirements of these regulations, as well as the Occupational Safety and Health Administration's (OSHA) 29 CFR 1910.120.

1.28 BUY AMERICAN

A. This project is subject to the American Iron and Steel requirements of P.L. 113-76, the Consolidated Appropriations Act of 2014.

1.29 ACCESS TO THE PROJECT

A. The successful Bidder shall provide full and complete access to the project site or any portion thereof by any authorized agent of the Town of Orleans any time during normal working hours throughout the duration of the Contract.

1.30 TRAFFIC POLICE

A. Traffic control, when required by the Chief of Police or the Owner, will be paid for by the Owner. The Contractor is required to directly coordinate all Police details.

B. Any police overtime expenses incurred by the Town due to the Contractor working longer than the specified normal workday (ten consecutive hours, Sundays, or holidays) shall be the responsibility of the Contractor, the cost of which will be deducted from the monthly pay requisition. The Contractor will also be charged for any police expenses when police coverage is requested or scheduled in advance by the Contractor, but the Contractor does not work.

1.31 THIRD PARTY WORK

A. The Contractor is responsible for maintaining a safe and secure worksite at all times, and for expeditiously repairing any damage done to private property. If, in the opinion of the Owner, the Contractor is negligent in these duties the Owner shall have the right to employ a third party to remedy the problem.

B. Situations which develop and require the services of and payment to a third party will be handled in the following manner:

1) The Contractor will be given a reasonable period of time determined at the discretion of the Owner to remedy the situation without third party involvement. If the Contractor is unavailable, the Owner will authorize work by a third party on the Contractor's behalf;

2) Third party work authorized on the Contractor's behalf by the Owner shall be paid for by the Contractor within a reasonable time period (generally two weeks). If payment is not made within a reasonable time period the Owner will make payment and deduct the cost from the next pay requisition; and

3) In the case of inadequately secured worksites necessitating extra or increase police details or other public safety personnel, the following procedure will be followed. The Contractor (if available) will be notified that the worksite needs to be secured in order to prevent the need for weekend/night police coverage. If the area is not immediately secured as determined by the Owner or Engineer, a police, fire, or highway department detail will be used and the Contractor will be charged for the cost. It is understood that in many instances worksites cannot realistically be secured to a point where police or other safety personnel are not needed. In these instances, the Owner will continue to pay for the coverages.

1.32 AWARDING AUTHORITY AND PROJECT ADMINISTRATOR

A. The Awarding Authority for this Project is the Town of Orleans, MA, acting through John Kelly, Town Administrator, 19 School Road, Orleans, MA 02653.

B. The Project Administrator for this Project is the Town of Orleans acting through Thomas Daley, Director of Public Works & Natural Resources, 40 Giddiah Hill Road, Orleans, MA 02653.

1.33 SAFETY AND HEALTH REGULATIONS

A. This project is subject to the Safety and Health Regulations of the U.S. Department of Labor set forth in Title 29 CFR, Part 1926 and to all subsequent amendments, and to any applicable Massachusetts regulations. Contractors shall be familiar with the requirements of these regulations.

1.34 MANUFACTURER'S EXPERIENCE

A. Whenever it is written that an equipment manufacturer must have a specified period of experience with his product, equipment which does not meet the specified experience period can be considered if the equipment supplier or manufacturer is willing to provide an "Efficiency Guarantee Bond" or cash deposit for the duration of the specified time period which will guarantee replacement of that equipment in the event of failure.

1.35 DIESEL RETROFIT PROGRAM

A. This project is subject to the requirements of the Department of Environmental Protection's Diesel Retrofit Program. Bidders must submit a signed and dated Statement of Intent to Comply form as part of their bid proposal documents.

END OF DOCUMENT

SECTION 00310

BID BOND

Know all men by these presents, that we, the undersigned, _____

_____ as Principal, and _____

as Surety, are hereby held and firmly bound unto the Town of Orleans, MA, 19 School Road, Orleans, MA 02653 hereinafter called "Owner", in the penal sum of five (5) percent of the value of the Bid for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors and assigns.

Signed, this _____ day of _____.

The Condition of the above obligation is such that whereas the Principal has submitted to the Town of Orleans, MA, 19 School Road, Orleans, MA 02653, hereinafter called "Owner", attached hereto and hereby made a part hereof to enter into a Contract in writing for Contract No. 2019-02, Downtown Area Collection System and Pumping Stations.

Now, therefore,

(a) If said Bid shall be rejected, or

(b) If said Bid shall be accepted and the Principal shall execute and deliver a Contract in SECTION 00520, AGREEMENT attached hereto (properly completed in accordance with said Bid) and shall furnish a Bond for its faithful performance of said Contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Bid, then this obligation, shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its Bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such Bid and said Surety does hereby waive notice of any such extension.

In witness whereof, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

Principal	Surety
Principal Signature	Surety Signature

Important - Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State where the

END OF SECTION

SECTION 00310

BID BOND (EJDC), AS ATTACHED

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

PENAL SUM FORM

SECTION 00310

BID BOND

Any singular reference to Bidder, Surety, Owner or other party shall be considered plural where applicable.

BIDDER *(Name and Address)*:

SURETY *(Name, and Address of Principal Place of Business)*:

OWNER *(Name and Address)*:

BID
Bid Due Date:
Description *(Project Name— Include Location)*:

BOND
Bond Number:
Date:
Penal sum _____ $ _____
(Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER	**SURETY**
_____ (Seal)	_____ (Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (Attach Power of Attorney)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____
Signature	Signature
Title	Title

Note: Addresses are to be used for giving any required notice.
Provide execution by any additional parties, such as joint venturers, if necessary.

Note: The Bidder may submit their standard Bid Bond as long as it fully complies with the requirements of DOCUMENT C-430.

EJCDC ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

PENAL SUM FORM

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation shall be null and void if:

   3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or

   3.2 All Bids are rejected by Owner, or

   3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

END OF DOCUMENT

SECTION 00410

FORM OF GENERAL BID

1. Proposal of _____ (hereinafter called "Bidder")*

   (_) a corporation, organized and existing under the laws of the State of _____

   (_) a partnership

   (_) a joint venture

   (_) a limited liability company

   (_) an individual doing business as _____

   *Check corporation, partnership, joint venture, LLC or individual as applicable.

2. To the Town of Orleans, MA (hereinafter called "Owner") regarding: Downtown Area Collection System and Pumping Stations, Contract No. 2019-02 and SRF No. 4486.

   The Bidder, in compliance with your invitation for bids for Downtown Area Collection System and Pumping Stations having examined the plans and specifications with related documents and the site of the proposed work, attended the mandatory pre-bid conference, and being familiar with all of the conditions surrounding the construction of the proposed project including the availability of materials and labor, hereby proposes to furnish all superintendence, labor, services, materials, equipment, plant, machinery, apparatus, appliances, tools, supplies, bailing, shoring, removal, and all other things necessary to construct the project in accordance with the contract documents, within the time set forth below, and at the prices stated below. These prices are to cover all expenses incurred in performing the work required under the contract documents, of which this bid is a part.

   The Bidder hereby agrees that if selected as the Contractor it will commence work under this contract on or before a date to be fixed in the written “Notice to Proceed” given by the Owner to the Contractor and to fully complete the project within 751 calendar days, using not more than 304 working days split into 6 phases.

   The Bidder further agrees to pay as liquidated damages the sum of $9,700 for each consecutive calendar day and/or working day thereafter during which the work as not been fully completed, as provided in the “Liquidated Damages” provisions of SECTION 00800 - SUPPLEMENTARY CONDITIONS.

3. Bidder acknowledges receipt of the following addenda:

No.	Dated	No.	Date
1		7	
2		8	
3		9	
4		10	
5		11	
6		12	

4. Bidder agrees to perform all the work, including all incidental labor, materials and equipment necessary for the satisfactory completion of the work and in full compliance with the contents and intent of the Specifications and/or Drawings of the work.

5. Bid Proposal

   A. The BID PROPOSAL unit prices shall include all labor, materials, bailing, shoring, removal, overhead, profit, insurance, engineering costs, etc., to cover the finished work of the several kinds called for. The Bidder understands that all bids for this project are subject to the applicable bidding laws of the Commonwealth of Massachusetts, including General Laws Chapter 30, Section 39M, as amended.

   B. Bidder shall complete and submit the Proposal Form. The bidder is not allowed to submit a proposal that has been printed out and prices typewritten or written by hand. Failure to utilize the Microsoft Excel Proposal Form shall void the bid.

   C. Use of the Microsoft Excel Proposal Form

      1) Upon Opening the Microsoft Excel Proposal Form:

         a) A yellow bar will appear on the top of the screen labeled as "*Security Warning*"

         b) You must select the "*Enable Content*" button in order to properly access the file.

            1) This will enable macros in the excel file, as you must enable macros to properly view the file.

            2) If you do not enable macros, the excel document will be invalid.

         c) Manually enter the Bidder's Name in the blue box.

         d) Manually enter the Date in the blue box.

         e) Manually enter the unit cost in the blue boxes for each bid item. Allowances have already been prepopulated.

         f) The document will automatically update the cost estimates (Unit Price in Words; Extended Totals and Bid Total based on the user's unit cost input into the blue boxes for each bid item.

      2) In Order to Save the Proposal Form Document.

         a) The document must be saved as a file with macros enabled.

         b) Please save as the file type "Excel Macro-Enabled Workbook (*.xlsm)".

         c) If the file is saved incorrectly as a different file type, the document will be invalid.

      This process must be repeated for every time the document is opened and saved.

   D. Bidder shall print out in Landscape Format and submit the completed Microsoft Excel Proposal Form. In addition, Bidder shall submit the completed Microsoft Excel Proposal Form in ".xlsm" format on a Thumb Drive.

   E. In the event of a discrepancy between the price in words and the price in figures, the words shall govern. In the event of a discrepancy between the total of the items and the total stated, the total of the items shall govern.

   F. In the event of a discrepancy between the printed out completed Microsoft Excel Proposal Form and the completed Microsoft Excel Proposal Form in ".xlsm" format, the printed out completed Microsoft Excel Proposal Form shall govern.

   G. Interlineation, alteration or erasure may void the bid.

   H. Bid security is attached in the sum of five percent (5%) of the total bid in accordance with the conditions of SECTION 00200 - INSTRUCTIONS TO BIDDERS. The bid security may become the property of the Owner in the event the contract and bond are not executed within the time set forth above.

   I. The undersigned states that no officer, agent or employees of the Owner directly or indirectly has a financial interest in this Bid.

6. The time period for holding bids, where Federal approval is not required is 30 days, Saturdays, Sundays and legal holidays excluded, after the opening of bids and where Federal approval is required, the time period for holding bids is 30 days, Saturdays, Sundays and holidays excluded after Federal approval.

7. State Taxes - Pursuant to M.G.L.c.62C, s49A I certify under the penalties of perjury that I, to my best knowledge and belief, have filed all state tax returns and paid all State Taxes required under law.

8. Award

   A. The contract will be awarded to the lowest responsible and eligible bidder.

   B. Bidder understands that the Owner reserves the right to reject any or all bids and to waive any informalities in the bidding as deemed to be in the best interest of the Owner.

   C. The Owner reserves the right to reject any bid in the event that any bid item or items are obviously unbalanced or appear to the Owner to be so unbalanced as to affect or to be liable to affect adversely any interest of the Owner.

   D. The Owner reserves the right to reject any or all bids if it deems it to be in its best interest to do so. The Owner reserves the right to award the Contract based on sufficiency of appropriated funds to complete the work.

   E. In the event the lowest bids from responsive and responsible bidders are tied, the following methods of breaking the tie shall be employed unless otherwise provided for in these bid documents: The bidder's names shall be entered on a slip of paper and placed in a hat. The award shall then be made to the bidder whose slip is drawn from the hat. The drawing of the slip from the hat shall be performed in the presence of the tied bidders unless they waive their right to be present in writing.

9. Within 10 days of receipt of the written notice of acceptance of this bid, the Bidder will execute the formal agreement attached in SECTION - AGREEMENT and provide the requisite payment and performance bonds and certificates of insurance.

10. The selected Contractor shall furnish a performance bond and a payment bond each in an amount at least equal to one hundred percent (100%) of the contract prices in accordance with SECTION 00610 - PERFORMANCE BOND, SECTION 00615 - PAYMENT BOND, and as stipulated in paragraph 5.01 of SECTION 00700 - GENERAL CONDITIONS of these specifications.

11. The Owner reserves the right to withhold the fair market value for work not completed in addition to the retainage on work completed. Unbalanced bid items will specifically be subject to review and to this potential withholding from periodic payment applications.

12. The Undersigned, as Bidder, declares as follows:

   A. The only parties interested in this BID as Principals are named herein;

   B. The Bidder has carefully examined the site of the proposed Work and fully informed and satisfied himself as to the conditions there existing, the character and requirements of the proposed Work, the difficulties attendant upon its execution and the accuracy of all estimated quantities stated in this BID, and has carefully read and examined the Drawings, the annexed proposed AGREEMENT and the Specifications and other Contract Documents therein referred to and knows and understands the terms and provisions thereof;

   C. This BID is made without collusion with any other person, firm, or corporation;

   D. No officer, agent, or employee of the Owner is directly or indirectly interested in this BID; and

   E. Understands that information relative to subsurface and other conditions, natural phenomena, existing pipes and other structures (surface and/or subsurface) has been furnished only for his information and convenience without any warranty or guarantee, expressed or implied, that the subsurface and/or other conditions, natural phenomena, existing pipes and other structures (surface and/or subsurface) actually encountered will be the same as those shown on the Drawings or in any of the other Contract Documents and agrees that the Bidder shall not use or be entitled to use any such information made available to him through the Contract Documents or otherwise or obtained by him in his own examination of the site, as a basis of or ground for any claim against the Owner or the Engineer arising from or by reason of any variance which may exist between the aforesaid information made available to or acquired by him and the subsurface and/or other conditions, natural phenomena, existing pipes and other structures (surface and/or subsurface) actually encountered during the construction work, and has made due allowance therefore in this BID.

13. Equal Employment Opportunity/Affirmative Action Provisions - C.30 s39 (c)

A. The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed in the work.

B. The undersigned bidder hereby certifies he/she will comply with the specific affirmative action steps contained in the Equal Employment Opportunity/Affirmative Action (EEO/AA) provisions of this Contract, including compliance with the Disadvantaged Business Enterprise provisions as required under these contract provisions. The contractor receiving the award of the contract shall incorporate the EEO/AA provisions of this contract into all subcontracts and purchase orders so that such provisions will be binding upon each subcontractor or vendor.

14. Non-Debarment - C.30 s39 (a)

A. The undersigned certifies under penalties of perjury that this bid is in all respects bonafide, fair and made without collusion or fraud with any other person. As use in this paragraph the "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity.

B. The undersigned is not presently debarred from doing public construction work in the Commonwealth of Massachusetts under the provisions of Section Twenty-Nine F of Chapter Twenty-Nine, or any other applicable debarment provisions of any other Chapter of the General Laws or any rule or regulations promulgated thereunder; and is not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency.

15. Suspension and Debarment

A. The EPA prohibits the use of suspended or debarred contractors and suppliers in SRF financed contracts. All SRF financed contracts and subcontracts must include the following language requiring compliance with 2 CFR 180 and 2 CFR 1532.

B. Bidders must fully comply with Subpart C of 2 CFR Part 180 and 2 CFR Part 1532, entitled responsibilities of Participants Regarding transactions (Doing Business with Other Persons). Contractors, subcontractors, or suppliers that appear on the Excluded Parties List System at www.usgovxml.com/dataservice.aspx?ds=EPLS are not eligible for award of any contracts funded by the Massachusetts State Revolving Fund.

16. Diesel Retrofit Program - The undersigned bidder hereby certifies he/she will comply with the Massachusetts Department of Environmental Protection's Diesel Retrofit Program Statement of Intent to Comply (see Appendix B).

17. The undersigned offers the following information as evidence of its qualifications to perform the work as bid upon according to all the requirements of the plans and specifications.

A. Have been in business under present name for _____years.

B. The Bidder shall state below what work of a similar character to that included in the proposed contract it has done within the last 1o years, and give references that will enable the Owner to judge its experience, skill and business standing (add supplementary page(s) if necessary).

Project No. 1

Completion Date	Project Name	Contract Amount
Design Engineer	**Reference Name**	**Telephone No.**

Project No. 2

Completion Date	Project Name	Contract Amount
Design Engineer	**Reference Name**	**Telephone No.**

Project No. 3

Completion Date	Project Name	Contract Amount
Design Engineer	**Reference Name**	**Telephone No.**

Project No. 4

Completion Date	Project Name	Contract Amount
Design Engineer	**Reference Name**	**Telephone No.**

Project No. 5

Completion Date	Project Name	Contract Amount
Design Engineer	**Reference Name**	**Telephone No.**

C. The names and addresses of all persons interested in the bid (if made by a partnership or corporation) as Principals, are as follows (add supplementary page(s) if necessary):

Name	Address

18. Pursuant to M.G.L. CH. 62C, Sec 49A, the undersigned Bidder certifies under the penalties of perjury that it is in compliance with all laws of the Commonwealth relating to taxes, reporting of employees and contractors, and withholding and remitting child support.

19. The undersigned Bidder hereby certifies that (1) it is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed in the work; and (2) that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee.

20. The undersigned certifies under penalties of perjury that this bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this paragraph the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity which sells materials, equipment or supplies used in or for, or engages in the performance of, the same or similar construction, reconstruction, installation, demolition, maintenance or repair work or any part thereof.

21. The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth of Massachusetts under the provisions of Section Twenty-Nine F of Chapter Twenty-Nine, Section 25C (10) of Chapter 152 (workers' compensation) or any other applicable debarment provisions of any other Chapter of the General Laws or any rule or regulations promulgated thereunder.

Respectfully submitted:

Date: _____ By: _____

(Signature)

_____

(Name – Typed or Printed)

_____

(Title)

_____

(Business Name)

_____

(Federal ID Number)

_____

(Business Address)

_____

(City and State)

_____

(Telephone Number)

(SEAL - if bid is by a corporation)

22. The following documents are attached to and made a condition of the bid, and shall be submitted with the bid:
    A. Microsoft Excel Proposal Form (hard copy in Landscape Format and ".xlsm" format copy on Thumb Drive);
    B. Bid Security (5%);
    C. Completed and signed Bid Proposal and Project Reference List;
    D. Insurance Requirements for Inclusion in All Specifications and Contracts;
    E. Statement of State Tax Compliance;
    F. Certificate of Non-Collusion;
    G. Acknowledgement of Principal, if a Corporation;
    H. Acknowledgement of Principal, if a Partnership;
    I. Certification of OSHA 10-Hour Training.
    J. Massachusetts Department of Environmental Protection's Diesel Retrofit Program Statement of Intent to Comply.
    K. MassDEP Appendix B - Diesel Retrofit Program
    L. MassDEP Appendix E - Construction Bid Specifications – Special Provisions for Disadvantaged Business Enterprises – Massachusetts Department of Environmental Protection Division of Municipal Services

END OF TEXT

SEE ATTACHED PROPOSAL FORM

SEE ATTACHED APPENDIX

MassDEP Appendix B Diesel Retrofit Program

MassDEP Appendix E Construction Bid Specifications – Special Provisions for Disadvantaged Business Enterprises – Massachusetts Department of Environmental Protection Division of Municipal Services

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Company's Name	Date
Company's Address	**Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.**

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - BASE BID			
1.	For Mobilization/Demobilization, as specified (maximum of five (5) percent of System Expansion bid), the sum of $ -	l.s.	1	$ -
2.A.	For furnishing and installing 1-1/2-inch through 2-inch, inclusive, Polyvinyl Chloride/High Density Polyethylene Low Pressure Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	930	$ -
2.B.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Less Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	3,930	$ -
2.C.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Greater Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	5,310	$ -
2.D.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	930	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.E.	For furnishing and installing 12-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	2,410	$ -
2.F.	For furnishing and installing 18-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,900	$ -
2.G.	For furnishing and installing 6-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	450	$ -
2.H.	For furnishing and installing 8-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	710	$ -
2.I.	For furnishing and installing 8-inch PVC Effluent Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	3,590	$ -
2.J.	For furnishing and installing 1-1/4-inch Polyvinyl Chloride Low-Pressure Sewer Service Connections and Associated Fittings from main line to property line, All Depths, as specified, the sum of $ -	per l.f.	170	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.K.	For furnishing and installing 6-inch Polyvinyl Chloride Service Connections and Associated Fittings from main line to property line as specified, the sum of $ -	per l.f.	3,270	$ -
2.L.	For furnishing and installing LPS Wyes, All Depths, as specified, the sum of $ -	per each	8	$ -
2.M.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	95	$ -
2.N.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	11	$ -
2.O.	For furnishing and installing 12-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	11	$ -
2.P.	For furnishing and installing 18-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	18	$ -
2.Q.	For furnishing and installing Low Pressure Sewer Main Line Valves, All Sizes and Depths, as specified, the sum of $ -	per each	2	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
3.A.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Less Than 10 feet in Depth, the sum of $ -	per each	11	$ -
3.B.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Greater Than 10 feet in Depth, the sum of $ -	per each	50	$ -
3.C.	For furnishing and installing 5-foot Diameter Precast Concrete Sewer Manholes, All Depths, as specified, the sum of $ -	per each	7	$ -
3.D.	For furnishing and installing 6-foot Diameter Precast Concrete Low Pressure Sewer Terminal Flushing Manholes, All Depths, as specified, the sum of $ -	per each	2	$ -
3.E.	For furnishing and installing 6-foot Diameter Precast Concrete Effluent Force Main In-Line Flushing Manholes, All Depths, as specified, the sum of $ -	per each	1	$ -
3.F.	For furnishing and installing 6-foot Diameter Precast Concrete Leaching Catch Basins with Grates, All Depths, as specified, the sum of $ -	per each	4	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
4.A.	For furnishing and installing Standard Manhole Frames and Covers, as specified, the sum of $ -	per each	72	$ -
4.B.	For furnishing and installing Bolted and Gasketed Manhole Frames and Covers, as specified, the sum of $ -	per each	3	$ -
5.	For furnishing and installing Interior Manhole Drop Connections, as specified, the sum of $ -	per v.f.	60	$ -
6.	For furnishing and installing chimneys, as specified, the sum of $ -	per v.f.	150	$ -
7.	For furnishing and placing miscellaneous cement concrete, as specified, the sum of $ -	per c.y.	240	$ -
8.	For Rock and Boulder Excavation including Replacement with Suitable Fill Material, as specified, the sum of * $ - * Minimum Bid = $80/c.y.	per c.y.	300	$ -
9.A.	For Replacement of Unsuitable Material Below Trench Grade and/or Subgrade, as specified, the sum of $ -	per c.y.	420	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
9.B.	For Replacement of Unsuitable Material Above Trench Grade, as specified, the sum of $ -	per c.y.	840	$ -
10.	For Experimental Excavation, as specified, the sum of $ -	per c.y.	240	$ -
11	Fill for embankments – Not Used			
12.	Sheeting and/or shoring ordered left in place – Not Used			
13.	For performing Soil Compaction Tests, as specified, the sum of $ -	per each	80	$ -
14.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	5,580	$ -
15.A.	For furnishing and placing 4-inch Temporary Bituminous Concrete Trench Pavement (base course) in State Roadways, as specified, the sum of $ -	per l.f.	6,200	$ -
15.B.	For furnishing and placing 7-inch Permanent Bituminous Concrete Trench Width Pavement (3-inch base course and 4-inch intermediate course or 7-inch intermediate course) in State Roadways, as specified, the sum of $ -	per l.f.	6,200	$ -

Company's Name	Date
Company's Address	**Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.**

Item	Description	Unit of Measure	Quantity	Extended Total
15.C.	Milling and 2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in State Roadways - Not Used			
15.D.	Not Used			
15.E.	1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways - Not Used			
15.F.	For furnishing and placing Dense Graded Gravel, as specified, the sum of $ -	per c.y.	350	$ -
15.G.	For furnishing and placing 4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways, as specified, the sum of * $ -	per l.f.	17,000	$ -
15.H.	Milling and 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways - Not Used			
15.I.	For Miscellaneous Restoration of State and Town Roadways, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	450	$ -
15.J.	For furnishing and placing Miscellaneous Bituminous Concrete Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	230	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.K.	For repair and/or replacement of the Vehicle Loop Detectors, as specified, the sum of $ -	per each	10	$ -
15.L.	For repainting of Traffic Markings - Lines, Symbols and Wording, as specified, the sum of Twenty Five Thousand Dollars and No Cents $ 25,000.00	Allowance	1	$ 25,000.00
16.A.	For removal and relaying and/or replacement of Existing Water Mains, associated fittings, valves and services, as specified, the sum of $ -	per inch-foot	6,000	$ -
16.B.	For removal and relaying and/or replacement of Existing Storm Drains, as specified, the sum of $ -	per inch-foot	10,000	$ -
16.C.	For removal and relaying and/or replacement of Existing Gas Mains and services, as specified, the sum of Fifty Thousand Dollars and No Cents $ 50,000.00	Allowance	1	$ 50,000.00
16.D.	For removal and relaying and/or replacement of Existing Miscellaneous Utilities, as specified, the sum of Fifty Thousand Dollars and No Cents $ 50,000.00	Allowance	1	$ 50,000.00
16.E.	For furnishing and removal of 6-inch Water Main Line Stops, as specified, the sum of $ -	per each	1	$ -

Company's Name

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
16.F.	For furnishing and removal of 8-inch Water Main Line Stops, as specified, the sum of $ -	per each	11	$ -
16.G.	10-inch Water Main Line Stops - Not Used			
17.	Uniformed Traffic Police Officers - Paid by Owner			
18.A.	For furnishing, installing, and removing Engineer's Field Office, as specified, the sum of $ -	per l.s.	1	$ -
18.B.	For maintaining Engineer's Field Office, as specified, the sum of $ -	per week	49	$ -
19.	Environmental Protection - Not Used			
20.	Trench Dewatering System - Not Used			
21.	Temporary By-pass Pumping - Not Used			
22.A.	For furnishing and installing Highway Crossing via Horizontal Directional Drilling, as specified, the sum of $ -	per l.s.	1	$ -
22.B.	For MassDOT Inspections, as specified, the sum of Ten Thousand Dollars and No Cents $ 10,000.00	Allowance	1	$ 10,000.00

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
23.A.	For furnishing and installing Pumping Station No. 1, as specified, the sum of $ -	per l.s.	1	$ -
23.B.	For furnishing and installing Pumping Station No. 2, as specified, the sum of $ -	per l.s.	1	$ -
23.C.	Pumping Station No. 3 - Not Used			
23.D.	For Electric Company Connection/Service Fee, as specified, the sum of One Hundred Thousand Dollars and No Cents $ 100,000.00	Allowance	1	$ 100,000.00
23.E.	For Telephone Company Connection/Service Fee, as specified, the sum of Twenty Thousand Dollars and No Cents $ 20,000.00	Allowance	1	$ 20,000.00
23.F.	For Planting Operations, as specified, the sum of Twenty Thousand Dollars and No Cents $ 20,000.00	Allowance	1	$ 20,000.00
24.	For furnishing and installing Tracer Wire in State Roadways, All Depths, as specified, the sum of $ -	l.f.	8,300	$ -

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Item	Description	Unit of Measure	Quantity	Extended Total
	SRF INELIGIBLE BID ITEMS - BASE BID			
B-1.	Replacement of Water Services			
		$		-
B-2.	Replacement of Canal Road Water Main			
		$		-
B-3.	Water Quality Improvements			
		$		-

Note: **Funding for the SRF Ineligible Bid Items - Base Bid (Bid Items B-1. through B-3., inclusive) is anticipated to be obtained at the Annual Town Meeting proposed to be held in June 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

TOTAL AMOUNT OF BASE BID (SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) PLUS SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B-3., inclusive) BASED ON ENGINEER'S ESTIMATE OF QUANTITIES THE SUM OF

$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
A-1.	Pavement Restoration in Town Roadways			
		$		-
A-2.	Pumping Station No. 3 Tributary Area			
		$		-
A-3.	Fiber Optic Conduits, Associated Fittings and Handholes			
		$		-
A-4.	Tracer Wire in Town Roadways			
		$		-
A-5.	Highway Crossing Using Jacking			
		$		-

Company's Name

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total

BASIS OF AWARD

BASIS OF AWARD - The OWNER's goal is to accomplish the work identified in SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B-3., inclusive) plus as many of the SRF ELIGIBLE BID ITEMS - ALTERNATIVES as its funding constraints will allow. The BASIS OF AWARD, therefore, is the lowest bid for the sum of SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B-3., inclusive) plus the cost of the greatest number of SRF ELIGIBLE BID ITEMS - ALTERNATIVES not exceeding its funding constraints. The SRF ELIGIBLE BID ITEMS - ALTERNATIVES are listed in the order of their priority for award. Bidders must provide a bid figure for each alternative required regardless of the cost. Additional Funding may be obtained at the Annual Town Meeting proposed to be held in June 2020.

TOTAL AMOUNT OF BASE BID BASED ON ENGINEER'S ESTIMATE OF QUANTITIES: SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B-3., inclusive)	**$**	**-**
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B-3., inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Item A-1.)	**$**	**-**
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B-3., inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Items A-1 through A-2., inclusive.)	**$**	**-**
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B-3., inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Items A-1 through A-3., inclusive.)	**$**	**-**
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B-3., inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Items A-1 through A-4., inclusive.)	**$**	**-**
TOTAL AMOUNT OF THE SRF ELIGIBLE BID ITEMS - BASE BID (Bid Items 1 through 24, inclusive) and SRF INELIGIBLE BID ITEMS - BASE BID (Bid Items B-1. through B-3., inclusive) Plus SRF ELIGIBLE BID ITEMS - ALTERNATIVES (Bid Items A-1 through A-5., inclusive.)	**$**	**-**

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF INELIGIBLE BID ITEMS			
Item B-1 - Replacement of Water Services				
B-1A.	For furnishing and installing 1-inch Polyvinyl Chloride Water Services and Associated Fittings from water main to property line as specified, the sum of $ -	per l.f.	2,040	$ -
B-1B.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	480	$ -
B-1C.	For furnishing and placing Permanent Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	100	$ -
	Item B-1 - Replacement of Water Services (Bid Items B-1A. through B-1C., inclusive)	**$**		**-**

Note: **Funding for the SRF Ineligible Bid Items is anticipated to be obtained at the Annual Town Meeting proposed to be held in June 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF INELIGIBLE BID ITEMS			
Item B-2 - Replacement of Canal Road Water Main				
B-2A.	For furnishing and installing 8-inch DI water main and Associated Fittings, as specified, the sum of $ -	per l.f.	2,060	$ -
B-2B.	For furnishing and installing 1-inch Polyvinyl Chloride Water Services and Associated Fittings from water main to property line as specified, the sum of $ -	per l.f.	320	$ -
B-2C.	For furnishing and installing 6-inch Gate Valves and Boxes, as specified, the sum of $ -	per each	6	$ -
B-2D.	For furnishing and installing 8-inch Gate Valves and Boxes, as specified, the sum of $ -	per each	7	$ -
B-2E.	For furnishing and installing Fire Hydrants, as specified, the sum of $ -	per each	6	$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
B-2F.	For furnishing and placing Road Gravel Material, as specified, the sum of $ -	per c.y.	560	$ -
B-2G.	For furnishing and placing Permanent Bituminous Concrete Trench Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	120	$ -
	Item B-2 - Replacement of Canal Road Water Main (Bid Items B-2A. through B-2G., inclusive)			**$ -**

Note: **Funding for the SRF Ineligible Bid Items is anticipated to be obtained at the Annual Town Meeting proposed to be held in June 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

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Item	Description	Unit of Measure	Quantity	Extended Total
	SRF INELIGIBLE BID ITEMS			
Item B-3 - Water Quality Improvements				
B-3A.	For Brewster Cross Road Water Quality Improvements, as specified, the sum of			
	$ -	per l.s.	1	$ -
B-3B.	For Locust Road Water Quality Improvements, as specified, the sum of			
	$ -	per l.s.	1	$ -
	Item B-3 - Water Quality Improvements (Bid Items B-3A. through B-3B., inclusive)			**$** -

Note: **Funding for the SRF Ineligible Bid Items is anticipated to be obtained at the Annual Town Meeting proposed to be held in June 2020. Therefore, performing the scope of work specified under these Bid Items is subject to this future appropriation and no payment will be made without written approval by the OWNER.**

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
Item A-1- Pavement Restoration in Town Roadways				
1.	For Mobilization/Demobilization, as specified (maximum of five (5) percent of System Expansion bid), the sum of $ -	l.s.	1	$ -
2.	Sewer Pipelines and Associated Fittings - Not Used			
3.	Precast Concrete Manholes and Structures - Not Used			
4.	Manhole Frames, Covers and Grates - Not Used			
5.	Interior Manhole Drop Connections - Not Used			
6.	Chimneys - Not Used			
7.	Miscellaneous Cement Concrete - Not Used			
8.	Rock and Boulder Excavation - Not Used			
9.	Replacement of Unsuitable Material - Not Used			
10.	Experimental Excavation - Not Used			

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
11.	Fill for embankments – Not Used			
12.	Sheeting and/or shoring ordered left in place – Not Used			
13.	Soil Compaction Tests - Not Used			
14.	Road Gravel Material - Not Used			
15.A.	4-inch Temporary Bituminous Concrete Trench Pavement (base course) in State Roadways - Not Used			
15.B.	7-inch Permanent Bituminous Concrete Trench Width Pavement (3-inch base course and 4-inch intermediate course or 7-inch intermediate course) in State Roadways - Not Used			
15.C.	For milling and furnishing and placing 2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in State Roadways, as specified, the sum of *			
	$ -	per ton	2,500	$ -
	* Minimum Bid = $80/ton			
15.D.	Not Used			
15.E.	For furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	200	$ -
	* Minimum Bid = $80/ton			
15.F.	Dense Graded Gravel - Not Used			
15.G.	4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways - Not Used			

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.H.	For milling and furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	3,000	$ -
	* Minimum Bid = $80/ton			
15.I.	For Miscellaneous Restoration of Town Roadways, as specified, the sum of *			
	$ -	per ton	50	$ -
	* Minimum Bid = $80/ton			
15.J.	For furnishing and placing Miscellaneous Bituminous Concrete Pavement, as specified, the sum of *			
	$ -	per ton	240	$ -
	* Minimum Bid = $80/ton			
15.K.	For repair and/or replacement of the Vehicle Loop Detectors, as specified, the sum of			
	$ -	per each	20	$ -
15.L.	For repainting of Traffic Markings - Lines, Symbols and Wording, as specified, the sum of			
	Twenty Five Thousand Dollars and No Cents			
	$ 25,000.00	Allowance	1	$ -
16.	Remove and Relaying and/or Replace Existing Utilities - Not Used			
17.	Uniformed Traffic Police Officers - Paid by Owner			
18..	Engineer's Field Office - Not Used			
19.	Environmental Protection - Not Used			
20.	Trench Dewatering Equipment - Not Used			

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
21.	Temporary By-pass Pumping - Not Used			
22.	Highway Crossing - Not Used			
23.	Pumping Stations - Not Used			
24.	Tracer Wire in State Roadways - Not Used			
	Item A-1 - Pavement Restoration in Town Roadways (Bid Item 1. through 24., inclusive)	**$**		**-**

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
Item A-2 - Pumping Station No. 3 Tributary Area				
1.	For Mobilization/Demobilization, as specified (maximum of five (5) percent of System Expansion bid), the sum of $ -	l.s.	1	$ -
2.A.	For furnishing and installing 1-1/2-inch through 2-inch, inclusive, Polyvinyl Chloride/High Density Polyethylene Low Pressure Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,100	$ -
2.B.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Less Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	3,070	$ -
2.C.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, Greater Than 10-feet in Depth, as specified, the sum of $ -	per l.f.	8,440	$ -
2.D.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	1,020	$ -
2.E.	12-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths - Not Used			
2.F.	18-inch Polyvinyl Chloride Sewer Pipe and Associated Fittings, All Depths - Not Used			

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.G.	For furnishing and installing 6-inch PVC Force Main and Associated Fittings, All Depths, as specified, the sum of $ -	per l.f.	2,610	$ -
2.H.	8-inch PVC Force Main and Associated Fittings, All Depths - Not Used			
2.I.	8-inch PVC Effluent Force Main and Associated Fittings, All Depths - Not Used			
2.J.	For furnishing and installing 1-1/4-inch Polyvinyl Chloride Low-Pressure Sewer Service Connections and Associated Fittings from main line to property line, All Depths, as specified, the sum of $ -	per l.f.	430	$ -
2.K.	For furnishing and installing 6-inch Polyvinyl Chloride Service Connections and Associated Fittings from main line to property line as specified, the sum of $ -	per l.f.	2,830	$ -
2.L.	For furnishing and installing LPS Wyes, All Depths, as specified, the sum of $ -	per each	13	$ -
2.M.	For furnishing and installing 8-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	95	$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
2.N.	For furnishing and installing 10-inch Polyvinyl Chloride Sewer Wyes, All Depths, as specified, the sum of $ -	per each	3	$ -
2.O.	12-inch Polyvinyl Chloride Sewer Wyes, All Depths - Not Used			
2.P.	18-inch Polyvinyl Chloride Sewer Wyes, All Depths - Not Used			
2.Q.	For furnishing and installing Low Pressure Sewer Main Line Valves, All Sizes and Depths, as specified, the sum of $ -	per each	2	$ -
3.A.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Less Than 10 feet in Depth, the sum of $ -	per each	13	$ -
3.B.	For furnishing and installing 4-foot Diameter Precast Concrete Sewer Manholes, Greater Than 10 feet in Depth, the sum of $ -	per each	52	$ -
3.C.	For furnishing and installing 5-foot Diameter Precast Concrete Sewer Manholes, All Depths, as specified, the sum of $ -	per each	2	$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
3.D.	For furnishing and installing 6-foot Diameter Precast Concrete Low Pressure Sewer Terminal Flushing Manholes, All Depths, as specified, the sum of $ -	per each	3	$ -
3.E.	6-foot Diameter Precast Concrete Effluent Force Main In-Line Flushing Manholes, All Depths - Not Used			
3.F.	6-foot Diameter Precast Concrete Leaching Catch Basins with Grates, All Depths - Not Used			
4.A.	For furnishing and installing Standard Manhole Frames and Covers, as specified, the sum of $ -	per each	36	$ -
4.B.	For furnishing and installing Bolted and Gasketed Manhole Frames and Covers, as specified, the sum of $ -	per each	34	$ -
5.	For furnishing and installing Interior Manhole Drop Connections, as specified, the sum of $ -	per v.f.	20	$ -
6.	For furnishing and installing chimneys, as specified, the sum of $ -	per v.f.	340	$ -
7.	For furnishing and placing miscellaneous cement concrete, as specified, the sum of $ -	per c.y.	200	$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
8.	For Rock and Boulder Excavation including Replacement with Suitable Fill Material, as specified, the sum of *			
	$ -	per c.y.	250	$ -
	* Minimum Bid = $80/c.y.			
9.A.	For Replacement of Unsuitable Material Below Trench Grade and/or Subgrade, as specified, the sum of			
	$ -	per c.y.	400	$ -
9.B.	For Replacement of Unsuitable Material Above Trench Grade, as specified, the sum of			
	$ -	per c.y.	790	$ -
10.	For Experimental Excavation, as specified, the sum of			
	$ -	per c.y.	200	$ -
11	Fill for embankments – Not Used			
12.	Sheeting and/or shoring ordered left in place – Not Used			
13.	For performing Soil Compaction Tests, as specified, the sum of			
	$ -	per each	70	$ -
14.	For furnishing and placing Road Gravel Material, as specified, the sum of			
	$ -	per c.y.	5,160	$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.A.	For furnishing and placing 4-inch Temporary Bituminous Concrete Trench Pavement (base course) in State Roadways, as specified, the sum of $ -	per l.f.	6,600	$ -
15.B.	For furnishing and placing 7-inch Permanent Bituminous Concrete Trench Width Pavement (3-inch base course and 4-inch intermediate course or 7-inch intermediate course) in State Roadways, as specified, the sum of $ -	per l.f.	6,600	$ -
15.C.	For milling and furnishing and placing 2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in State Roadways, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	1,970	$ -
15.D.	Not Used			
15.E.	For furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	325	$ -
15.F.	For furnishing and placing Dense Graded Gravel, as specified, the sum of $ -	per c.y.	350	$ -
15.G.	For furnishing and placing 4-1/2-inch Permanent Bituminous Concrete Trench Width Pavement (base course) in Town Roadways, as specified, the sum of * $ -	per l.f.	12,200	$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.H.	For milling and furnishing and placing 1-1/2-inch Permanent Bituminous Concrete Full Width Pavement (top course) in Town Roadways, as specified, the sum of *			
	$ -	per ton	2,000	$ -

* Minimum Bid = $80/ton

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
15.I.	For Miscellaneous Restoration of State and Town Roadways, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	190	$ -
15.J.	For furnishing and placing Miscellaneous Bituminous Concrete Pavement, as specified, the sum of * $ - * Minimum Bid = $80/ton	per ton	210	$ -
15.K.	For repair and/or replacement of the Vehicle Loop Detectors, as specified, the sum of $ -	per each	10	$ -
15.L.	For repainting of Traffic Markings - Lines, Symbols and Wording, as specified, the sum of Twenty Five Thousand Dollars and No Cents $ 25,000.00	Allowance	1	$ -
16.A.	For removal and relaying and/or replacement of Existing Water Mains, associated fittings, valves and services, as specified, the sum of $ -	per inch-foot	6,000	$ -
16.B.	For removal and relaying and/or replacement of Existing Storm Drains, as specified, the sum of $ -	per inch-foot	10,000	$ -

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Item	Description	Unit of Measure	Quantity	Extended Total
16.C.	For removal and relaying and/or replacement of Existing Gas Mains and services, as specified, the sum of Fifty Thousand Dollars and No Cents $ 50,000.00	Allowance	1	$ -
16.D.	For removal and relaying and/or replacement of Existing Miscellaneous Utilities, as specified, the sum of Twenty Five Thousand Dollars and No Cents $ 25,000.00	Allowance	1	$ -
16.E.	6-inch Water Main Line Stops - Not Used			
16.F.	For furnishing and removal of 8-inch Water Main Line Stops, as specified, the sum of $ -	per each	7	$ -
16.G.	For furnishing and removal of 10-inch Water Main Line Stops, as specified, the sum of $ -	per each	1	$ -
17.	Uniformed Traffic Police Officers - Paid by Owner			
18.A.	For furnishing, installing, and removing Engineer's Field Office, as specified, the sum of $ -	per l.s.	1	$ -
18.B.	For maintaining Engineer's Field Office, as specified, the sum of $ -	per week	42	$ -
19.	For furnishing, installing, maintaining and removing Environmental Protection, as specified, the sum of $ -	per l.f.	2,830	$ -

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Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
20.	For furnishing, installing, maintaining and removing Trench Dewatering System, as specified, the sum of $ -	per l.f.	11,220	$ -
21.	Temporary By-pass Pumping - Not Used			
22.A.	Highway Crossing via Horizontal Directional Drilling - Not Used			
22.B.	MassDOT Inspections - Not Used			
23.A.	Pumping Station No. 1 - Not Used			
23.B.	Pumping Station No. 2 - Not Used			
23.C.	For furnishing and installing Pumping Station No. 3, as specified, the sum of $ -	per l.s.	1	$ -
23.D.	For Electric Company Connection/Service Fee, as specified, the sum of Twenty Five Thousand Dollars and No Cents $ 25,000.00	Allowance	1	$ -
23.E.	For Telephone Company Connection/Service Fee, as specified, the sum of Ten Thousand Dollars and No Cents $ 10,000.00	Allowance	1	$ -
23.F.	For Planting Operations, as specified, the sum of Ten Thousand Dollars and No Cents $ 10,000.00	Allowance	1	$ -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
24.	For furnishing and installing Tracer Wire in State Roadways, All Depths, as specified, the sum of			
	$ -	l.f.	6,700	$ -
	Item A-2 - Pump Station No. 3 Tributary Area (Bid Item 1. through 24., inclusive)			**$ -**

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
	Item A-3 - Fiber Optic Conduits, Associated Fittings and Handholes			
A-3A.	For furnishing and installing 4-inch Fiber Optic Conduits and Associated Fittings, All Depths, as specified, the sum of $ -	l.f.	3,590	$ -
A-3B.	For furnishing and installing Fiber Optic Handholes, All Depths, as specified, the sum of $ -	ea.	10	$ -
	Item A-3 - Fiber Optic Conduits, Associated Fittings and Handholes (Bid Item A-3A. through A-3B., inclusive)			**$** -

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
Item A-4 - Tracer Wire in Town Roadways				
A-4A.	For furnishing and installing Tracer Wire in Town Roadways All Depths, as specified, the sum of			
	$ -	l.f.	28,100	$ -
	Item A-4 -Tracer Wire in Town Roadways (Bid Item A-4A., inclusive)		**$**	**-**

Company's Name

Date

Company's Address

Refer to the Instructions in SECTION 00410, Page 2 - Bid Proposal in filling out this Proposal Form.

Item	Description	Unit of Measure	Quantity	Extended Total
	SRF ELIGIBLE BID ITEMS - ALTERNATIVES			
Item A-5 - Highway Crossing Using Jacking				
A-4A.	For Additional Cost to furnish and install the Highway Crossing Using Jacking versus furnishing and installing the Highway Crossing Using Horizontal Directional Drilling , as specified, the sum of $ -	l.s.	1	$ -
	Item A-5 - Highway Crossing Using Jacking (Bid Item A-5A., inclusive)			**$ -**

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APPENDIX B

APPENDIX B
DIESEL RETROFIT PROGRAM

The Department of Environmental Protection ("DEP") has developed the Diesel Retrofit Program in response to increasing public health concerns with the emissions from diesel engines and vehicles.

Diesel Construction Equipment Standard

All diesel powered non-road construction equipment and vehicles greater than 50 brake horsepower which will be used in the performance of the work under the Contract (hereinafter "Diesel Construction Equipment") must have the following pollution control device installed unless exempt as provided below:

1. Emission control technology verified by U.S. Environmental Protection Agency ("EPA") or the California Air Resources Board ("CARB") for use with non-road engines;
2. Emission control technology verified by EPA or CARB for use with on-road engines provided that such equipment is operated with diesel fuel that has no more than 15 parts per million sulfur content (i.e. Ultra Low Sulfur Diesel fuel); or
3. Emission control technology certified by the manufacturer that such technology meets or exceeds the emission reductions provided by on-road or off-road emission control technology verified by EPA or CARB, i.e. that a Diesel Oxidation Catalyst is achieving the following minimum emission reductions: particulate matter 20%; carbon monoxide 40%; volatile organic compounds 50%; or a Diesel Particulate Filter is achieving a minimum of 85% emission reductions for particulate matter.

Emission control devices, such as oxidation catalysts or particulate filters, shall be installed on the exhaust system side of the Diesel Construction Equipment. The Contractor shall be responsible to insure that the emissions control technology is operated, maintained, and serviced as recommended by the manufacturer.

For the latest up-to-date list of EPA verified-technologies, see:
https://www.epa.gov/verified-diesel-tech
For the latest up-to-date list of CARB verified technologies, see:
http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm

Exemptions

The following Diesel Construction Equipment shall be exempt from the standard above. The Contractor shall include such Diesel Construction Equipment in the required recordkeeping:

1. Diesel Construction Equipment not owned by the Contractor and used in the performance of the work under this Contract for 30 calendar days (cumulative days but not necessarily consecutive) or less;
2. Unless otherwise exempt, additional Diesel Construction Equipment originally not anticipated to be used under the Contract or used as permanent replacement after the work under the Contract has commenced, for 15 calendars days from the date such Diesel Construction Equipment is brought on site;

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APPENDIX B (cont.)
DIESEL RETROFIT PROGRAM

3. Diesel Construction Equipment with an engine that meets the EPA particulate matter (PM) Tier emission standards in effect at the start of the Contract for non-road diesel engines for the applicable engine power group (e.g., as of January 1, 2009, a piece of Diesel Construction Equipment with a Tier 3 engine is exempt from meeting the standard until the piece of Diesel Construction Equipment is available with a Tier 4 engine) provided that if such emissions standards are superseded during the Contract then such Diesel Construction Equipment must be retrofitted in accordance with the standards above prior to the end of the Contract;
4. A large crane (e.g. a sky crane or link belt crane which is responsible for critical lift operations) if such device would adversely affect the operation of the crane provided the Contractor submits to the municipality's project engineer written technical justification documenting the adverse impact on operation; and
5. Diesel Construction Equipment that the project engineer has determined is necessary to control a compelling emergency including but not limited to, the need for rescue vehicles or other equipment to prevent harm to human beings or additional equipment required to address a catastrophic emergency such as structure collapse or imminent collapse. After the compelling emergency is controlled, such non-compliant equipment must be removed from the Contract site and may not be used in further performance of the work under this Contract. Meeting Contract deadlines is not a compelling emergency.

Contractor Certification

Each bidder shall submit as part of its bid, the Statement of Intent to Comply. Within 10 days of being notified that it has been awarded a contract, the bidder and each of its Contractors and Subcontractors shall submit a Diesel Retrofit Program Contractor Certification. Each such Certification shall contain the following information for each piece of Diesel Construction Equipment:

1. Contractor or Subcontractor name;
2. Equipment type, make, model;
3. Vehicle Identification Number or VIN;
4. Engine model and year of manufacture;
5. Engine HP rating;
6. Emission Control Device (ECD) type (Diesel Oxidation Catalyst or Diesel Particulate Filter);
7. ECD make, model, and manufacturer;
8. ECD EPA or CARB Verification Number or manufacturer's certification that the DOC or DPF meets or exceeds emission reductions provided by similar emission control technology verified by EPA or CARB;
9. ECD installation date;
10. Type of fuel to be used; and
11. Whether the equipment is owned or rented.

Recordkeeping

Each Contractor and Subcontractor shall maintain detailed records of all Diesel Construction Equipment used under the Contract, including the dates and duration times the Diesel Construction Equipment is

APPENDIX B (cont.)
DIESEL RETROFIT PROGRAM

used at the Contract site. Records shall be available for inspection by DEP. Each Contractor and Subcontractor shall notify DEP within 48 hours of any new Diesel Construction Equipment brought onto the Contract site.

For Diesel Construction Equipment that has an emissions control device with a manufacturer's certification, the Contractor shall maintain records of all supporting emissions test data and test procedures. If upon review the emissions reductions are not supported by the test data and test procedures, then the emissions control device may need to be replaced with a compliant retrofit device.

Project Regulatory Agreement

The following language shall be included section 4 (Covenants of the Borrower) of the municipality's Project Regulatory Agreement if it receives funds from the State Revolving Fund:

> The Borrower shall require each Contractor and Subcontractor to submit the Diesel Retrofit Program Contractor Certification to DEP and the Borrower prior to commencing work on the Project. The Borrower shall not allow any Contractor or Subcontractor to commence work at the Project site prior to submitting such Certification.

APPENDIX B (cont.)
DIESEL RETROFIT PROGRAM

STATEMENT OF INTENT TO COMPLY

This form must be signed and submitted by the bidder as part of the bid.

Local Governmental Unit _____ **SRF Project No.** _____

Contract No. _____ **Contact Title** _____

Bidder _____

The undersigned, on behalf of the above-named Bidder, agrees that, if awarded the Contract:

1. **the Bidder shall comply with the Massachusetts Department of Environmental Protection's ("MassDEP") Diesel Retrofit Program by ensuring that all diesel powered non-road construction equipment and vehicles greater than 50 brake horsepower which will be used in the performance of the work under the Contract are equipped or retrofitted with a pollution control device in accordance with the Diesel Retrofit Program Standard;**
2. **the Bidder shall require all Subcontractors to comply with MassDEP's Diesel Retrofit Program by ensuring all diesel powered non-road construction equipment and vehicles greater than 50 brake horsepower which will be used in the performance of the work under the Contract are equipped or retrofitted with a pollution control device in accordance with the Diesel Retrofit Program Standard; and**

3. **The Bidder shall submit and shall require each Subcontractor to submit a Diesel Retrofit Program Contractor Certification (form attached) with a Diesel Retrofit List to MassDEP Municipal Services and the Bidder within 10 days of the bidder being notified that it has been awarded the Contract. The Bidder shall require each Subcontractor to update such Certification and List within 2 days of using additional Diesel Construction Equipment on the project under the Contract.**

_____

(Signature of Bidder's Authorized Representative) **(Date)**

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APPENDIX B (cont.)

DIESEL RETROFIT PROGRAM CONTRACTOR CERTIFICATION

Each Contractor and its Subcontractor(s) must sign and submit this form to DEP DMS project engineer, 5th Floor, MassDEP, One Winter Street, Boston, MA 02108 and the Municipality within 10 days after the Contractor is notified that it is awarded the Contract.

Local Governmental Unit _____ **SRF Project No.** _____

Contract No. _____ **Contact Title** _____

Contractor _____

I, _____, an authorized signatory for _____, whose principal place of business is at _____ do hereby certify that any and all diesel powered non-road construction equipment and vehicles greater than 50 brake horsepower which will be used in the performance of the work under the Contract (hereinafter "Diesel Construction Equipment") have pollution control devices, such as oxidation catalysts or particulate filters, installed on the exhaust system side of the diesel combustion engine equipment in accordance with the Diesel Retrofit Program Standard.

I am submitting on behalf of _____ a list of all said Diesel Construction Equipment, labeled "Diesel Retrofit List," that will be used in connection with this Contract by _____. I hereby certify that the information on the attached Diesel Retrofit List is correct and accurate as of the date of signature. The List includes the following information for each piece of Diesel Construction Equipment:

1. Equipment type, make, model;
2. Vehicle Identification Number or VIN;
3. Engine model and year of manufacture;
4. Engine HP rating;
5. Emission Control Device ("ECD") type (Diesel Oxidation Catalyst or Diesel Particulate Filter);
6. ECD make, model, and manufacturer;
7. ECD EPA or CARB Verification Number or manufacturer's certification that the DOC or DPF meets or exceeds emission reductions provided by similar emission control technology verified by EPA or CARB;
8. ECD installation date;
9. Type of fuel to be used; and
10. Whether the equipment is owned or rented.

APPENDIX B (cont.)

DIESEL RETROFIT PROGRAM CONTRACTOR CERTIFICATION

_____shall notify DEP within 48 hours of any new Diesel Construction Equipment brought onto the Contract site. _____shall maintain detailed records of all Diesel Construction Equipment used at the Contract site, including the dates and duration times the Diesel Construction Equipment is used at the Contract site. _____ shall make such records available for inspection by DEP. _____shall ensure that the emissions control technology for each piece of Diesel Construction Equipment is operated, maintained, and serviced as recommended by the manufacturer. _____ shall retrofit prior to the end of the Contract any Diesel Construction Equipment no longer exempt from meeting the Diesel Construction Equipment Standard under exemption 3 (because it had an engine that met the EPA particulate matter (PM) Tier emission standards currently in effect at the start of the Contract for non-road diesel engines for the applicable engine power group and such emissions standards were superseded during the Contract).

I acknowledge that this certificate is being furnished as a requirement under this Contract and is subject to applicable State and federal laws, both criminal and civil. Signed under pains and penalty of perjury on this date _____.

Signature_____

Name: _____

Title: _____

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APPENDIX E

APPENDIX E
CONSTRUCTION BID SPECIFICATIONS
SPECIAL PROVISIONS FOR DISADVANTAGED BUSINESS ENTERPRISES
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF MUNICIPAL SERVICES

DISADVANTAGED BUSINESS ENTERPRISE PROGRAM BACKGROUND

In May 2008 a United States Environmental Protection Agency (EPA) rule became effective that changed the Minority Business Enterprise (MBE) and Women Business Enterprise (WBE) Program to a Disadvantaged Business Enterprise (DBE) Program.

For firms to qualify under the old MBE/WBE program they needed to be socially disadvantaged and had to be certified by the Supplier Diversity Office (SDO). Under the new DBE rule, the firms must be both **socially** and **economically** disadvantaged, **citizens of the United States**, and certified as a DBE. Women and certain minorities are presumed to be socially disadvantaged. The economic disadvantage is measured by the owner's initial and continuing personal net worth of less than $1,320,000.

Because the Clean Water Act requires the use of MBEs and WBEs, these firms will still be utilized in the State Revolving Fund (SRF) Loan Program, but they must also be certified as DBEs.

SDO will continue to be the certifying agency for the SRF program. SDO certifies firms under the federal Department of Transportation program, which is acceptable for use in the SRF program. An additional form has been added to the DBE package to verify that DBEs are owned or controlled by United States citizens.

BID SPECIFICATIONS

I. In this contract, the percentage of business activity to be performed by disadvantaged business enterprise(s) (DBE) shall not be less than the following percentages of the total contract price or the percentage submitted by the contractor in the Schedule of Participation, whichever is greater:

Disadvantaged MBE (D/MBE) 4.2% Disadvantaged WBE (D/WBE) 4.5%

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II. DEFINITIONS

For the purpose of these provisions, the following terms are defined as follows:

A. Awarding Authority – Entity that awards a prime contract under a State Revolving Fund loan.

B. Bidder - Any individual, partnership, joint venture, corporation, or firm submitting a price, directly or through an authorized representative, for the purpose of performing construction or construction related activities under a Contract.

C. Certified DBE – A DBE certified by the United States Small Business Administration, under its 8(a) Business Development Program (13 CFR part 124, subpart A) or its Small Disadvantaged Business Program (13 CFR part 124, subpart B); The United States Department of Transportation (DOT), under its regulations for Participation by DBSs in DOT programs (49 CFR parts 23 and 26); or SDO in accordance with 40 CFR part 33; provided that the certification meets the U.S. citizenship requirement under 40 CFR §33.202 or §33.203.

D. Compliance Unit - A subdivision of MassDEP's Affirmative Action Office designated to ensure compliance under these provisions.

E. Contractor - Any business that contracts or subcontracts for construction, demolition, renovation, survey, or maintenance work in the various classifications customarily used in work and that is acting in this capacity under the subject contract.

F. Construction Related Services - Those services performed at the work site ancillary to, and/or in support of, the construction work, such as hauling, trucking, equipment operation, surveying or other technical services, etc. For the purposes hereof, supply and delivery of materials (e.g. pre-cast concrete elements) to the site by a supplier who has manufactured those goods, or substantially altered them before re-sales shall be considered as "construction related services

G. Construction Work - The activities at the work site, or labor and use of materials in the performance of constructing, reconstructing, erecting, demolishing, altering, installing, disassembling, excavating, etc, all or part of the work required by the Contract Documents.

H. Disadvantaged Business Enterprise (DBE) - An entity owned or controlled by a socially and economically disadvantaged individual as described by Public Law 102-389 (42 U.S.C. 4370d) or an entity owned and controlled by a socially and economically disadvantaged individual as described by Title X of the Clean Air Act Amendments of 1990 (42 U.S.C. 7601 note); a Small Business Enterprise (SBE); a Small Business in a Rural Area (SBRA); or a Labor Surplus Area Firm (LAF), a Historically Underutilized Business (HUB) Zone Small Business Concern, or a concern under a successor program.

I. Equipment Rental Firm - A firm that owns equipment and assumes actual and contractual responsibility for renting said equipment to perform a useful function of the work of the contract consistent with normal industry practice

J. Good Faith Efforts – The race and/or gender neutral measures described in 40 CFR 33, subpart C.

K. HUBZone - A historically underutilized business zone, which is an area located within one or more qualified census tracts, qualified metropolitan counties, or lands within the external boundaries of an Indian reservation.

L. HUBZone small business concern - A small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration.

M. Joint Venture - An agreement between SDO certified DBE and a non-DBE or non-DBE controlled enterprise.

1. A pairing of companies will be considered a DBE joint venture if the SDO certified DBE which is part of the relationship has more than 51% of the profits that are derived from that project.

2. A joint venture between a certified DBE subcontractor and a non DBE subcontractor, in which the DBE for that proportion of the joint venture's contract equal to the DBE participation in the joint venture.

3. Whenever a general bid is filed by a joint venture with a certified DBE participant in the joint venture that does not exercise more than 51% control over management and profits, that joint venture shall be entitled to credit as a DBE for that portion of the joint venture's contract equal to the DBE participation in the joint venture. Minority As deemed by SDO.

N. Labor surplus area firm (LSAF) - A concern that together with its first-tier subcontractors will perform substantially in labor surplus areas (as identified by the Department of Labor in accordance with 20 CFR part 654). Performance is substantially in labor surplus areas if the costs incurred under the contract on account of manufacturing, production or performance of appropriate services in labor surplus areas exceed 50 percent of the contract price.

O. Letter of Intent – Certified document signed by the principal(s) of the DBE with respect to the work to be performed under contract.

P. Local Government Unit (LGU) – A city, town, or municipal district which applies for a loan under the Clean Water Trust Program.

Q. Material Supplier – A vendor certified by SDO as a DBE in sales to supply industry from an established place of business or source of supply, and that vendor.

1. Manufactures goods from raw materials, or substantially utilizes them in the work, or substantially alters them before resale, entitling the general contractor to DBE credit for 100% of the purchase order.

2. Provides and maintains a storage facility for materials utilized in the work, entitling the general contractor to DBE credit for 10% of the purchase order

R. Minority and Women Business Enterprise (M/WBE) – Any business concern certified by the SDO as a bona-fide M/WBE. A bona-fide M/WBE is a business whose minority group/women ownership interests are real, which have at least 51% ownership and control over management and operation.

S. Percent of Total Price – Is the percentage to be paid to the DBE, work they perform, as compared to the total bid price

T. Recipient - An agency, person or political subdivision which has been awarded or received financial assistance by the Trust or MassDEP.

U. Small business, small business concern or small business enterprise (SBE) - A concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding, and qualified as a small business under the criteria and size standards in 13 CFR part 121.

V. Small business in a rural area (SBRA) - A small business operating in an area identified as a rural county with a code 6-9 in the Rural-Urban continuum Classification Code developed by the United States Department of Agriculture in 1980.

W. SDO – The Supplier Diversity Office.

X. Subcontractor – A company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an award of financial assistance.

Y. Total Contract Price – The total amount of compensation to be paid for all materials, work or services rendered in the performance of the contract

Z. Trust – The Massachusetts Clean Water Trust established by M.G.L. c.29.

III. REQUIREMENTS FOR CONTRACT AWARD

DBE packages must be submitted by the two lowest bidders on the project. Following bid opening, the LGU shall notify the two lowest bidders to submit DBE packages to the LGU or the LGUs consultant, as directed. By the close of business on the third business day after notification, the two lowest bidders, including a bidder who is a MBE, WBE or DBE, shall submit the following information:

A. A Schedule of Participation (Form EEO-DEP-190). The Schedule of Participation shall list those certified DBEs the bidder intends to use in fulfilling the contract obligations, the nature of the work to be performed by each certified DBE subcontractor and the total price they are to be paid.

   1. A listing of bona-fide services such as a professional, technical, consultant or managerial services, assistance in the procurement of essential personnel, facilities, equipment, materials, or supplies required for performance of the contract, and reasonable fees or commissions charged.

   2. A listing of haulers, truckers, or delivery services, not the contractors, including reasonable fees for delivery of said materials or supplies to be included on the project.

B. A Letter of Intent (Form EEO-DEP-191) for each DBE the bidder intends to use on the project. The Letter of Intent shall include, among other things, a reasonable description of the work the certified DBE is proposing to perform and the prices the certified DBE proposes to charge for the work. A Letter of Intent shall be jointly signed by the certified DBE and the General Contractor who proposes to use them in the performance of the Contract.

C. Each DBE must also sign and return the DBE Certification of United States Citizenship form to verify that the firm is owned or controlled by a United States citizen.

D. The SDO "DBE Certification" as prepared by each certified DBE.

E. A completed Request for Waiver form and backup documentation should the goals not be achieved (See IV below).

IV. REQUIREMENTS FOR MODIFICATION OR WAIVERS.

The bidder shall make every possible effort to meet the minimum requirements of certified DBE participation. If the percentage of DBE participation submitted by the bidder on its Schedule of Participation (EEO-DEP-190) does not meet the minimum requirements, the bid may be rejected by the Awarding Authority and found not to be eligible for award of the contract.

In the event that the bidder is unable to meet the minimum requirements of DBE participation, the bidder shall submit with his/her submittal required in Section III. Requirement of Contract Award a Request for Waiver form (EEO-DEP-490). The Awarding Authority shall review the waiver request to determine if the request should proceed. If approved by the Awarding Authority, the Awarding Authority shall submit the waiver request and supporting documentation, with a recommendation to MassDEP within five days of receipt of the Request for Waiver. MassDEP in conjunction with the project manager, Compliance Unit, will determine whether the waiver will be granted.

The waiver request shall include detailed information as specified below to establish that the bidder has made a good faith effort to comply with the minimum requirements of DBE participation specified in Part I. In addition, the bidder must show that such efforts were undertaken well in advance of the time set for opening of bids to allow adequate response. A waiver request shall include the following:

A. A detailed record of the effort made to contact and negotiate with the certified DBE, including, but not limited to:

   1. names, addresses and telephone numbers of all such companies contacted;

   2. copies of written notices(s) which were sent to certified DBE potential subcontractors, prior to bid opening;

   3. a detailed statement as to why each subcontractor contacted (i) was not willing to do the job or (ii) was not qualified to perform the work as solicited; and

   4. in the case(s) where a negotiated price could not be reached the bidder should detail what efforts were made to reach an agreement on a competitive price;

   5. copies of advertisements, dated not less than ten (10) days prior to bid opening, as appearing in general publications, trade-oriented publications, and applicable minority/ women-focused media detailing the opportunities for participation.

B. MassDEP may require the bidder to produce such additional information as it deems appropriate.

C. No later than fifteen (15) days after MassDEP receives all required information and documentation, it shall make a decision in writing, whether the waiver is granted and shall provide that determination to the bidder and Awarding Authority. If the waiver request is denied, the facts upon which a denial is based will be set forth in writing. If the waiver request is denied, the bid shall be rejected by the Awarding Authority, or the contract will be determined ineligible for SRF funding.

   If a Request for Waiver is denied by MassDEP and the bid is rejected by the Awarding Authority, the Awarding Authority may then move to the second bidder on the project. At the Awarding Authority's discretion, it may collect a DBE package from the third bidder on the project.

V. DISADVANTAGED BUSINESS ENTERPRISES PARTICIPATION

A. Reporting Requirements

1. The Contractor's utilization of certified DBEs will be documented based upon submittal of the LGU's monthly Payment Requisitions as reported on Form-2000. The Form-2000 form will show all certified DBEs performing work on the project regardless of any billing activity for that month. For auditing and accounting purposes, the Contractor periodically may be required to submit copies of canceled checks verifying that payments have been made to the certified DBE as listed on the schedule. The Contractor may also be required to submit current schedules on utilization of all DBEs to indicate when their services will commence and be billed for.

2. During the life of the Contract, the Contractor's fulfillment of the percentage requirements in Part I shall be determined with reference to the Contract price as follows:

   A. If the price in the Contract executed exceeds the base bid price (e.g., because an alternate was selected or because unit prices were used in awarding the Contract), the Contractor shall submit for approval by MassDEP a revised Schedule of Participation by certified DBEs satisfying the percentage requirements and such other information concerning additional DBE participation as may be requested by MassDEP.

   B. If the Contract price increases after execution due to change orders or other adjustments, MassDEP may require the Contractor to subcontract additional work or to purchase additional goods and services from certified DBEs up to the percentages stated in Part I.

VI. COMPLIANCE

A. If the Schedule or any of the Letters of Intent are materially incomplete or not submitted in a timely manner, the LGU may rescind its vote of award; treat the bid informal as to substance and reject the bid. If the bid is incomplete in any other respect than the Schedule the LGU with the approval of MassDEP may waive the informalities upon satisfactory completion of the required information by the Contractor and the certified DBE as applicable.

B. If the LGU finds that the percentage of certified DBE participation submitted by the contractor on its Schedule does not meet the percentage requirement in Part I, it shall rescind its vote of award and find such contractor not to be eligible for award of the contract.

C. The Contractor shall not perform with its own organization, or subcontract to any other primary or subcontractor any work designated for the named certified DBEs on the schedule submitted by the Contractor under Part III without the approval of MassDEP.

D. A Contractor's compliance with the percentage requirement in Part I shall continue to be determined by reference to the required percentage of the total contract price as stated in Section I even though the total of actual contract payments may be greater or less than the bid price.

E. If the Contractor for reasons beyond its control cannot comply with Part III in accordance with the Schedule submitted under Part III, Section B, the contractor must submit to MassDEP as soon as they are aware of the deficiency, the reason for its inability to comply. Proposed revisions to the Schedule stating how the contractor intends to meet its obligations under these conditions must be submitted within ten (10) working days of notification.

F. If the Contractor is becomes aware by any means that that DBE is no longer certified, the Contractor shall immediately notify MassDEP. The Contractor shall use good faith efforts to retain a substitute certified DBE.

G. If a certified DBE listed by the bidder in its Schedule of M/WBE contractors fails to obtain a performance or payment bond requested by the bidder, said failure shall not entitle the bidder to avoid the requirements of Part III (A). After a bidder has been awarded the contract, he shall not change the certified DBE listed in its Schedule at the time of the award or make any other such substitutions without the written approval of MassDEP.

VII. SANCTIONS

A. If the Contractor does not comply with the terms of these Special Provisions, the Awarding Authority may (1) suspend any payment for the work that should have been performed by a certified DBE pursuant to the schedule, or (2) require specific performance of the Contractor's obligation by requiring the Contractor to subcontract with a DBE for any contract or specialty item at the contract price established for that item in the proposal submitted by the Contractor.

B. To the extent that the Contractor has not complied with the terms of these Special Provisions, the Awarding Authority may retain in connection with Estimates and Payments an amount determined by multiplying the bid price of this contract by the percentage in Section I, less the amount paid to DBE's for work performed under the contract and any payments already suspended under VII A.

C. The Awarding Authority may suspend, terminate or cancel this contract, in whole or in part, or may call upon the Contractor's surety to perform all terms and conditions in the contract, unless the contractor is able to demonstrate his compliance with the terms

of these Special Provisions, and further deny to the Contractor, the right to participate in any future contracts awarded by the Awarding Authority for a period of up to three years.

D. In any proceeding involving the imposition of sanctions by the Awarding Authority, no sanctions shall be imposed if the Awarding Authority finds that the contractor has taken every possible measure to comply with these Special Provisions or that some other justifiable reason exists for waiving these Special Provisions in whole or in part.

E. The contract shall provide such information as is necessary in the judgment of the Awarding Authority to ascertain its compliance with the terms of these Special Provisions.

F. A contractor shall have the right to request suspension of any sanctions imposed under this section upon demonstrating that he is in compliance with these Special Provisions.

DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF MUNICIPAL SERVICES

SCHEDULE OF PARTICIPATION FOR SRF CONSTRUCTION

Project Title: _____ **Project Location:** _____

Disadvantaged Minority Business Enterprise Participation in the SRF Loan Work

Name & Address of D/MBE	Nature of Participation	Dollar Value of Participation
1.		
2.		
3.		
	Total D/MBE Commitment:	**$**
Percentage D/MBE Participation = (Total D/MBE Commitment) / (Bid Price) =		**%**

Disadvantaged Women Business Enterprise Participation in the SRF Loan Work

Name & Address of D/WBE	Nature of Participation	Dollar Value of Participation
1.		
2.		
3.		
	Total D/WBE Commitment:	**$**
Percentage D/WBE Participation = (Total D/WBE Commitment) / (Bid Price) =		**%**

The Bidder agrees to furnish implementation reports as required by MassDEP to indicate the D/MBEs and D/WBE(s) which it has used or intends to use. Breach of this commitment constitutes a breach of the contract.

Name of Bidder: _____

Date: _____ By: _____
Signature

NOTE: Participation of a DBE may be counted in only their certified category; the same dollar participation cannot be used in computing the percentage of D/MBE participation and again of D/WBE participation.

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LETTER OF INTENT FOR SRF CONSTRUCTION

This form is to be completed by the D/MBE and D/WBE and must be submitted by the Bidder no later than close of business on the third business day after notification by the LGU. A separate form must be completed for each D/MBE and D/WBE involved in the project.

Project Title: _____ Project Location: _____

TO: _____
(Name of Bidder)

FROM: _____
(Please Indicate Status [ ] D/MBE or [ ] D/WBE)

º I/we intend to perform work in connection with the above project as (check one):

[ ] An individual
[ ] A corporation
[ ] A partnership
[ ] A joint venture with: _____
[ ] Other (explain): _____

º It is understood that if you are awarded the contract, you intend to enter into an agreement to perform the activity described below for the prices indicated.

DBE PARTICIPATION

Description of Activity	Date of Project Commencement	$ Amount	% Bid Price
		$	**%**

º The undersigned certify that they will enter into a formal agreement upon execution of the contract for the above referenced project.

BIDDER	**DBE**
(Authorized Original Signature) Date	(Authorized Original Signature) Date
ADDRESS:	ADDRESS:
TELEPHONE #:	TELEPHONE #:
FEIN:	FEIN:
EMAIL ADDRESS:	EMAIL ADDRESS:

ORIGINALS:

- **º Compliance Mgr. City/Town Project Location**
- **º DEP Program Manager for DEP's AAO Director**

*** Attach a copy of current (within 2 years) DBE Certification**

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DBE CERTIFICATION OF UNITED STATES CITIZENSHIP

For the SRF program, under the EPA Disadvantage Business Enterprise (DBE) Rule, a DBE must be owned or controlled by a socially and economically disadvantaged person that is also a **citizen of the United States** (*See* 40 CFR 33.202). "Ownership" is defined at 13 CFR 124.105 and "control" is defined at 13 CFR 124.106.

DBEs are certified for the SRF program through the Supplier Diversity Office using the federal Department of Transportation (DOT) DBE rules. EPA allows the use of DBEs certified under the DOT rules as long as they are also United States citizens. To ensure compliance with the EPA rule, MassDEP must verify United States citizenship through the completion of the following form for each DBE used on the project.

SRF Project Number _____

Contract Number _____

Contract Title _____

DBE Subcontractor _____

The undersigned, on behalf of the above named DBE subcontractor, hereby certifies that the DBE firm is either owned or controlled by a person or persons that are citizens of the United States.

_____
Printed Name and Title of DBE Signatory

_____
DBE Signature

_____
Date

DISADVANTAGED BUSINESS ENTERPRISE
PROGRAM DBE SUBCONTRACTOR PARTICIPATION
FORM

The United States Environmental Protection Agency (EPA) requires that this form be provided to all subcontractors on the project. At the option of the subcontractor, this form may be filled out and submitted directly to the EPA DBE Coordinator.

NAME OF SUBCONTRACTOR	PROJECT NAME
ADDRESS	CONTRACT NO.
TELEPHONE NO.	E-MAIL ADDRESS
PRIME CONTRACTOR NAME:	

Please use the space below to report any concerns regarding the above EPA-funded project (e.g., reason for termination by prime contractor, late payment, etc.).

_____

_____

_____

_____

_____

CONTRACT ITEM NO.	ITEM OF WORK OR DESCRIPTION OF SERVICES RECEIVED FROM THE PRIME CONTRACTOR	AMOUNT SUBCONTRACTOR WAS PAID BY PRIME CONTRACTOR

_____ _____
Subcontractor Signature Title/Date

Equivalent to EPA form 6100-2

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REQUEST FOR WAIVER FOR SRF CONSTRUCTION

Upon exhausting all known sources and making every possible effort to meet the minimum requirements for DBE participation, the Bidder may seek relief either partially or entirely from these requirements by submitting a completed waiver package by the close of business on the third business day after notification by the LGU. Failure to comply with this process shall be cause to reject the bid thereby rendering the Bidder not eligible for award of the contract.

General Information

Project Title: _____ Project Location: _____

Bid Opening (time/date) _____

Bidder: _____

Mailing Address: _____

Contact Person: _____ Telephone No. ( ) _____ Ext. _____

Minimum Requirements

The bidder must demonstrate that good faith efforts were undertaken to comply with the percentage goals as specified. The firm seeking relief must show that such efforts were taken appropriately in advance of the time set for opening bid proposals to allow adequate time for response(s) by submitting the following:

A. A detailed record of the effort made to contact and negotiate with disadvantaged minority and/or woman owned businesses, including:

1. names, addresses, telephone numbers and contact dates of all such companies contacted;

2. copies of written notice(s) which were sent to DBE potential subcontractors prior to bid opening;

3. a detailed statement as to why each subcontractor contacted (i) was not willing to do the job or (ii) was not qualified to perform the work as solicited; and

4. in the case(s) where a negotiated price could not be reached the bidder should detail what efforts were made to reach an agreement on a competitive price.

5. copies of advertisements, dated not less than ten (10) days prior to bid opening, as appearing in general publications, trade-oriented publications, and applicable minority/women-focused media detailing the opportunities for participation;

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B. MassDEP may require the bidder to produce such additional information as it deems appropriate.

C. No later than fifteen (15) days after submission of all required information and documentation, MassDEP shall make a determination, in writing, whether the waiver request is granted and shall provide that determination to the bidder and Awarding Authority. If the waiver request is denied, the facts upon which a denial is based will be set forth in writing.

CERTIFICATION

The undersigned herewith certifies that the above information and appropriate attachments are true and accurate to the best of my knowledge and that I have been authorized to act on behalf of the bidder in this matter.

_____ _____

(authorized original signature) DATE

DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF MUNICIPAL SERVICES

STATE REVOLVING FUND LOAN PROGRAM – SCHEDULE OF SUBCONTRACTOR PARTICIPATION

Local Governmental Unit _____

Project Name _____

SRF Identification Number _____

General Contractor _____

Contract Value _____

The United States Environmental Protection Agency (EPA) requires that all SRF borrowers develop and maintain a list of all MBE/WBE and non MBE/WBE subcontractors on the project.

This form must be completed and returned to MassDEP within 90 days of award of the contract.

Subcontractor	Point of Contact	Mailing Address	Telephone Number	E-Mail Address	MBE	WBE	DBE	Subcontract Value

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SECTION 00520

AGREEMENT

Made in triplicate this the _____ day of _____, 20____ between the Town of Orleans, MA

AND

hereafter the "Contractor".

WITNESSETH: That for and in consideration of the following mutual covenants contained herein the parties agree with each other as follows:

ARTICLE I: The Contractor agrees to sell and/or deliver to the Town of Orleans, MA materials and/or services in accordance with the following: DOWNTOWN AREA COLLECTION SYSTEM AND PUMPING STATIONS, Contract No. 2019-02 and SRF No. 4486:

Exhibit 1. Quote/bid dated

Exhibit 2. Certificate of Non-Collusion

Exhibit 3. Statement of State Tax Compliance

Exhibit 4. Acknowledgement of Principal

Exhibit 5. Certificate of Insurance

Exhibit 6. Certification of OSHA 10-Hour Training

ARTICLE II: The Town of Orleans, MA agrees to process the bills for payment to the Contractor upon the execution of the contract, satisfactory completion of the services as outlined in the specifications and approval by the appropriate Department Manager, Town Administrator and Town Accountant in the amount of _____-- and 00/100 ($____.00) Dollars.

ARTICLE III

1. The Contractor agrees that it will fully comply with Subpart C of 2 CFR Part 180 and 2 CFR Part1532, entitled Responsibilities of Participants Regarding Transactions (Doing Business with Other Persons). The Contractor shall not award any subcontracts or purchase any materials from suppliers that appear on the Excluded Parties List System.

   The Contractor shall include this requirement in each subcontract and require it to be included in all subcontracts regardless of tier. The Contractor shall maintain reasonable records to demonstrate compliance with these requirements.

2. The fair share goals for disadvantaged business enterprise (DBE) participation for this contract are a minimum of 4.2 percent Disadvantaged Minority Business Enterprise (D/MBE) participation and 4.5 percent Disadvantaged Women Business Enterprise(D/WBE) participation, applicable to the total dollar amount paid for the construction contract. The Contractor shall take all affirmative steps necessary to achieve this goal, and shall provide reports documenting the portion of contract and subcontract dollars paid to DBEs, and its efforts to achieve the goals, with each invoice submitted or at such greater intervals as specified by the (municipality). The contractor shall require similar reports from its subcontractors.

3. Equal Employment Opportunity/Affirmative Action (EEO/AA) Requirements - During the performance of this contract, the contractor agrees as follows:

   A. The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

B. The contractor will, in all solicitations or advancements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.

C. The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

D. The contractor will comply with all provisions of Executive Order No. 11246 of Sept. 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

E. The contractor will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders. Comp., p. 684, EO 12086 of Oct. 5, 1978, 43 FR 46501, 3 CFR, 1978 Comp., p. 230

F. In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of Sept. 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

G. The contractor will include the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions including sanctions for noncompliance: Provided, however, that in the event the contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the contractor may request the United States to enter into such litigation to protect the interests of the United States." [Sec. 202 amended by EO 11375 of Oct. 13, 1967, 32 FR 14303, 3 CFR, 1966- 1970”

4. The contractor shall not participate in or cooperate with an international boycott, as defined in Section 999 (b)(3) and (4) of the Internal Revenue code 1986, as amended, or engage in conduct declared to be unlawful by Section 2 of Chapter 151E of the Massachusetts General Laws.

5. The Bidder hereby agrees that if selected as the Contractor it will commence work under this contract on or before a date to be fixed in the written “Notice to Proceed” given by the Owner to the Contractor and to fully complete the project within 751 calendar days, using not more than 304 working days split into four phases.

6. The Bidder further agrees to pay as liquidated damages the sum of $9,700 for each consecutive calendar day and/or working day thereafter during which the work as not been fully completed, as provided in the “Liquidated Damages” provisions of SECTION 00800, SUPPLEMENTARY CONDITIONS.

7. As per MassDEP’s Policy Memorandum #10 – the agreed upon DIRECT LABOR MARKUP (percentage) for Change Orders on this project shall be ___ percent.

8. American Iron and Steel (AIS) Requirements - The Contractor acknowledges to and for the benefit of the Town of Orleans (“Purchaser”) and the Commonwealth of Massachusetts (the “State”) that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as “American Iron and Steel;” that requires all of the iron and steel products used in the project to be produced in the United States (“American Iron and Steel Requirement”) including iron and steel products provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a)the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and

Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees)incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

9. All contracts for water and sewer projects awarded as a result of a proposal or invitation for bids under MGL Chapter 30 section 39M shall include a price adjustment clause for fuel, both diesel and gasoline; liquid asphalt; and Portland cement contained in cast-in-place concrete. A base price for each material shall be set by the awarding authority or agency and shall be included in the bid documents at the time the project is advertised. The awarding authority or agency shall also identify in the bid documents the price index to be used for each material. The price adjustment clause shall provide for a contract adjustment to be made on a monthly basis when the monthly cost change exceeds plus or minus 5 percent.

10. All construction contracts are subject to the Davis Bacon wage rate requirements.

11. The Contractor agrees that it will fully comply with Subpart C of 2 CFR Part 180 and 2 CFR Part 1532, entitled Responsibilities of Participants Regarding Transactions (Doing Business with Other Persons). The Contractor shall not award any subcontracts or purchase any materials from suppliers that appear on the Excluded Parties List System. The Contractor shall include this requirement in each subcontract and require it to be included in all subcontracts regardless of tier. The Contractor shall maintain reasonable records to demonstrate compliance with these requirements.

IN WITNESS: Whereof the respective parties hereto have caused this instrument to be duly subscribed and sealed.

TOWN OF ORLEANS, MA

_____

John Kelly
Orleans Town Administrator

(INSERT VENDOR'S NAME)

_____

Signature of Individual or
Corporate Name (Mandatory)

APPROVED AS TO APPROPRIATIONS: Pursuant to M.G.L. c.44, s31C, I certify that an appropriation has been made in the total amount of the contract.

_____

Cathy Doane
Finance Director

SOURCE: _____

_____

Corporate Officer

(Mandatory, If applicable)

EIN # (Mandatory) _____

Not to Exceed: $_____

END OF DOCUMENT

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SECTION 00520

ATTACHMENT A

ADDITIONAL FORMS TO BE SUBMITTED WITH THE BID

A. INSURANCE REQUIREMENTS FOR INCLUSION IN ALL SPECIFICATIONS AND CONTRACTS

B. STATEMENT OF STATE TAX COMPLIANCE

C. CERTIFICATE OF NON-COLLUSION

D. ACKNOWLEDGEMENT OF PRINCIPAL, IF A CORPORATION

E. ACKNOWLEDGEMENT OF PRINCIPAL, IF A PARTNERSHIP

F. CERTIFICATION OF OSHA 10-HOUR TRAINING

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INSURANCE REQUIREMENTS FOR INCLUSION IN ALL SPECIFICATIONS AND CONTRACTS

OWNERS NAME: Town of Orleans, MA

PROJECT NAME: Downtown Area Collection System and Pumping Stations, Contract No. 2019-02 and SRF No. 4486

Insurance. The Contractor shall carry and maintain in effect during the entire currency of the contract, at his own expense, the following kinds and minimum amounts of insurance in a company or companies approved by the Town of Orleans, MA. Such insurance shall cover claims and suits which arise out of or result from the Contractor's execution of the contract work whether such execution by the Contractor himself or by any Subcontractor.

1) X - Worker's Compensation as required by the Worker's Compensation Laws of the Commonwealth of Massachusetts and, in conjunction therewith, Employer's Liability with a minimum limit as required by statute.

2) X - "Broad Form" Comprehensive General Liability including, but not limited to, Bodily Injury, Personal Injury and Property Damage Liability, Full Contractual Liability and liability arising from Explosion, Collapse and Underground Damage and all other applicable insurance necessary to carry out the contractual obligation to proceed under the contract. Provide a minimum limit of liability of $5,000,000.00 utilizing: (a) a standalone certificate or (b) a minimum $2,000,000.00 General Liability Policy combined with Umbrella Policy.

3) X - Automobile Bodily Injury and Property Damage Liability for all owned, non-owned and hired automobiles operated in connection with the performance of the contract. Minimum limits of liability: Single limits of Property Damage and Bodily Injury $1,000,000.

4) X - Builder's Risk - Amount of the General Contractor's Contract

5) ___ - Professional Liability/ Errors and Omissions – Not Required

Certificate of Insurance - Prior to beginning work under the contract, the Contractor shall furnish the Town of Orleans, MA a Certificate of Insurance naming the Town of Orleans, MA and AECOM Technical Services, Inc. as additional insured. Such Certificate also shall provide that the Town of Orleans, MA will be notified at least 30 days in advance of the cancellation or non-renewal of any insurance covered by the Certificate.

END OF DOCUMENT

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STATEMENT OF STATE TAX COMPLIANCE

OWNERS NAME: Town of Orleans, MA

PROJECT NAME: Downtown Area Collection System and Pumping Stations, Contract No. 2019-02 and SRF No. 4486

Pursuant to Ch. 233 of the Acts of 1983, §49A(b), I, _____, acknowledge that I am the authorized signatory for _____, whose principal place of business is at _____ , and as such, do hereby certify under the pains of penalties of perjury that this company has complied with all laws of the Commonwealth relating to taxes.

Social Security or Federal ID Number: _____

Subscribed and sworn to this _____day of _____, 20____.

_____

Contractor's Signature

_____

Notary Public Signature

(Seal)

My Commission expires on: _____

END OF DOCUMENT

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CERTIFICATE OF NON-COLLUSION

OWNERS NAME: Town of Orleans, MA

PROJECT NAME: Downtown Area Collection System and Pumping Stations, Contract No. 2019-02 and SRF No. 4486

Pursuant to M.G.L. Ch. 30, the undersigned certifies under penalties of perjury that this bid or proposal has been made and submitted in good faith and without collusion or fraud with any other person. As used in this certification, the word "person" shall mean any natural person, business, partnership, corporation, union, committee, club, or other organization, entity, or group of individuals.

_____

Name of business

_____

Contractor's Signature

_____

Notary Public Signature

(Seal)

My Commission expires on: _____

END OF DOCUMENT

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ACKNOWLEDGEMENT OF PRINCIPAL, IF A CORPORATION

OWNERS NAME: Town of Orleans, MA

PROJECT NAME: Downtown Area Collection System and Pumping Stations, Contract No. 2019-02 and SRF No. 4486

State of _____

County of _____

SS: _____

On this ___ day of _____, 20__, before me personally came and appeared to me who, being by me duly sworn, did depose and say to me that he resides at _____ that he is of _____, the corporation described in and which executed the foregoing instrument; that he knows the seal of said corporation; that one of the impressions affixed to said instrument is an impression of such seal; that it was so affixed by the order of the directors of said corporation, and that he signed his name thereto by like order.

_____
Contractor's Signature

_____
Notary Public Signature

(Seal)

My Commission expires on: _____

END OF DOCUMENT

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ACKNOWLEDGEMENT OF PRINCIPAL, IF A PARTNERSHIP

OWNERS NAME: Town of Orleans, MA

PROJECT NAME: Downtown Area Collection System and Pumping Stations, Contract No. 2019-02 and SRF No. 4486

State of _____

County of _____

SS: _____

On this ___ day of _____, 20__, before me personally came and appeared _____ to me known, and known to me to be one of the members of the firm described in and which executed the foregoing instrument and he acknowledged to me that he executed the same as and for the act and deed of said firm.

_____

Contractor's Signature

_____

Notary Public Signature

(Seal)

My Commission expires on: _____

END OF DOCUMENT

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CERTIFICATION OF OSHA 10-HOUR TRAINING

OWNERS NAME: Town of Orleans, MA

PROJECT NAME: Downtown Area Collection System and Pumping Stations, Contract No. 2019-02 and SRF No. 4486

A contractor will not be eligible for award of a contract unless such contractor has submitted the following certification, which is deemed a part of the resulting contract.

All employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and shall furnish documentation of successful completion of said course with the first certified payroll report for each employee.

State of _____

County of _____

SS: _____

On this ___ day of _____, 20__, before me personally came and appeared _____ to me known, and known to me to be one of the members of the firm described in and which executed the foregoing instrument and he acknowledged to me that he executed the same as and for the act and deed of said firm.

_____

Contractor's Signature

_____

Notary Public Signature

(Seal)

My Commission expires on: _____

END OF DOCUMENT

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SECTION 00610

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: That we _____
(Name of Contractor)

a _____ hereinafter called "Principal" and
(Corporation, Partnership, Joint Venture, LLC or Individual)

_____ of _____, State of _____
(Surety) (City)

hereinafter called the "Surety" and licensed by the State Division of Insurance to do business under the laws of the Commonwealth of Massachusetts, are held and firmly bound to the Town of Orleans, MA, Orleans, Massachusetts, hereinafter called "Owner", in the penal sum of _____Dollars and _____Cents ($) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas the Principal has entered into a certain contract with the Owner (the "Construction Contract"), dated the _____ day of _____, 20____, for the construction described as follows:

DOWNTOWN AREA COLLECTION SYSTEM AND PUMPING STATIONS

Contract No. 2019-02 and SRF No. 4486

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of the Construction Contract during the original term thereof, and any extensions thereof which may be granted by the Owner, with or without notice to the Surety, and if he shall satisfy all claims and demands incurred under the Construction Contract, and shall fully indemnify and save harmless the Owner from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, then this obligation shall be void; otherwise, this obligation shall remain in full force and effect.

PROVIDED, FURTHER, that the Surety's obligation under this Bond shall arise after (1) the Owner has declared the Principal in default of the Construction Contract or any provision thereof, or (2) has declared that the Principal has failed, or is otherwise unable or unwilling, to execute the work consistent with, and in conformance to, the Construction Contract (collectively referred to as a "Contractor Default"). The determination of a Contractor Default shall be made solely by the Owner. The Owner need not terminate the Construction Contract to declare a Contractor Default or to invoke its rights under this Bond, and Contractor hereby agrees not to assert any claims against Surety under any indemnity or similar agreements on the grounds that Surety has interfered with the Construction Contract by fulfilling its obligations hereunder in the absence of a termination of said contract.

When the Surety's obligation under this Bond arises, the Surety, at its sole expense and at the consent and election of the Owner, shall promptly take one of following steps: (1) arrange for the Principal to perform and complete the work of the Construction Contract; (2) arrange for a contractor other than the Principal to perform and complete the work of the Construction Contract;
(3) reimburse the Owner, in a manner and at such time as the Owner shall reasonably decide, for all costs and expenses incurred by the Owner in performing and completing the work of the Construction Contract. Surety will keep Owner reasonably informed of the progress, status and results of any investigation of any claim of the Owner.

If the Surety does not proceed as provided in this Bond with due diligence and all deliberate speed, the Surety shall be deemed to be in default of this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner.

After the Surety's obligation under this Bond arises, the Surety is obligated, to the limit of the amounts of this Bond, for (1) the correction of defective work and completion of the Construction Contract; (2) additional design, professional services, and legal costs, including attorney's fees, resulting from the Contractor Default or from the default of the Surety under this Bond; (3) any additional work beyond the Construction Contract made necessary by the Contractor Default or default of the Surety under this Bond; (4) indemnification obligations of the Principal, if any, as provided in the Construction Contract; and (5) liquidated damages as provided in the Construction Contract, or if no such damages are specified, actual damages and consequential damages resulting from the Contractor Default or any default of the Surety under this Bond.

Any proceeding, legal or equitable, under this Bond shall be instituted in any court of competent jurisdiction in the Commonwealth of Massachusetts.

The Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Construction Contract or to the work to be performed thereunder or the specifications accompanying the same shall in any way affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Construction Contract or to the work or to the specifications.

The Surety providing the Bond shall have a rating of A or better within Best's Key Rating Guide.

IN WITNESS WHEREOF, this instrument is executed in three (3) counterparts, each one of which shall be deemed an original, this _____ day of _____, 20____.

ATTEST:

Principal	Witness
Principal Signature	Witness as to Principal Signature
Name and Title	Name and Title
Address	Address
City and State	City and State

(SEAL)

ATTEST:

Surety	Witness
Attorney-in-Fact Signature	Witness as to Surety Signature
Name and Title	Name and Title
Address	Address
City and State	City and State

(SEAL)

NOTES: Date of Bond must not be prior to date of Contract.
If Contractor is a Partnership, all partners shall execute Bond.

END OF DOCUMENT

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SECTION 00615

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: That we _____
(Name of Contractor)

a _____ hereinafter called "Principal" and
(Corporation, Partnership, Joint Venture, LLC or Individual)

_____ of _____, State of _____
(Surety) (City)

hereinafter called the "Surety" and licensed by the State Division of Insurance to do business under the laws of the Commonwealth of Massachusetts, are held and firmly bound to the Town of Orleans, MA, Orleans, Massachusetts, hereinafter called "Owner", in the penal sum of _____Dollars and _____Cents ($) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas the Principal has entered into a certain contract with the Owner (the "Construction Contract"), dated the _____ day of _____, 20____, for the construction described as follows:

DOWNTOWN AREA COLLECTION SYSTEM AND PUMPING STATIONS

CONTRACT NO. 2019-02 AND SRF NO. 4486

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, subcontractors, and corporations furnishing materials for or performing labor in the prosecution of the work provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such work, and all insurance premiums on said work, and for all labor, performed in such work whether by subcontractor or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder or the specifications accompanying the same shall in any way affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of this contract or to the work or to the specifications. The Surety Company providing the bond shall have a rating of A or better within the Best Key Rating Guide.

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in _____ ( ) counterparts, each one of which shall be deemed an original, this the _____ day of _____, 20__.

ATTEST:

Principal	Witness
Principal Signature	Witness as to Principal Signature
Name and Title	Name and Title
Address	Address
City and State	City and State

ATTEST:

Surety	Witness
Attorney-in-Fact Signature	Witness as to Surety Signature
Name and Title	Name and Title
Address	Address
City and State	City and State

(SEAL)

NOTES: Date of Bond must not be prior to date of Contract.
If Contractor is a Partnership, all partners shall execute Bond.

END OF DOCUMENT

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

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GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

A. Wherever used in the Contract Documents and printed with initial or all capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof.

1. *Addenda*--Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the Contract Documents.

2. *Agreement*--The written instrument which is evidence of the agreement between OWNER and CONTRACTOR covering the Work.

3. *Application for Payment*--The form acceptable to ENGINEER which is to be used by CON- TRACTOR during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Asbestos*--Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

5. *Bid*--The offer or proposal of a bidder submit- ted on the prescribed form setting forth the prices for the Work to be performed.

6. *Bidding Documents*--The Bidding Requirements and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

7. *Bidding Requirements*--The Advertisement or Invitation to Bid, Instructions to Bidders, Bid security form, if any, and the Bid form with any supplements.

8. *Bonds*--Performance and payment bonds and other instruments of security.

9. *Change Order*--A document recommended by ENGINEER which is signed by CONTRACTOR and OWNER and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

10. *Claim*--A demand or assertion by OWNER or CONTRACTOR seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

11. *Contract*--The entire and integrated written agreement between the OWNER and CONTRACTOR concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

*****12. *Contract Documents*--The Contract Documents establish the rights and obligations of the parties and include the Agreement, Addenda (which pertain to the Con- tract Documents), CONTRACTOR's Bid (including documentation accompanying the Bid and any post Bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Agreement, the Notice to Proceed, the Bonds, these General Conditions, the Supplementary Conditions, the Specifications and the Drawings as the same are more specifically identified in the Agreement, together with all Written Amendments, Change Orders, Work Change Directives, Field Orders, and ENGINEER's written interpretations and clarifications issued on or after the Effective Date of the Agreement. Approved Shop Drawings and the reports and drawings of subsurface and physical conditions are not Contract Documents. Only printed or hard copies of the items listed in this paragraph are Contract Documents. Files in electronic media format of text, data, graphics, and the like that may be furnished by OWNER to CONTRACTOR are not Contract Documents.

13. *Contract Price*--The moneys payable by OWNER to CONTRACTOR for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of paragraph 11.03 in the case of Unit Price Work).

14. *Contract Times*--The number of days or the dates stated in the Agreement to: (i) achieve Substantial Completion; and (ii) complete the Work so that it is ready for final payment as evidenced by ENGINEER's written recommendation of final payment.

15. *CONTRACTOR*--The individual or entity with whom OWNER has entered into the Agreement.

16. *Cost of the Work*--See paragraph 11.01.A for definition.

17. *Drawings*--That part of the Contract Documents prepared or approved by ENGINEER which graphically shows the scope, extent, and character of the Work to be performed by CONTRACTOR. Shop Drawings and other CONTRACTOR submittals are not Drawings as so defined.

18. *Effective Date of the Agreement*--The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

*****19. *ENGINEER*--The individual or entity named as such in the Agreement.

*****20. *ENGINEER's Consultant*--An individual or entity having a contract with ENGINEER to furnish services as ENGINEER's independent professional associate or consultant with respect to the Project and who is identified as such in the Supplementary Conditions.

21. *Field Order*--A written order issued by ENGINEER which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.

22. General Requirements--Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.

23. *Hazardous Environmental Condition*--The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto in connection with the Work.

24. *Hazardous Waste*--The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

25. *Laws and Regulations; Laws or Regulations*-- Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*--Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

27. *Milestone*--A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

28. *Notice of Award*--The written notice by OWNER to the apparent successful bidder stating that upon timely compliance by the apparent successful bidder with the conditions precedent listed therein, OWNER will sign and deliver the Agreement.

29. *Notice to Proceed*--A written notice given by OWNER to CONTRACTOR fixing the date on which the Contract Times will commence to run and on which CONTRACTOR shall start to perform the Work under the Contract Documents.

**30. *OWNER*--The individual, entity, public body, or authority with whom CONTRACTOR has entered into the Agreement and for whom the Work is to be performed.

31. *Partial Utilization*--Use by OWNER of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.

32. *PCBs*--Polychlorinated *biphenyls.*

33. *Petroleum*--Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

34. *Project*--The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part as may be indicated elsewhere in the Contract Documents.

35. *Project Manual*--The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

36. *Radioactive Material*--Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

37. *Resident Project Representative*--The authorized representative of ENGINEER who may be assigned to the Site or any part thereof.

38. *Samples*--Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

39. *Shop Drawings*--All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for CONTRACTOR and submitted by CONTRACTOR to illustrate some portion of the Work.

40. *Site*--Lands or areas indicated in the Contract Documents as being furnished by OWNER upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by OWNER which are designated for the use of CONTRACTOR.

*41. *Specifications*~~--That part of the Contract Documents consisting of written technical descriptions of materials, equipment, systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto.~~

42. *Subcontractor*--An individual or entity having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the Site.

**43. *Substantial Completion*--The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of ENGINEER, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

44. *Supplementary Conditions*--That part of the Contract Documents which amends or supplements these General Conditions.

45. *Supplier*--A manufacturer, fabricator, supplier, distributor, material-man, or vendor having a direct contract with CONTRACTOR or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by CONTRACTOR or any Subcontractor.

46. *Underground Facilities*--All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

47. *Unit Price Work*--Work to be paid for on the basis of unit prices.

48. *Work*--The entire completed construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

49. *Work Change Directive*--A written statement to CONTRACTOR issued on or after the Effective Date of the Agreement and signed by OWNER and recommended by ENGINEER ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

50. *Written Amendment*--A written statement modifying the Contract Documents, signed by OWNER and CONTRACTOR on or after the Effective Date of the Agreement and normally dealing with the non-engineering or nontechnical rather than strictly construction-related aspects of the Contract Documents.

1.02 Terminology

A. Intent of Certain Terms or Adjectives

1. Whenever in the Contract Documents the terms "as allowed," "as approved," or terms of like effect or import are used, or the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of ENGINEER as to the Work, it is intended that such action or determination will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise).

   The use of any such term or adjective shall not be effective to assign to ENGINEER any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 9.10 or any other provision of the Contract Documents.

B. Day

1. The word "day" shall constitute a calendar day of 24 hours measured from midnight to the next midnight.

C. Defective

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it does not conform to the Contract Documents or does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract Documents, or has been damaged prior to ENGINEER's recommendation of final payment (unless responsibility for the protection thereof has been assumed by OWNER at Substantial Completion in accordance with paragraph 14.04 or 14.05).

D. Furnish, Install, Perform, Provide

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of CONTRACTOR, "provide" is implied.

E. Unless stated otherwise in the Contract Documents, words or phrases which have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 - PRELIMINARY MATTERS

2.01 Delivery of Bonds

A. When CONTRACTOR delivers the executed Agreements to OWNER, CONTRACTOR shall also deliver to OWNER such Bonds as CONTRACTOR may be required to furnish.

2.02 Copies of Documents

A. OWNER shall furnish to CONTRACTOR up to ten copies of the Contract Documents. Additional copies will be furnished upon request at the cost of reproduction.

2.03 Commencement of Contract Times; Notice to Proceed *

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.04 Starting the Work

A. CONTRACTOR shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 Before Starting Construction

A. *CONTRACTOR's Review of Contract Documents:* Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. CONTRACTOR shall promptly report in writing to ENGINEER any conflict, error, ambiguity, or discrepancy which CONTRACTOR may discover and shall obtain a written interpretation or clarification from ENGINEER before proceeding with any Work affected thereby; however, CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless CONTRACTOR knew or reasonably should have known thereof.

B. *Preliminary Schedules:* Within ten days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), CONTRACTOR shall submit to ENGINEER for its timely review:

1. a preliminary progress schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

2. a preliminary schedule of Shop Drawing and Sample submittals which will list each required submittal and the times for submitting, reviewing, and processing such submittal; and

3. a preliminary schedule of values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

*****C. *Evidence of Insurance:* ~~Before any Work at the Site is started, CONTRACTOR and OWNER shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which CONTRACTOR and OWNER respectively are required to purchase and maintain in accordance with Article 5.~~

2.06 Preconstruction Conference

A. Within 20 days after the Contract Times start to run, but before any Work at the Site is started, a conference attended by CONTRACTOR, ENGINEER, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in paragraph 2.05.B, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

2.07 Initial Acceptance of Schedules

A. Unless otherwise provided in the Contract Documents, at least ten days before submission of the first Application for Payment a conference attended by CON- TRACTOR, ENGINEER, and others as appropriate will be held to review for acceptability to ENGINEER as provided below the schedules submitted in accordance with paragraph 2.05.B. CONTRACTOR shall have an additional ten days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to CONTRACTOR until acceptable schedules are submitted to ENGINEER.

1. The progress schedule will be acceptable to ENGINEER if it provides an orderly progression of the Work to completion within any specified Mile- stones and the Contract Times. Such acceptance will not impose on ENGINEER responsibility for the progress schedule, for sequencing, scheduling, or progress of the Work nor interfere with or relieve CONTRACTOR from CONTRACTOR's full responsibility therefor.

2. CONTRACTOR's schedule of Shop Drawing and Sample submittals will be acceptable to ENGINEER if it provides a workable arrangement for reviewing and processing the required submittals.

3. CONTRACTOR's schedule of values will be acceptable to ENGINEER as to form and substance if it

provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 Intent

*****A. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be provided whether or not specifically called for at no additional cost to OWNER.

C. Clarifications and interpretations of the Contract Documents shall be issued by ENGINEER as provided in Article 9.

3.02 Reference Standards

A. Standards, Specifications, Codes, Laws, and Regulations

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard, specification, manual or code, or any instruction of a Supplier shall be effective to change the duties or responsibilities of OWNER, CONTRACTOR, or ENGINEER, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall any such provision or instruction be effective to assign to OWNER, ENGINEER, or any of ENGINEER's Consultants, agents, or employees any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 Reporting and Resolving Discrepancies

A. Reporting Discrepancies

1. If, during the performance of the Work, CONTRACTOR discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code, or of any instruction of any Supplier, CONTRACTOR shall report it to ENGINEER in writing at once. CONTRACTOR shall not proceed with the Work affected thereby (except in an emergency as required by paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in paragraph 3.04; provided, however, that CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any such conflict, error, ambiguity, or discrepancy unless CONTRACTOR knew or reasonably should have known thereof.

B. Resolving Discrepancies

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

a. the provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 Amending and Supplementing Contract Documents

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways: (i) a Written Amendment; (ii) a Change Order; or (iii) a Work Change Directive.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways: (i) a Field Order; (ii) ENGINEER's approval of a Shop Drawing or Sample; or (iii) ENGINEER's written interpretation or clarification.

3.05 Reuse of Documents

A. CONTRACTOR and any Subcontractor or Supplier or other individual or entity performing or furnishing any of the Work under a direct or indirect contract with OWNER: (i) shall not have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of ENGINEER or ENGINEER's Consultant, including electronic media editions; and (ii) shall not reuse any of such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of OWNER and ENGINEER and specific written verification or adaption by ENGINEER. This prohibition will survive final payment, completion, and acceptance of the Work, or termination or completion of the Contract. Nothing herein shall preclude CONTRACTOR from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 – AVAILABILITY OF LANDS, SUBSURFACE AND PHYSICAL CONDITIONS, REFERENCE POINTS REFERENCE POINTS

4.01 Availability of Lands

A. OWNER shall furnish the Site. OWNER shall notify CONTRACTOR of any encumbrances or restrictions not of general application but specifically related to use of the Site with which CONTRACTOR must comply in performing the Work. OWNER will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If CONTRACTOR and OWNER are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in OWNER's furnishing the Site, CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

B. Upon reasonable written request, OWNER shall furnish CONTRACTOR with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and OWNER's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 Subsurface and Physical Conditions

* A. Reports and Drawings: The Supplementary Conditions identify:

1. those reports of explorations and tests of subsurface conditions at or contiguous to the Site that ENGINEER has used in preparing the Contract Documents; and

2. those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) that ENGINEER has used in preparing the Contract Documents.

B. *Limited Reliance by CONTRACTOR on Technical Data Authorized:* CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," CONTRACTOR may not rely upon or make any Claim against OWNER, ENGINEER, or any of ENGINEER's Consultants with respect to:

1. the completeness of such reports and drawings for CONTRACTOR's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by CONTRACTOR, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any CONTRACTOR interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 Differing Subsurface or Physical Conditions

A. *Notice:* If CONTRACTOR believes that any subsurface or physical condition at or contiguous to the Site that is uncovered or revealed either:

1. is of such a nature as to establish that any "technical data" on which CONTRACTOR is entitled to rely as provided in paragraph 4.02 is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents; then CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by paragraph 6.16.A), notify OWNER and ENGINEER in writing about such condition. CONTRACTOR shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

****** B. *ENGINEER's Review:* After receipt of written notice as required by paragraph 4.03.A, ENGINEER will promptly review the pertinent condition, determine the necessity of OWNER's obtaining additional exploration or tests with respect thereto, and advise OWNER in writing (with a copy to CONTRACTOR) of ENGINEER's findings and conclusions.

C. Possible Price and Times Adjustments

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in CONTRACTOR's cost of, or time required for, performance of the Work; subject, however, to the following:

a. such condition must meet any one or more of the categories described in paragraph 4.03.A; and

b. with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of para- graphs 9.08 and 11.03.

2. CONTRACTOR shall not be entitled to any adjustment in the Contract Price or Contract Times if:

a. CONTRACTOR knew of the existence of such conditions at the time CONTRACTOR made a final commitment to OWNER in respect of Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for CONTRACTOR prior to CONTRACTOR's making such final commitment; or

c. CONTRACTOR failed to give the written notice within the time and as required by paragraph 4.03.A.

3. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in paragraph 10.05. However, OWNER, ENGINEER, and ENGINEER's Consultants shall not be liable to CONTRACTOR for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by CONTRACTOR on or in connection with any other project or anticipated project.

4.04 Underground Facilities

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to OWNER or ENGINEER by the owners of such Underground Facilities, including OWNER, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. OWNER and ENGINEER shall not be responsible for the accuracy or completeness of any such information or data; and

2. the cost of all of the following will be included in the Contract Price, and CONTRACTOR shall have full responsibility for:

a. reviewing and checking all such information and data,

b. locating all Underground Facilities shown or indicated in the Contract Documents,

c. coordination of the Work with the owners of such Underground Facilities, including OWNER, during construction, and

d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. Not Shown or Indicated

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to OWNER and ENGINEER. ENGINEER will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, CONTRACTOR shall be responsible for the safety and protection of such Underground Facility.

2. If ENGINEER concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable *adjustment shall be made i n the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or *indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that CONTRACTOR did not know of and could not reasonably have been expected to be aware of or to have anticipated. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, OWNER or CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

4.05 Reference Points

A. OWNER shall provide engineering surveys to establish reference points for construction which in ENGINEER's judgment are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of OWNER. CONTRACTOR shall report to ENGINEER whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate

replacement or relocation of such reference points or property monuments by professionally qualified personnel.**

4.06 Hazardous Environmental Condition at Site

A. *Reports and Drawings:* Reference is made to the Supplementary Conditions for the identification of those** reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that have been utilized by the ENGINEER in the preparation of the Contract Documents. *

B. *Limited Reliance by CONTRACTOR on Technical Data Authorized:* CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," CONTRACTOR may not rely upon or make any Claim against OWNER, ENGINEER or any of ENGINEER's Consultants with respect to:

1. the completeness of such reports and drawings for CONTRACTOR's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any CONTRACTOR interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

C. CONTRACTOR shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. CONTRACTOR shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by CONTRACTOR, Subcontractors, Suppliers, or anyone else for whom CONTRACTOR is responsible.

D. If CONTRACTOR encounters a Hazardous Environmental Condition or if CONTRACTOR or anyone for whom CONTRACTOR is responsible creates a Hazardous Environmental Condition, CONTRACTOR shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by paragraph 6.16); and (iii) notify OWNER and ENGINEER (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ENGINEER concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

E. CONTRACTOR shall not be required to resume Work in connection with such condition or in any affected area until after OWNER has obtained any required permits related thereto and delivered to CONTRACTOR written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If OWNER and CONTRACTOR cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stop- page or such special conditions under which Work is agreed to be resumed by CONTRACTOR, either party may make a Claim therefor as provided in paragraph 10.05.

F. If after receipt of such written notice CONTRACTOR does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then OWNER may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If OWNER and CONTRACTOR cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in paragraph 10.05. OWNER may have such deleted portion of the Work performed by OWNER's own forces or others in accordance with Article 7.

G. To the fullest extent permitted by Laws and Regulations, OWNER shall indemnify and hold harmless CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants and the officers, directors, partners, employees, agents, other consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by CONTRACTOR or by anyone for whom CONTRACTOR is responsible. Nothing in this paragraph 4.06.E shall obligate OWNER to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

H. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, other consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by CONTRACTOR or by anyone for whom CONTRACTOR is responsible. Nothing in this paragraph 4.06.F shall obligate CONTRACTOR to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. The provisions of paragraphs 4.02, 4.03, and 4.04 are not intended to apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 - BONDS AND INSURANCE

5.01 Performance, Payment, and Other Bonds

A. CONTRACTOR shall furnish performance and payment Bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all CONTRACTOR's obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date when final payment becomes due, except as provided otherwise by Laws or Regulations or by the Contract Documents. CONTRACTOR shall also furnish such other Bonds as are required by the Contract Documents.*

B. All Bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All Bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act.

C. If the surety on any Bond furnished by CON- TRACTOR is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of paragraph 5.01.B, CONTRACTOR shall within 20 days thereafter substitute another Bond and surety, both of which shall comply with the requirements of paragraphs 5.01.B and 5.02.

5.02 Licensed Sureties and Insurers

A. All Bonds and insurance required by the Contract Documents to be purchased and maintained by OWNER or CONTRACTOR shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue Bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 Certificates of Insurance

A. CONTRACTOR shall deliver to OWNER, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by OWNER or any other additional insured) which CONTRACTOR is required to *****purchase and maintain. ~~OWNER shall deliver to CONTRACTOR, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by CONTRACTOR or any other additional insured) which OWNER is required to purchase and maintain.~~

5.04 CONTRACTOR's Liability Insurance

*****A. CONTRACTOR shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from CONTRACTOR's performance of the Work and CONTRACTOR's other obligations under the Contract Documents, whether it is to be performed by CONTRACTOR, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;
2. claims for damages because of bodily injury, occupational sickness or disease, or death of CONTRACTOR's employees;
3. claims for damages because of bodily injury, sickness or disease, or death of any person other than CONTRACTOR's employees;
4. claims for damages insured by reasonably available personal injury liability coverage which are sustained: (i) by any person as a result of an offense directly or indirectly related to the employment of such person by CONTRACTOR, or (ii) by any other person for any other reason;
5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and
6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

B. The policies of insurance so required by this paragraph 5.04 to be purchased and maintained shall:

*1. with respect to insurance required by para- graphs 5.04.A.3 through 5.04.A.6 inclusive, include as additional insureds (subject to any customary exclusion in respect of professional liability) OWNER, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary

Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

3. include completed operations insurance;

4. include contractual liability insurance covering CONTRACTOR's indemnity obligations under paragraphs 6.07, 6.11, and 6.20;

5. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least thirty days prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the CONTRACTOR pursuant to paragraph 5.03 will so provide);

6. remain in effect at least until final payment and at all times thereafter when CONTRACTOR may be correcting, removing, or replacing defective Work in accordance with paragraph 13.07; and

7. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment (and CONTRACTOR shall furnish OWNER and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to OWNER and any such additional insured of continuation of such insurance at final payment and one year thereafter).*

~~*5.05 OWNER's Liability Insurance*~~

~~*~~A. In addition to the insurance required to be provided by CONTRACTOR under paragraph 5.04, OWNER, at OWNER's option, may purchase and maintain at OWNER's expense OWNER's own liability insurance as will protect OWNER against claims which may arise from operations under the Contract Documents.~~

~~*5.06 Property Insurance*~~

~~*~~ A. Unless otherwise provided in the Supplementary Conditions, OWNER shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the interests of OWNER, CON- TRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an additional insured;

2. be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, false work, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water dam- age, and such other perils or causes of loss as may be specifically required by the Supplementary Conditions;

3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);

4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by OWNER prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by ENGINEER;

5. allow for partial utilization of the Work by OWNER;

6. include testing and startup; and

7. be maintained in effect until final payment is made unless otherwise agreed to in writing by OWNER, CONTRACTOR, and ENGINEER with 30 days written notice to each other additional insured to whom a certificate of insurance has been issued.

~~*~~B. OWNER shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and any other individuals or entities identified in the Supplementary Conditions, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured.

~~*~~ C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with paragraph *5.07*.

~~*~~D. OWNER shall not be responsible for purchasing and maintaining any property insurance specified in this paragraph 5.06 to protect the interests of CONTRACTOR,

~~Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by CONTRACTOR, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.~~

~~*E. If CONTRACTOR requests in writing that other special insurance be included in the property insurance policies provided under paragraph 5.06, OWNER shall, if possible, include such insurance, and the cost thereof will be charged to CONTRACTOR by appropriate Change Order or Written Amendment. Prior to commencement of the Work at the Site, OWNER shall in writing advise CONTRACTOR whether or not such other insurance has been procured by OWNER.~~

5.07 Waiver of Rights

*****A. OWNER and CONTRACTOR intend that all policies purchased in accordance with paragraph 5.06 will protect OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or additional insureds thereunder. OWNER and CONTRACTOR waive all rights against each other and their respective officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors, ENGINEER, ENGINEER's Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance * ~~held by OWNER as trustee or~~ otherwise payable under any policy so issued.

B. OWNER waives all rights against CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to OWNER's property or the Work caused by, arising out of, or resulting from fire or other peril whether or not insured by OWNER; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by OWNER during partial utilization pursuant to paragraph 14.05, after Substantial Completion pursuant to paragraph 14.04, or after final payment pursuant to paragraph 14.07.

C. Any insurance policy maintained by OWNER covering any loss, damage or consequential loss referred to in paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against CONTRACTOR, Subcontractors, ENGINEER, or ENGINEER's Consultants and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them.

5.08 Receipt and Application of Insurance Proceeds

~~*****A. Any insured loss under the policies of insurance required by paragraph 5.06 will be adjusted with OWNER and made payable to OWNER as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of paragraph 5.08.B. OWNER shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order or Written Amendment.~~

~~*****B. OWNER as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to OWNER's exercise of this power. If such objection be made, OWNER as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, OWNER as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, OWNER as fiduciary shall give bond for the proper performance of such duties.~~

5.09 Acceptance of Bonds and Insurance; Option to Replace

~~*****A. If either OWNER or CONTRACTOR has any objection to the coverage afforded by or other provisions of the Bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by paragraph 2.05.C. OWNER and CONTRACTOR shall each provide to the other such~~

~~additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the Bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent Bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.~~

5.10 Partial Utilization, Acknowledgment of Property Insurer

A. If OWNER finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.01 Supervision and Superintendence

A. CONTRACTOR shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction, but CONTRACTOR shall not be responsible for the negligence of OWNER or ENGINEER in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents. CONTRACTOR shall be responsible to see that the completed Work complies accurately with the Contract Documents.

~~*~~B. ~~At all times during the progress of the Work, CONTRACTOR shall assign a competent resident superintendent thereto who shall not be replaced without written notice to OWNER and ENGINEER except under extraordinary circumstances. The superintendent will be CONTRACTOR's representative at the Site and shall have authority to act on behalf of CONTRACTOR. All communications given to or received from the superintendent shall be binding on CONTRACTOR.~~

6.02 Labor; Working Hours

A. CONTRACTOR shall provide competent, suitably qualified personnel to survey, lay out, and construct the Work as required by the Contract Documents. CONTRACTOR shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, and CONTRACTOR will not permit overtime work or the performance of Work on Saturday, Sunday, or any legal holiday without OWNER's written consent (which will not be unreasonably withheld) given after prior written notice to ENGINEER.

6.03 Services, Materials, and Equipment

A. Unless otherwise specified in the General Requirements, CONTRACTOR shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All warranties and guarantees specifically called for by the Specifications shall expressly run to the benefit of OWNER. If required by ENGINEER, CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 Progress Schedule

A. CONTRACTOR shall adhere to the progress schedule established in accordance with paragraph 2.07 as it may be adjusted from time to time as provided below.

1. CONTRACTOR shall submit to ENGINEER for acceptance (to the extent indicated in paragraph 2.07) proposed adjustments in the progress schedule that will not result in changing the Contract Times (or Milestones). Such adjustments will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the progress schedule that will change the Contract Times (or Milestones) shall be submitted in accordance with the requirements of Article 12. Such adjustments may only be made by a Change Order or Written Amendment in accordance with Article 12.

**6.05 Substitutes and "Or-Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to ENGINEER for review under the circumstances described below.

1. "Or-Equal" Items: If in ENGINEER's sole discretion an item of material or equipment proposed by CONTRACTOR is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by ENGINEER as an "or-equal" item, in which case review and approval of the proposed item may, in ENGINEER's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

   a. in the exercise of reasonable judgment ENGINEER determines that: (i) it is at least equal in quality, durability, appearance, strength, and design characteristics; (ii) it will reliably perform at least equally well the function imposed by the design concept of the completed Project as a functioning whole, and;

   b. CONTRACTOR certifies that: (i) there is no increase in cost to the OWNER; and (ii) it will conform substantially, even with deviations, to the detailed requirements of the item named in the Contract Documents.

2. Substitute Items

   a. If in ENGINEER's sole discretion an item of material or equipment proposed by CONTRACTOR does not qualify as an "or-equal" item under paragraph 6.05.A.1, it will be considered a proposed substitute item.

   b. CONTRACTOR shall submit sufficient information as provided below to allow ENGINEER to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by ENGINEER from anyone other than CON- TRACTOR.

   c. The procedure for review by ENGINEER will be as set forth in paragraph 6.05.A.2.d, as supplemented in the General Requirements and as ENGINEER may decide is appropriate under the circumstances.

   d. CONTRACTOR shall first make written application to ENGINEER for review of a proposed substitute item of material or equipment that CONTRACTOR seeks to furnish or use. The application shall certify that the proposed substitute item will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified, and be suited to the same use as that specified. The application will state the extent, if any, to which the use of the proposed substitute item will prejudice CONTRACTOR's achievement of Substantial Completion on time, whether or not use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) to adapt the design to the proposed substitute item and whether or not incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute item from that specified will be identified in the application, and available engineering, sales, maintenance, repair, and replacement services will be indicated. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change, all of which will be considered by ENGINEER in evaluating the proposed substitute item. ENGINEER may require CONTRACTOR to furnish additional data about the proposed substitute item.

B. Substitute Construction Methods or Procedures: If a specific means, method, technique, sequence, or procedure of construction is shown or indicated in and expressly required by the Contract Documents, CON- TRACTOR may furnish or utilize a substitute means, meth- od, technique, sequence, or procedure of construction approved by ENGINEER. CONTRACTOR shall submit sufficient information to allow ENGINEER, in ENGINEER's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The procedure for review by ENGINEER will be similar to that provided in subparagraph 6.05.A.2.

C. *Engineer's Evaluation:* ENGINEER will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to paragraphs 6.05.A and 6.05.B. ENGINEER will be the sole judge of accept- ability. No "or-equal" or substitute will be ordered, installed or utilized until ENGINEER's review is complete, which will be evidenced by either a Change Order for a substitute or an approved Shop Drawing for an "or equal." ENGINEER will advise CONTRACTOR in writing of any negative determination.

D. *Special Guarantee:* OWNER may require CON- TRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety with respect to any substitute.

E. *ENGINEER's Cost Reimbursement:* ENGINEER will record time required by ENGINEER and ENGINEER's Consultants in evaluating substitute proposed or submitted by CONTRACTOR pursuant to paragraphs 6.05.A.2 and 6.05.B and in making changes in the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) occasioned thereby. Whether or not ENGINEER approves a substitute item so proposed or submitted by CONTRACTOR, CON- TRACTOR shall reimburse OWNER for the charges of ENGINEER and ENGINEER's Consultants for evaluating each such proposed substitute.

F. *CONTRACTOR's Expense:* CONTRACTOR shall provide all data in support of any proposed substitute or "or-equal" at CONTRACTOR's expense.

6.06 Concerning Subcontractors, Suppliers, and Others

A. CONTRACTOR shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to OWNER as indicated in paragraph 6.06.B), whether initially or as a replacement, against whom OWNER may have reasonable objection. CONTRACTOR shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom CONTRACTOR has reasonable objection.

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to OWNER in advance for acceptance by OWNER by a specified date prior to the Effective Date of the Agreement, and if CONTRACTOR has submitted a list thereof in accordance with the Supplementary Conditions, OWNER's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation.

CONTRACTOR shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued or Written Amendment signed. No acceptance by OWNER of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of OWNER or ENGINEER to reject defective Work.

C. CONTRACTOR shall be fully responsible to OWNER and ENGINEER for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as CONTRACTOR is responsible for CONTRACTOR's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between OWNER or ENGINEER and any such Subcontractor, Supplier or other individual or entity, nor shall it create any obligation on the part of OWNER or ENGINEER to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. CONTRACTOR shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR.

E. CONTRACTOR shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with ENGINEER through CONTRACTOR.

******F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control CONTRACTOR in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

G. All Work performed for CONTRACTOR by a Subcontractor or Supplier will be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of OWNER and ENGINEER. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in paragraph 5.06, the agreement between the CONTRACTOR and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against OWNER, CONTRACTOR, ENGINEER, ENGINEER's Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, CONTRACTOR will obtain the same.

6.07 Patent Fees and Royalties

A. CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of OWNER or ENGINEER its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by OWNER

in the Contract Documents. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees or agents, and other consultants of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 Permits

******A. Unless otherwise provided in the Supplementary Conditions, CONTRACTOR shall obtain and pay for all construction permits and licenses. OWNER shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. CONTRACTOR shall pay all charges of utility owners for connections to the Work, and OWNER shall pay all charges of such utility owners for capital costs related thereto, such as plant investment fees.

6.09 Laws and Regulations

A. CONTRACTOR shall give all notices and comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither OWNER nor ENGINEER shall be responsible for monitoring CONTRACTOR's compliance with any Laws or Regulations.

B. If CONTRACTOR performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, CONTRACTOR shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work; however, it shall not be CONTRACTOR's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve CONTRACTOR of CONTRACTOR's obligations under paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work may be the subject of an adjustment in Contract Price or Contract Times. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in paragraph 10.05.

*6.10 Taxes ***

A. CONTRACTOR shall pay all sales, consumer, use, and other similar taxes required to be paid by CONTRACTOR in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

*6.11 Use of Site and Other Areas ***

A Limitation on Use of Site and Other Areas

1. CONTRACTOR shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, CONTRACTOR shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultant, and the officers, directors, partners, employees, agents, and other consultants of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against OWNER, ENGINEER, or any other party indemnified hereunder to the extent caused by or based upon CONTRACTOR's performance of the Work.

B. *Removal of Debris During Performance of the Work:* During the progress of the Work CONTRACTOR shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of

such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning:* Prior to Substantial Completion of the Work CONTRACTOR shall clean the Site and make it ready for utilization by OWNER. At the completion of the Work CONTRACTOR shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading Structures:* CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 Record Documents

A. CONTRACTOR shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to ENGINEER for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to ENGINEER for OWNER.

6.13 Safety and Protection

A. CONTRACTOR shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Under- ground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. CONTRACTOR shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property. All damage, injury, or loss to any property referred to in paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of OWNER or ENGINEER or ENGINEER's Consultant, or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of CONTRACTOR or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

CONTRACTOR's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and ENGINEER has issued a notice to OWNER and CONTRACTOR in accordance with paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 Safety Representative

A. CONTRACTOR shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 Hazard Communication Programs

A. CONTRACTOR shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.16 Emergencies

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, CONTRACTOR is obligated to act to prevent threatened damage, injury, or loss. CONTRACTOR shall give ENGINEER prompt written notice if CONTRACTOR believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If ENGINEER determines that a change in the Contract Documents is required because of the action taken by CONTRACTOR in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 Shop Drawings and Samples

A. CONTRACTOR shall submit Shop Drawings to ENGINEER for review and approval in accordance with the

acceptable schedule of Shop Drawings and Sample submittals. All submittals will be identified as ENGINEER may require and in the number of copies specified in the General Requirements. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show ENGINEER the services, materials, and equipment CONTRACTOR proposes to provide and to enable ENGINEER to review the information for the limited purposes required by paragraph 6.17.E.

B. CONTRACTOR shall also submit Samples to ENGINEER for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog numbers, and the use for which intended and otherwise as ENGINEER may require to enable ENGINEER to review the submittal for the limited purposes required by paragraph 6.17.E. The numbers of each Sample to be submitted will be as specified in the Specifications.

C. Where a Shop Drawing or Sample is required by the Contract Documents or the schedule of Shop Drawings and Sample submittals acceptable to ENGINEER as required by paragraph 2.07, any related Work performed prior to ENGINEER's review and approval of the pertinent submittal will be at the sole expense and responsibility of CONTRACTOR.

D. Submittal Procedures

1. Before submitting each Shop Drawing or Sample, CONTRACTOR shall have determined and verified:

   a. all field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

   b. all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;

   c. all information relative to means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incident thereto; and

   d. CONTRACTOR shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

2. Each submittal shall bear a stamp or specific written indication that CONTRACTOR has satisfied CONTRACTOR's obligations under the Contract Documents with respect to CONTRACTOR's review and approval of that submittal.

3. At the time of each submittal, CONTRAC- TOR shall give ENGINEER specific written notice of such variations, if any, that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each Shop Drawing and Sample submitted to ENGINEER for review and approval of each such variation.

E. ENGINEER's Review

*1. ENGINEER will ~~timely~~ review and approve Shop Drawings and Samples in accordance with the schedule of Shop Drawings and Sample submittals acceptable to ENGINEER. ENGINEER's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. ENGINEER's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. ENGINEER's review and approval of Shop Drawings or Samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has in writing called ENGINEER's attention to each such variation at the time of each submittal as required by paragraph 6.17.D.3 and ENGINEER has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample approval; nor will any approval by ENGINEER relieve CONTRACTOR from responsibility for complying with the requirements of paragraph 6.17.D.1.

F. Resubmittal Procedures

1. CONTRACTOR shall make corrections required by ENGINEER and shall return the required number of corrected copies of Shop Drawings and submit as required new Samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals.

6.18 Continuing the Work

A. CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with OWNER. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as

permitted by paragraph 15.04 or as OWNER and CONTRACTOR may otherwise agree in writing.

6.19 CONTRACTOR's General Warranty and Guarantee

A. CONTRACTOR warrants and guarantees to OWNER, ENGINEER, and ENGINEER's Consultants that all Work will be in accordance with the Contract Documents and will not be defective. CONTRACTOR's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than CONTRACTOR, Subcontractors, Suppliers, or any other individual or entity for whom CONTRACTOR is responsible; or

2. normal wear and tear under normal usage. B. CONTRACTOR's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of CONTRACTOR's obligation to perform the Work in accordance with the Contract Documents:

   a. observations by ENGINEER;
   b. recommendation by ENGINEER or payment by OWNER of any progress or final payment;
   c. the issuance of a certificate of Substantial Completion by ENGINEER or any payment related thereto by OWNER;
   d. use or occupancy of the Work or any part thereof by OWNER;
   e. any acceptance by OWNER or any failure to do so;
   f. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by ENGINEER;
   g. any inspection, test, or approval by others; or
   h. any correction of defective Work by OWNER.

6.20 Indemnification

~~*A. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage:~~

~~1. is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom; and~~

~~2. is caused in whole or in part by any negligent act or omission of CONTRACTOR, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by any negligence or omission of an individual or entity indemnified hereunder or whether liability is imposed upon such indemnified party by Laws and Regulations regardless of the negligence of any such individual or entity.~~

B. In any and all claims against OWNER or ENGINEER or any of their respective consultants, agents, officers, directors, partners, or employees by any employee (or the survivor or personal representative of such employee) of CONTRACTOR, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for CONTRACTOR or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

~~*C. The indemnification obligations of CONTRACTOR under paragraph 6.20.A shall not extend to the liability of ENGINEER and ENGINEER's Consultants or to the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them arising out of:~~

~~1. the preparation or approval of, or the failure to prepare or approve, maps, Drawings, opinions, reports, surveys, Change Orders, designs, or~~ Specifications~~; or~~

~~2. giving directions or instructions, or failing to give them, if that is the primary cause of the~~ injury ~~or damage.~~

ARTICLE 7 - OTHER WORK

7.01 Related Work at Site

A. OWNER may perform other work related to the Project at the Site by OWNER's employees, or let other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

1. written notice thereof will be given to CONTRACTOR prior to starting any such other work; and

2. if OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in paragraph 10.05.

B. CONTRACTOR shall afford each other contractor who is a party to such a direct contract and each utility owner (and OWNER, if OWNER is performing the other work with OWNER's employees) proper and safe access to the Site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work and shall properly coordinate the Work with theirs. Unless otherwise provided in the Contract Documents, CONTRACTOR shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating, or otherwise altering their work and will only cut or alter their work with the written consent of ENGINEER and the others whose work will be affected. The duties and responsibilities of CONTRACTOR under this paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of CONTRACTOR in said direct contracts between OWNER and such utility owners and other contractors.

C. If the proper execution or results of any part of CONTRACTOR's Work depends upon work performed by others under this Article 7, CONTRACTOR shall inspect such other work and promptly report to ENGINEER in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of CONTRACTOR's Work. CONTRACTOR's failure to so report will constitute an acceptance of such other work as fit and proper for integration with CONTRACTOR's Work except for latent defects and deficiencies in such other work.

7.02 Coordination

A. If OWNER intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;

2. the specific matters to be covered by such authority and responsibility will be itemized; and

3. the extent of such authority and responsibilities will be provided.

B. Unless otherwise provided in the Supplementary Conditions, OWNER shall have sole authority and responsibility for such coordination.

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.01 Communications to Contractor

A. Except as otherwise provided in these General Conditions, OWNER shall issue all communications to CONTRACTOR through ENGINEER.

8.02 Replacement of ENGINEER

A. In case of termination of the employment of ENGINEER, OWNER shall appoint an engineer to whom CONTRACTOR makes no reasonable objection, whose status under the Contract Documents shall be that of the former ENGINEER.

8.03 Furnish Data

A. OWNER shall promptly furnish the data required of OWNER under the Contract Documents.

8.04 Pay Promptly When Due

A. OWNER shall make payments to CONTRACTOR promptly when they are due as provided in paragraphs 14.02.C and 14.07.C.

8.05 Lands and Easements; Reports and Tests

A. OWNER's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.01 and 4.05. Paragraph 4.02 refers to OWNER's identifying and making available to CONTRACTOR copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site that have been utilized by ENGINEER in preparing the Contract Documents.

8.06 Insurance

~~*A. OWNER's responsibilities, if any, in respect to purchasing and maintaining liability and property insurance are set forth in Article 5.~~

8.07 Change Orders

A. OWNER is obligated to execute Change Orders as indicated in paragraph 10.03.

8.08 Inspections, Tests, and Approvals

A. OWNER's responsibility in respect to certain inspections, tests, and approvals is set forth in paragraph 13.03.B.

8.09 Limitations on OWNER's Responsibilities

A. The OWNER shall not supervise, direct, or have control or authority over, nor be responsible for, CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work. OWNER will not be responsible for CONTRACTOR's failure to perform the Work in accordance with the Contract Documents.

8.10 Undisclosed Hazardous Environmental Condition

A. OWNER's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in paragraph 4.06.

8.11 Evidence of Financial Arrangements

A. If and to the extent OWNER has agreed to furnish CONTRACTOR reasonable evidence that financial arrangements have been made to satisfy OWNER's obligations under the Contract Documents, OWNER's responsibility in respect thereof will be as set forth in the Supplementary Conditions.

ARTICLE 9 - ENGINEER'S STATUS DURING CONSTRUCTION

9.01 OWNER'S Representative

A. ENGINEER will be OWNER's representative during the construction period. The duties and responsibilities and the limitations of authority of ENGINEER as OWNER's representative during construction are set forth in the Contract Documents and will not be changed without written consent of OWNER and ENGINEER.

**9.02 Visits to Site*

A. ENGINEER will make visits to the Site at intervals appropriate to the various stages of construction as ENGINEER deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of CONTRACTOR's executed Work. Based on information obtained during such visits and observations, ENGINEER, for the benefit of OWNER, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. ENGINEER will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. ENGINEER's efforts will be directed toward providing for OWNER a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, ENGINEER will keep OWNER informed of the progress of the Work and will endeavor to guard OWNER against defective Work.

B. ENGINEER's visits and observations are subject to all the limitations on ENGINEER's authority and responsibility set forth in paragraph 9.10, and particularly, but without limitation, during or as a result of ENGINEER's visits or observations of CONTRACTOR's Work ENGINEER will not supervise, direct, control, or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work.

9.03 Project Representative

A. If OWNER and ENGINEER agree, ENGINEER will furnish a Resident Project Representative to assist ENGINEER in providing more extensive observation of the Work. The responsibilities and authority and limitations thereon of any such Resident Project Representative and assistants will be as provided in paragraph 9.10 and in the Supplementary Conditions. If OWNER designates another representative or agent to represent OWNER at the Site who is not ENGINEER's Consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 Clarifications and Interpretations

A. ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents as ENGINEER may deter- mine necessary, which shall be consistent with the intent of and reasonably inferable from the Contract Documents. Such written clarifications and interpretations will be binding on OWNER and CONTRACTOR. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a written clarification or interpretation, a Claim may be made therefor as provided in paragraph 10.05.

***9.05 Authorized Variations in Work*

A. ENGINEER may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on OWNER and also on CONTRACTOR, who shall perform the Work involved promptly. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of a Field Order, a Claim may be made therefor as provided in paragraph 10.05.

9.06 Rejecting Defective Work

A. ENGINEER will have authority to disapprove or reject Work which ENGINEER believes to be defective, or that ENGINEER believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. ENGINEER will also have authority to require special inspection or testing of the Work as provided in paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.07 Shop Drawings, Change Orders and Payments

A. In connection with ENGINEER's authority as to Shop Drawings and Samples, see paragraph 6.17.

B. In connection with ENGINEER's authority as to Change Orders, see Articles 10, 11, and 12.

C. In connection with ENGINEER's authority as to Applications for Payment, see Article 14.

9.08 Determinations for Unit Price Work

A. ENGINEER will determine the actual quantities and classifications of Unit Price Work performed by CONTRACTOR. ENGINEER will review with CONTRACTOR the ENGINEER's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). ENGINEER's written decision thereon will be final and binding (except as modified by ENGINEER to reflect changed factual conditions or more accurate data) upon OWNER and CONTRACTOR, subject to the provisions of paragraph 10.05.

9.09 Decisions on Requirements of Contract Documents and Acceptability of Work

A. ENGINEER will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. Claims, disputes and other matters relating to the acceptability of the Work, the quantities and classifications of Unit Price Work, the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, and Claims seeking changes in the Contract Price or Contract Times will be referred initially to ENGINEER in writing, in accordance with the provisions of paragraph 10.05, with a request for a formal decision.

B. When functioning as interpreter and judge under this paragraph 9.09, ENGINEER will not show partiality to OWNER or CONTRACTOR and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. The rendering of a decision by ENGINEER pursuant to this paragraph 9.09 with respect to any such Claim, dispute, or other matter (except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.07) will be a condition precedent to any exercise by OWNER or CONTRACTOR of such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such Claim, dispute, or other matter.

9.10 Limitations on ENGINEER's Authority and Responsibilities

A. Neither ENGINEER's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by ENGINEER in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by ENGINEER shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by ENGINEER to CONTRACTOR, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. ENGINEER will not supervise, direct, control, or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work. ENGINEER will not be responsible for CONTRACTOR's failure to perform the Work in accordance with the Contract Documents.

C. ENGINEER will not be responsible for the acts or omissions of CONTRACTOR or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. ENGINEER's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, Bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.

E. The limitations upon authority and responsibility set forth in this paragraph 9.10 shall also apply to ENGINEER's Consultants, Resident Project Representative, and assistants.

ARTICLE 10 - CHANGES IN THE WORK; CLAIMS

10.01 Authorized Changes in the Work

A. Without invalidating the Agreement and without notice to any surety, OWNER may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Written Amendment, a Change Order, or a Work Change Directive. Upon receipt of any such document, CONTRACTOR shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

B. If OWNER and CONTRACTOR are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in paragraph 10.05.

10.02 Unauthorized Changes in the Work

A. CONTRACTOR shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in paragraph 3.04, except in the case of an emergency as provided in paragraph 6.16 or in the case of uncovering Work as provided in paragraph 13.04.B.

10.03 Execution of Change Orders

A. OWNER and CONTRACTOR shall execute appropriate Change Orders recommended by ENGINEER (or Written Amendments) covering:

1. changes in the Work which are: (i) ordered by OWNER pursuant to paragraph 10.01.A, (ii) required because of acceptance of defective Work under paragraph 13.08.A or OWNER's correction of defective Work under paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by ENGINEER pursuant to para- graph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, CONTRACTOR shall carry on the Work and adhere to the progress schedule as provided in paragraph 6.18.A.

10.04 Notification to Surety

A. If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be CONTRACTOR's responsibility. The amount of each applicable Bond will be adjusted to reflect the effect of any such change.

10.05 Claims and Disputes

A. *Notice:* Written notice stating the general nature of each Claim, dispute, or other matter shall be delivered by the claimant to ENGINEER and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. Notice of the amount or extent of the Claim, dispute, or other matter with supporting data shall be delivered to the ENGINEER and the other party to the Contract within 60 days after the start of such event (unless ENGINEER allows additional time for claimant to submit additional or more accurate data in support of such Claim, dispute, or other matter). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of paragraph 12.01.B. A Claim for an adjustment in Contract Time shall be prepared in accordance with the provisions of paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to ENGINEER and the claimant within 30 days after receipt of the claimant's last submittal (unless ENGINEER allows additional time).

B. *ENGINEER's Decision:* ENGINEER will render a formal decision in writing within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any. ENGINEER's written decision on such Claim, dispute, or other matter will be final and binding upon OWNER and CONTRACTOR unless:

1. an appeal from ENGINEER's decision is taken within the time limits and in accordance with the dispute resolution procedures set forth in Article 16; or

2. if no such dispute resolution procedures have been set forth in Article 16, a written notice of intention to appeal from ENGINEER's written decision is delivered by OWNER or CONTRACTOR to the other and to ENGINEER within 30 days after the date of such decision, and a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction within 60 days after the date of such decision or within 60 days after Substantial Completion, whichever is later (unless otherwise agreed in writing by OWNER and CONTRACTOR), to exercise such rights or remedies as the appealing party may have with respect to such Claim, dispute, or other matter in accordance with applicable Laws and Regulations.

C. If ENGINEER does not render a formal decision in writing within the time stated in paragraph 10.05.B, a decision denying the Claim in its entirety shall be deemed to have been issued 31 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any.

D. No Claim for an adjustment in Contract Price or Contract Times (or Milestones) will be valid if not submitted in accordance with this paragraph 10.05.

ARTICLE 11 - COST OF THE WORK; CASH ALLOWANCES; UNIT PRICE WORK

***11.01 Cost of the Work*

~~A. *Costs Included:* The term Cost of the Work means the sum of all costs necessarily incurred and paid by CONTRACTOR in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on~~

the basis of Cost of the Work, the costs to be reimbursed to CONTRACTOR will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by OWNER, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items, and shall not include any of the costs itemized in paragraph 11.01.B.

1. Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the Work under schedules of job classifications agreed upon by OWNER and CONTRACTOR. Such employees shall include without limitation superintendents, foremen, and other personnel employed full time at the Site. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by OWNER.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to CONTRACTOR unless OWNER deposits funds with CONTRACTOR with which to make payments, in which case the cash discounts shall accrue to OWNER. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to OWNER, and CONTRACTOR shall make provisions so that they may be obtained.

3. Payments made by CONTRACTOR to Subcontractors for Work performed by Subcontractors. If required by OWNER, CON- TRACTOR shall obtain competitive bids from subcontractors acceptable to OWNER and CON-TRACTOR and shall deliver such bids to OWNER, who will then determine, with the advice of ENGINEER, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as CONTRACTOR's Cost of the Work and fee as provided in this paragraph 11.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

   a. The proportion of necessary transportation, travel, and subsistence expenses of CONTRACTOR's employees incurred in discharge of duties connected with the Work.

   b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of CONTRACTOR.

   c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from CONTRACTOR or others in accordance with rental agreements approved by OWNER with the advice of ENGINEER, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

   d. Sales, consumer, use, and other similar taxes related to the Work, and for which CON-TRACTOR is liable, imposed by Laws and Regulations.

   e. Deposits lost for causes other than negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses within the deductible amounts of property insurance established in accordance with paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of OWNER. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining CONTRACTOR's fee.

   f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by CONTRACTOR in connection with the performance of the Work (except losses and damages

   g. The cost of utilities, fuel, and sanitary facilities at the Site.

   h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site,

expressage, and similar petty cash items in connection with the Work.

i. When the Cost of the Work is used to determine the value of a Change Order or of a Claim, the cost of premiums for additional Bonds and insurance required because of the changes in the Work or caused by the event giving rise to the Claim.

j. When all the Work is performed on the basis of cost plus, the costs of premiums for all Bonds and insurance CONTRACTOR is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of CONTRACTOR's officers, executives, principals (of partnerships and sole proprietorships), general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by CONTRACTOR, whether at the Site or in CONTRACTOR's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in paragraph 11.01.A.1 or specifically covered by paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the CONTRACTOR's fee.

2. Expenses of CONTRACTOR's principal and branch offices other than CONTRACTOR's office at the Site.

3. Any part of CONTRACTOR's capital expenses, including interest on CONTRACTOR's capital employed for the Work and charges against CONTRACTOR for delinquent payments.

4. Costs due to the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraphs 11.01.A and 11.01.B.

C. *CONTRACTOR's Fee:* When all the Work is performed on the basis of cost plus, CONTRACTOR's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, CONTRACTOR's fee shall be determined as set forth in paragraph 12.01.C.

D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to paragraphs 11.01.A and 11.01.B, CONTRACTOR will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to ENGINEER an itemized cost breakdown together with supporting data.

11.02 Cash Allowances

A. It is understood that CONTRACTOR has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums as may be acceptable to OWNER and ENGINEER. CONTRACTOR agrees that:

1. the allowances include the cost to CON- TRACTOR (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. CONTRACTOR's costs for unloading and handling on the Site, labor, installation costs, over- head, profit, and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

B. Prior to final payment, an appropriate Change Order will be issued as recommended by ENGINEER to reflect actual amounts due CONTRACTOR on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 Unit Price Work

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by CONTRACTOR will be made by ENGINEER subject to the provisions of paragraph 9.08.

B. Each unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR's overhead and profit for each separately identified item.

*C. OWNER or CONTRACTOR may make a Claim for an adjustment in the Contract Price in accordance with paragraph 10.05 if:

1. the quantity of any item of Unit Price Work performed by CONTRACTOR differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

2. there is no corresponding adjustment with respect any other item of Work; and

3. if CONTRACTOR believes that CONTRACTOR is entitled to an increase in Contract Price as a result of having incurred additional expense or OWNER believes that OWNER is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 - CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 Change of Contract Price

**A. The Contract Price may only be changed by a Change Order or by a Written Amendment. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the ENGINEER and the other party to the Contract in accordance with the provisions of paragraph 10.05.

B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of para- graph 11.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with paragraph 12.01.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under para- graph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in paragraph 11.01) plus a CONTRACTOR's fee for overhead and profit (determined as provided in paragraph 12.01.C).

C. *CONTRACTOR's Fee:* The CONTRACTOR's fee for overhead and profit shall be determined as follows:

1. mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. for costs incurred under paragraphs 11.01.A.1 and 11.01.A.2, the CONTRACTOR's fee shall be 15 percent;

b. for costs incurred under paragraph 11.01.A.3, the CONTRACTOR's fee shall be five percent;

c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of paragraph 12.01.C.2.a is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and CONTRACTOR will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

d. no fee shall be payable on the basis of costs itemized under paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

e. the amount of credit to be allowed by CONTRACTOR to OWNER for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in CONTRACTOR's fee by an amount equal to five percent of such net decrease; and

f. when both additions and credits are involved in any one change, the adjustment in CONTRACTOR's fee shall be computed on the basis of the net change in accordance with para- graphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 Change of Contract Times

A. The Contract Times (or Milestones) may only be changed by a Change Order or by a Written Amendment. Any Claim for an adjustment in the Contract Times (or Milestones) shall be based on written notice submitted by the party making the claim to the ENGINEER and the other party to the Contract in accordance with the provisions of paragraph 10.05.

B. Any adjustment of the Contract Times (or Milestones) covered by a Change Order or of any Claim for an adjustment in the Contract Times (or Milestones) will be determined in accordance with the provisions of this Article 12.

12.03 Delays Beyond CONTRACTOR's Control

A. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of CONTRACTOR, the Contract Times (or Milestones) will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in paragraph 12.02.A. Delays beyond the control of CONTRACTOR shall include, but not be limited to, acts or neglect by OWNER, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

12.04 Delays Within CONTRACTOR's Control

A. The Contract Times (or Milestones) will not be extended due to delays within the control of CONTRACTOR. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of CONTRACTOR.

12.05 Delays Beyond OWNER's and CONTRACTOR's Control

A. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of both OWNER and CONTRACTOR, an extension of the Contract Times (or Milestones) in an amount equal to the time lost due to such delay shall be CONTRACTOR's sole and exclusive remedy for such delay.

12.06 Delay Damages

A. In no event shall OWNER or ENGINEER be liable to CONTRACTOR, any Subcontractor, any Supplier, or any other person or organization, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from:

1. delays caused by or within the control of CONTRACTOR; or

2. delays beyond the control of both OWNER and CONTRACTOR including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God, or acts or neglect by utility owners or other contractors performing other work as contemplated by Article 7.

B. Nothing in this paragraph 12.06 bars a change in Contract Price pursuant to this Article 12 to compensate CONTRACTOR due to delay, interference, or disruption directly attributable to actions or inactions of OWNER or anyone for whom OWNER is responsible.

* ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 Notice of Defects

A. Prompt notice of all defective Work of which OWNER or ENGINEER has actual knowledge will be given to CONTRACTOR. All defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 Access to Work

A. OWNER, ENGINEER, ENGINEER's Consultants, other representatives and personnel of OWNER, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspecting, and testing. CONTRACTOR shall provide them proper and safe conditions for such access and advise them of CONTRACTOR's Site safety procedures and programs so that they may comply therewith as applicable.

13.03 Tests and Inspections

A. CONTRACTOR shall give ENGINEER timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B. OWNER shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to paragraph 13.04.B shall be paid as provided in said paragraph 13.04.B; and

3. as otherwise specifically provided in the Contract Documents.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, CONTRACTOR shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish ENGINEER the required certificates of inspection or approval.

D. CONTRACTOR shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for OWNER's and ENGINEER's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to CONTRACTOR's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to OWNER and ENGINEER.

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by CONTRACTOR without written concurrence of ENGINEER, it must, if requested by ENGINEER, be uncovered for observation.

F. Uncovering Work as provided in paragraph 13.03.E shall be at CONTRACTOR's expense unless CON- TRACTOR has given ENGINEER timely notice of CONTRACTOR's intention to cover the same and ENGINEER has not acted with reasonable promptness in response to such notice.

13.04 Uncovering Work

A. If any Work is covered contrary to the written request of ENGINEER, it must, if requested by ENGINEER, be uncovered for ENGINEER's observation and replaced at CONTRACTOR's expense.

B. If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER or inspected or tested by others, CONTRACTOR, at ENGINEER's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as ENGINEER may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment. If it is found that

such Work is defective, CONTRACTOR shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and OWNER shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, OWNER may make a Claim therefor as provided in paragraph 10.05. If, however, such Work is not found to be defective, CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Times (or Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

13.05 OWNER May Stop the Work

A. If the Work is defective, or CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, OWNER may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of OWNER to stop the Work shall not give rise to any duty on the part of OWNER to exercise this right for the benefit of CONTRACTOR, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 Correction or Removal of Defective Work

A. CONTRACTOR shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by ENGINEER, remove it from the Project and replace it with Work that is not defective. CONTRACTOR shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

13.07 Correction Period

~~*A. If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for CONTRACTOR's use by OWNER or permitted by Laws and Regulations as contemplated in paragraph 6.11.A is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instructions: (i) repair such defective land or areas, or (ii) correct such defective Work or, if the defective Work has been rejected by OWNER, remove it from the Project and replace it with Work that is not defective, and (iii) satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom. If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or repaired or may have the rejected Work removed and replaced, and all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by CONTRACTOR.~~

B. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications or by Written Amendment.

C. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

D. CONTRACTOR's obligations under this paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this paragraph 13.07 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitation or repose.

13.08 Acceptance of Defective Work

A. If, instead of requiring correction or removal and replacement of defective Work, OWNER (and, prior to ENGINEER's recommendation of final payment, ENGINEER) prefers to accept it, OWNER may do so. CONTRACTOR shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to OWNER's evaluation of and determination to accept such defective Work (such costs to be approved by ENGINEER as to reasonableness) and the diminished value of the Work to the extent not otherwise paid by CONTRACTOR pursuant to this sentence. If any such acceptance occurs prior to ENGINEER's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and OWNER shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, OWNER may make a Claim therefor as provided in paragraph 10.05.

If the acceptance occurs after such recommendation, an appropriate amount will be paid by CONTRACTOR to OWNER.

13.09 OWNER May Correct Defective Work

*A. If CONTRACTOR fails within a reasonable time after written notice from ENGINEER to correct defective Work or to remove and replace rejected Work as required by ENGINEER in accordance with paragraph 13.06.A, or if CONTRACTOR fails to perform the Work in accordance with the Contract Documents, or if CONTRACTOR fails to comply with any other provision of the Contract Documents, OWNER may, after seven days written notice to CONTRACTOR, correct and remedy any such deficiency.

B. In exercising the rights and remedies under this paragraph, OWNER shall proceed expeditiously. In connection with such corrective and remedial action, OWNER may exclude CONTRACTOR from all or part of the Site, take possession of all or part of the Work and suspend CONTRACTOR's services related thereto, take possession of CONTRACTOR's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which OWNER has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow OWNER, OWNER's representatives, agents and employees, OWNER's other contractors, and ENGINEER and ENGINEER's Consultants access to the Site to enable OWNER to exercise the rights and remedies under this paragraph.

C. All Claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by OWNER in exercising the rights and remedies under this paragraph 13.09 will be charged against CON- TRACTOR, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and OWNER shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, OWNER may make a Claim therefor as provided in paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of CONTRACTOR's defective Work.

D. CONTRACTOR shall not be allowed an extension of the Contract Times (or Milestones) because of any delay in the performance of the Work attributable to the exercise by OWNER of OWNER's rights and remedies under this paragraph 13.09.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 Schedule of Values

A. The schedule of values established as provided in paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to ENGINEER. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 Progress Payments

A. Applications for Payments

1. At least 20 days before the date established for each progress payment (but not more often than once a month), CONTRACTOR shall submit to ENGINEER for review an Application for Payment filled out and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that OWNER has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect OWNER's interest therein, all of which must be satisfactory to OWNER.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of CONTRACTOR stating that all previous progress payments received on account of the Work have been applied on account to discharge CONTRACTOR's legitimate obligations associated with prior Applications for Payment.

~~*3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.~~

B. Review of Applications

~~**1. ENGINEER will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to OWNER or return the Application to CONTRACTOR indicating in writing ENGINEER's reasons for refusing to recommend payment. In the latter case, CONTRACTOR may make the necessary corrections and resubmit the Application.~~

2. ENGINEER's recommendation of any payment requested in an Application for Payment will constitute

a representation by ENGINEER to OWN- ER, based on ENGINEER's observations on the Site of the executed Work as an experienced and qualified design professional and on ENGINEER's review of the Application for Payment and the accompanying data and schedules, that to the best of ENGINEER's knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under paragraph 9.08, and to any other qualifications stated in the recommendation); and

c. the conditions precedent to CONTRACTOR's being entitled to such payment appear to have been fulfilled in so far as it is ENGINEER's responsibility to observe the Work.

3. By recommending any such payment ENGINEER will not thereby be deemed to have represented that: (i) inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to ENGINEER in the Contract Documents; or (ii) that there may not be other matters or issues between the parties that might entitle CON- TRACTOR to be paid additionally by OWNER or entitle OWNER to withhold payment to CONTRACTOR.

4. Neither ENGINEER's review of CONTRACTOR's Work for the purposes of recommending payments nor ENGINEER's recommendation of any payment, including final payment, will impose responsibility on ENGINEER to supervise, direct, or control the Work or for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for CONTRACTOR's failure to comply with Laws and Regulations applicable to CONTRACTOR's performance of the Work. Additionally, said review or recommendation will not impose responsibility on ENGINEER to make any examination to ascertain how or for what purposes CONTRACTOR has used the moneys paid on account of the Contract Price, or to determine that title to any of the Work, materials, or equipment has passed to OWNER free and clear of any Liens.

5. ENGINEER may refuse to recommend the whole or any part of any payment if, in ENGINEER's opinion, it would be incorrect to make the representations to OWNER referred to in paragraph 14.02.B.2. ENGINEER may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in ENGINEER's opinion to protect OWNER from loss because:

a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

b. the Contract Price has been reduced b Written Amendment or Change Orders;

c. OWNER has been required to correct defective Work or complete Work in accordance with paragraph 13.09; or

d. ENGINEER has actual knowledge of the occurrence of any of the events enumerated in paragraph 15.02.A.

C. Payment Becomes Due

*1. Ten days after presentation of the Application for Payment to OWNER with ENGINEER's recommendation, the amount recommended will (subject to the provisions of paragraph 14.02.D) become due, and when due will be paid by OWNER to CONTRACTOR.

**D. Reduction *in Payment*

1. OWNER may refuse to make payment of the full amount recommended by ENGINEER because:

a. claims have been made against OWN- ER on account of CONTRACTOR's performance or furnishing of the Work;

b. Liens have been filed in connection with the Work, except where CONTRACTOR has delivered a specific Bond satisfactory to OWNER to secure the satisfaction and discharge of such Liens;

c. there are other items entitling OWNER to a set-off against the amount recommended; or

d. OWNER has actual knowledge of the occurrence of any of the events enumerated in paragraphs 14.02.B.5.a through 14.02.B.5.c or paragraph 15.02.A.

2. If OWNER refuses to make payment of the full amount recommended by ENGINEER, OWNER must give CONTRACTOR immediate written notice (with a copy to ENGINEER) stating the reasons for such action and promptly pay CONTRACTOR any amount remaining after deduction of the amount so withheld. OWNER shall promptly pay CONTRACTOR the amount so withheld, or any adjustment thereto agreed to by OWNER and CONTRACTOR, when CONTRACTOR corrects to OWNER's satisfaction the reasons for such action.

3. If it is subsequently determined that OWNER's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by paragraph 14.02.C.1.

14.03 CONTRACTOR's Warranty of Title

***** ~~A. CONTRACTOR warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER no later than the time of payment free and clear of all Liens.~~

14.04 Substantial Completion

A. When CONTRACTOR considers the entire Work ready for its intended use CONTRACTOR shall notify OWNER and ENGINEER in writing that the entire Work is substantially complete (except for items specifically listed by CONTRACTOR as incomplete) and request that ENGINEER issue a certificate of Substantial Completion. Promptly thereafter, OWNER, CONTRACTOR, and ENGI- NEER shall make an inspection of the Work to determine the status of completion. If ENGINEER does not consider the Work substantially complete, ENGINEER will notify CONTRACTOR in writing giving the reasons therefor. If ENGINEER considers the Work substantially complete, ENGINEER will prepare and deliver to OWNER a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. OWNER shall have seven days after receipt of the tentative certificate during which to make written objection to ENGINEER as to any provisions of the certificate or attached list

   If, after considering such objections, ENGINEER concludes that the Work is not substantially complete, ENGINEER will within 14 days after submission of the tentative certificate to OWNER notify CONTRACTOR in writing, stating the reasons therefor. If, after consideration of OWNER's objections, ENGINEER considers the Work substantially complete, ENGINEER will within said 14 days execute and deliver to OWNER and CONTRACTOR a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as ENGINEER believes justified after consideration of any objections from OWNER. At the time of delivery of the tentative certificate of Substantial Completion ENGINEER will deliver to OWNER and CONTRACTOR a written recommendation as to division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless OWNER and CONTRACTOR agree otherwise in writing and so inform ENGINEER in writing prior to ENGINEER's issuing the definitive certificate of Substantial Completion, ENGINEER's aforesaid recommendation will be binding on OWNER and CONTRACTOR until final payment.

B. OWNER shall have the right to exclude CONTRACTOR from the Site after the date of Substantial Completion, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

14.05 Partial Utilization

A. Use by OWNER at OWNER's option of any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which OWNER, ENGINEER, and CONTRACTOR agree constitutes a separately functioning and usable part of the Work that can be used by OWNER for its intended purpose without significant interference with CONTRACTOR's performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work subject to the following conditions.

   1. OWNER at any time may request CON- TRACTOR in writing to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and substantially complete. If CONTRACTOR agrees that such part of the Work is substantially complete, CONTRACTOR will certify to OWNER and ENGINEER that such part of the Work is substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. CONTRACTOR at any time may notify OWNER and ENGINEER in writing that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, OWNER, CONTRACTOR, and ENGINEER shall make an inspection of that part of the Work to determine its status of completion. If ENGINEER does not consider that part of the Work to be substantially complete, ENGINEER will notify OWNER and CONTRACTOR in writing giving the reasons there- for. If ENGINEER considers that part of the Work to be substantially complete, the provisions of para- graph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

   2. No occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of paragraph 5.10 regarding property insurance.

14.06 Final Inspection

A. Upon written notice from CONTRACTOR that the entire Work or an agreed portion thereof is complete, ENGINEER will promptly make a final inspection with OWNER and CONTRACTOR and will notify CONTRACTOR in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 Final Payment

A. Application for Payment

   1. After CONTRACTOR has, in the opinion of ENGINEER, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all

maintenance and operating instructions, schedules, guarantees, Bonds, certificates or other evidence of insurance certificates of inspection, marked-up record documents (as provided in paragraph 6.12), and other documents, CONTRACTOR may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by: (i) all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by subparagraph 5.04.B.7; (ii) consent of the surety, if any, to final payment; and (iii) complete and legally effective releases or waivers (satisfactory to OWNER) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in paragraph 14.07.A.2 and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full and an affidavit of CONTRACTOR that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which OWNER or OWNER's property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to OWNER to indemnify OWNER against any Lien.

B. Review of Application and Acceptance

**1. If, on the basis of ENGINEER's observation of the Work during construction and final inspection, and ENGINEER's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, ENGINEER is satisfied that the Work has been completed and CONTRACTOR's other obligations under the Contract Documents have been fulfilled, ENGINEER will, within ten days after receipt of the final Application for Payment, indicate in writing ENGINEER's recommendation of payment and present the Application for Payment to OWNER for payment. At the same time ENGINEER will also give written notice to OWNER and CONTRACTOR that the Work is acceptable subject to the provisions of paragraph 14.09. Otherwise, ENGINEER will return the Application for Payment to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application for Payment.

C. Payment Becomes Due

1. Thirty days after the presentation to OWN- ER of the Application for Payment and accompanying documentation, the amount recommended by ENGINEER will become due and, when due, will be paid by OWNER to CONTRACTOR.

14.08 Final Completion Delayed

A. If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed, and if ENGINEER so confirms, OWNER shall, upon receipt of CONTRACTOR's final Application for Payment and recommendation of ENGINEER, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by OWNER for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to ENGINEER with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 Waiver of Claims

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by OWNER against CONTRACTOR, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from CONTRACTOR's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by CONTRACTOR against OWNER other than those previously made in writing which are still unsettled.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.01 OWNER May Suspend Work

**A. At any time and without cause, OWNER may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to CON- TRACTOR and ENGINEER which will fix the date on which Work will be resumed. CONTRACTOR shall resume the Work on the date so fixed. CONTRACTOR shall be allowed an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if CONTRACTOR makes a Claim therefor as provided in paragraph 10.05.

15.02 OWNER May Terminate for Cause

A. The occurrence of any one or more of the following events will justify termination for cause:

1. CONTRACTOR's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under paragraph 2.07 as adjusted from time to time pursuant to paragraph 6.04);

2. CONTRACTOR's disregard of Laws or Regulations of any public body having jurisdiction;

3. CONTRACTOR's disregard of the authority of ENGINEER; or

4. CONTRACTOR's violation in any substantial way of any provisions of the Contract Documents.

*B. If one or more of the events identified in paragraph 15.02.A occur, OWNER may, after giving CONTRACTOR (and the surety, if any) seven days written notice, terminate the services of CONTRACTOR, exclude CONTRACTOR from the Site, and take possession of the Work and of all CONTRACTOR's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), incorporate in the Work all materials and equipment stored at the Site or for which OWNER has paid CONTRACTOR but which are stored elsewhere, and finish the Work as OWNER may deem expedient. In such case, CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by OWNER arising out of or relating to completing the Work, such excess will be paid to CONTRACTOR. If such claims, costs, losses, and damages exceed such unpaid balance, CONTRACTOR shall pay the difference to OWNER. Such claims, costs, losses, and damages incurred by OWNER will be reviewed by ENGINEER as to their reasonableness and, when so approved by ENGINEER, incorporated in a Change Order. When exercising any rights or remedies under this paragraph OWNER shall not be required to obtain the lowest price for the Work performed.

C. Where CONTRACTOR's services have been so terminated by OWNER, the termination will not affect any rights or remedies of OWNER against CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR from liability.

15.03 OWNER May Terminate For Convenience

A. Upon seven days written notice to CON- TRACTOR and ENGINEER, OWNER may, without cause and without prejudice to any other right or remedy of OWNER, elect to terminate the Contract. In such case, CONTRACTOR shall be paid (without duplication of any items):

1. for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. for expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

3. for all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. for reasonable expenses directly attributable to termination.

B. CONTRACTOR shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 CONTRACTOR May Stop Work or Terminate

A. If, through no act or fault of CONTRACTOR, the Work is suspended for more than 90 consecutive days by OWNER or under an order of court or other public authority, or ENGINEER fails to act on any Application for Payment within 30 days after it is submitted, or OWNER fails for 30 days to pay CONTRACTOR any sum finally determined to be due, then CONTRACTOR may, upon seven days written notice to OWNER and ENGINEER, and provided OWNER or ENGINEER do not remedy such suspension or failure within that time, terminate the Contract and recover from OWNER payment on the same terms as provided in paragraph 15.03. In lieu of terminating the Contract and without prejudice to any other right or remedy, if ENGINEER has failed to act on an Application for Payment within 30 days after it is submitted, or OWNER has failed for 30 days to pay CONTRACTOR any sum finally determined to be due, CONTRACTOR may, seven days after written notice to OWNER and ENGINEER, stop the Work until payment is made of all such amounts due CONTRACTOR, including interest thereon. The provisions of this paragraph 15.04 are not intended to preclude CON- TRACTOR from making a Claim under paragraph 10.05 for an adjustment in Contract Price or Contract Times or other- wise for expenses or damage directly attributable to CONTRACTOR's stopping the Work as permitted by this paragraph.

ARTICLE 16 - DISPUTE RESOLUTION

16.01 Methods and Procedures

A. Dispute resolution methods and procedures, if any, shall be as set forth in the Supplementary Conditions. If no method and procedure has been set forth, and subject to the provisions of

paragraphs 9.09 and 10.05, OWNER and CONTRACTOR may exercise such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any dispute.

ARTICLE 17 - MISCELLANEOUS

17.01 Giving Notice

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 Computation of Times

A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 Cumulative Remedies

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 Survival of Obligations

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Agreement.

17.05 Controlling Law

A. This Contract is to be governed by the law of the state in which the Project is located.

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SECTION 00800

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (No. 1910-8, 1996 edition) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

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ARTICLE 1. DEFINITIONS AND TERMINOLOGY

Add the following language at the beginning of definition 1.01 A.12 entitled "Contract Documents" in the General Conditions: "The Advertisement for Bids, Instructions to Bidders, State Regulations,..."

Delete the words "The individual or entity named as such in the Agreement" in 1.01.A.19, “Engineer”, and insert the following in their place: "The individual or entity duly appointed by the Owner to undertake the duties and powers herein assigned to the Engineer, acting either directly or through duly appointed representatives."

Delete the words "and who is identified as such in the Supplementary Conditions" at the end of definition 1.01 A.20, entitled "ENGINEER'S Consultant."

Delete definition 1.01 A.41 entitled "Specifications" in the General Conditions in its entirety and insert the following in its place: "Sections included under Division 1 through Division 16 of the Contract Documents."

ARTICLE 2. PRELIMINARY MATTERS SC-2.02

Delete paragraph 2.02A of the General Conditions in its entirety.

SC-2.03

Add paragraph 2.03B:

Notwithstanding the time limitations provided in paragraph 2.03A, the OWNER may desire to commence the Contract Times later than the sixtieth day after the bid opening. The OWNER and CONTRACTOR, upon mutual agreement, may extend the commencement of the Contract Times to any date that they elect. OWNER must obtain CONTRACTOR's approval for extending the time beyond the dates/times stated in the Contract Documents.

SC-2.05

Delete paragraph 2.05C of the General Conditions in its entirety and insert the following in its place:

"C. Evidence of Insurance: CONTRACTOR shall deliver to OWNER, with a copy to the ENGINEER, Certificates of Insurance within 10 days after receipt of the notice of the acceptance of bid (and other evidence requested by OWNER) which CONTRACTOR is required to purchase and maintain in accordance with the requirements of Article 5."

ARTICLE 3. CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE SC-3.01

Add the following sentence at the end of Paragraph 3.01A of the General Conditions:

"...by all. Each and every provision of law and clause required by law to be inserted in these Contract Documents shall be deemed to be inserted herein, and they shall be read and enforced as though it were included herein, and if through mistake or otherwise, any such provision is not inserted, or if not correctly inserted, then upon the application of either party, the Contract Documents shall forthwith be physically amended to make such insertion."

ARTICLE 4. AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

SC-4.02

Delete the term "Supplementary Conditions" of paragraph 4.02 A of the General Conditions and replace it with "Contract Documents".

SC-4.04

Change "of" to "or" on line 6 of paragraph 4.04 B.2 of the General Conditions.

Delete the following words from lines 8 and 9 of paragraph 4.04 B.2 of the General Conditions: "...or not shown or indicated with reasonable accuracy..."

SC-4.05

Add a new paragraph immediately after paragraph 4.05A of the General Conditions which is to read as follows:

"B. ENGINEER may check the lines, elevations and reference marks set by CONTRACTOR, and CONTRACTOR shall correct any errors disclosed by such check. Such a check shall not be considered as approval of CONTRACTOR's work and shall not relieve CONTRACTOR of the responsibility for construction of the entire Work in accordance with the Contract Documents. CONTRACTOR shall furnish personnel to assist ENGINEER in checking lines and grades."

ARTICLE 5. BONDS AND INSURANCE NOTICE TO CONTRACTOR:

1. Proof of Insurance coverage shall be furnished to the OWNER in accordance with the schedule for submittal of Bonds and Agreements.

2. Additionally refer to Article 2. PRELIMINARY MATTERS, Paragraph SC-2.05.C

SC-5.01

Insert these sentences following SC-5.01.A:

"The Surety Company providing the bonds shall have a rating of A or better within the Best Key Rating Guide and be licensed by the Massachusetts Division of Insurance. The CONTRACTOR shall pay the premiums for such Bonds."

SC-5.03

Delete the second sentence in paragraph 5.03A of the General Conditions, which begins "OWNER shall deliver to...."

SC-5.04

The limits of liability for the insurance required by paragraph 5.04A of the General Conditions shall provide coverage for not less than the following amounts or greater where required by law:

5.04 A.1 and 5.04 A.2 Workers' Compensation.

(1) Worker's Compensation per Statutory Requirements

(2) Coverage B - Employer's Liability $100,000/$500,000/$100,000

5.04 A.3, 5.04 A.4 and 5.04 A.5 Commercial General Liability Limits shall include coverage for Independent Contractors (also known as Owners and Contractors Protective Liability), explosion, collapse and underground hazard coverage (XCU), broad form property damage, blanket contractual liability and products/completed operations. The general aggregate limits shall be endorsed so that they respond on a per project and per location basis.

Limits: $1,000,000 each occurrence

$2,000,000 general aggregate

$2,000,000 products/completed operations aggregate

5.04 A.6 Automobile Liability for owned, hired and non-owned vehicles:

(1)	Bodily injury:	$1,000,000	Combined single limit
(2)	Property damage	$1,000,000	Combined single limit

Revise the beginning of paragraph 5.04.B.1 to read as follows: "with respect to insurance required by paragraphs 5.04.A.3 through 5.04.A.5 inclusive and paragraph 5.04.C, include as additional insureds…"

Delete paragraph 5.04.B.5 in its entirety and insert the following in its place:

"5. Contains a provision that notice of cancellation of insurance be delivered in accordance with policy provisions. In addition, the CONTRACTOR and/or its insurance broker/agent shall immediately notify the OWNER and ENGINEER should any insurance coverage be cancelled. The CONTRACTOR shall immediately stop work on the Project and shall not resume work until the CONTRACTOR provides evidence, to the OWNER and ENGINEER, in the form of an acceptable insurance certificate, of new insurance coverage that replaces all cancelled coverage that is required for the Project."

Add two new paragraphs immediately after paragraph 5.04B of the General Conditions which are to read as follows:

"C. The CONTRACTOR shall also provide:

1. CONTRACTOR shall, as a minimum, purchase and maintain excess liability insurance in the umbrella form with a combined single limit of not less than $5,000,000 per occurrence and in the aggregate. Evidence of such excess liability shall be delivered to OWNER in accordance with paragraph 2.05C in the form of a certificate indicating the policy numbers and limits of liability of all underlying insurance.

2. General Liability, Workers' Compensation, Automobile Liability and Umbrella Liability Policies will contain waivers of subrogation in favor of the Engineer and Owner.

5) If the aggregate limits of liability indicated in CONTRACTOR' insurance provided in accordance with paragraphs 5.03 and 5.04 are not sufficient to cover all claims for damages arising from his operations under this Contract and from any other work performed by him or if the commercial general liability insurance policy of insurance does not provide that the general aggregate limits apply on a per project and per location basis, CONTRACTOR shall have the policy amended so that the aggregate limits of liability required by this Contract will be available to cover all claims for damages due to operations under this Contract."

6) The General Contractor shall carry the coverage for Subcontractors naming the Subcontractors, the Town of Orleans, Tighe & Bond and AECOM Technical Services, Inc. as additional insured in the limits specified herein. SECTION 05020A-3, INSURANCE REQUIREMENTS FOR INCLUSION IN ALL SPECIFICATIONS AND CONTRACTS are separate from the Owners and Contractors Protective Liability and shall name the Town of Orleans, Tighe & Bond and AECOM Technical Services, Inc. as additional insured.

SC-5.05

Delete paragraph 5.05 of the General Conditions in its entirety.

SC-5.06

Delete Paragraph 5.06A of the General Conditions in its entirety.

Delete paragraph 5.06B of the General Conditions in its entirety.

Delete Paragraph 5.06C of the General Conditions in its entirety.

Delete paragraph 5.06D of the General Conditions in its entirety.

Delete paragraph 5.06E of the General Conditions in its entirety.

SC-5.07

Amend the last sentence of paragraph 5.07A of the General Conditions by striking out the words "held by OWNER as trustee or." As so amended, paragraph 5.07A remains in effect.

SC-5.08

Delete paragraph 5.08A of the General Conditions in its entirety.

Delete paragraph 5.08B of the General Conditions in its entirety.

SC-5.09

Delete paragraph 5.09A of the General Conditions in its entirety and insert the following in its place:

"A. If OWNER has any objection to the coverage afforded by or other provisions of the insurance required to be purchased and maintained by CONTRACTOR in accordance with this Article 5 on the basis of its not complying with the Contract Documents, OWNER will notify CONTRACTOR in writing thereof within thirty days of the date of delivery of such certificates to OWNER in accordance with paragraph 2.05C. CONTRACTOR will provide such additional information in respect of insurance provided by him as OWNER may reasonably request."

ARTICLE 6. CONTRACTOR'S RESPONSIBILITIES SC-6.01

Delete paragraph 6.01B of the General Conditions in its entirety and replace with the following:

"B. At the site of the Work the CONTRACTOR shall employ a full-time construction superintendent or foreman who shall have full authority to act for the CONTRACTOR. It is understood that such representative shall be acceptable to the ENGINEER and shall be one who will be continued in the capacity for the particular job involved unless the representative ceases to be on the CONTRACTOR's payroll. If at any time during the Work the representative is deemed by the ENGINEER to be no longer acceptable, the representative shall be promptly replaced by the CONTRACTOR. All communications to the superintendent or foreman shall be as binding as if given to the CONTRACTOR."

SC-6.04

Add the following paragraph after paragraph 6.04A.2 of the General Conditions:

"B. The CONTRACTOR's resident superintendent shall attend monthly progress meetings at the site of the work with the ENGINEER and others as appropriate to review schedule status and such other pertinent subjects as may be listed on the agenda by the ENGINEER."

SC-6.05

Revise the second sentence of Paragraph A to read as follows:

"Unless the specification indicates that a proprietary item is called for, other items of material or equipment or material or equipment of other suppliers may be submitted to ENGINEER for review under the circumstances described below, and in accordance with MGL c.30, s.39M."

SC-6.17

In paragraph 6.17 E.1 of the General Conditions, delete the word "timely" from the first line.

SC-6.20

Delete paragraph 6.20A of the General Conditions in its entirety and replace with the following:

"A. To the fullest extent permitted by law, the CONTRACTOR shall indemnify and hold harmless the OWNER, the ENGINEER, ENGINEER's consultants, and any of their officers, directors, employees, agents, affiliates, subsidiaries and partners from and against all claims, damages, losses and expenses, including but not limited to attorney's fees, arising out of or resulting from the performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including loss of use resulting therefrom, but only to the extent caused in whole or in part by acts or omissions of the CONTRACTOR, a subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall apply to any such claims, damages, losses and expenses which arise and/or are incurred by any person or entity either during the performance of the Work and/or after completion of construction. Nothing in this paragraph shall be construed to negate, abridge, or reduce other rights or obligations of indemnity or contribution which would otherwise exist as to a party or person indemnified hereunder. CONTRACTOR hereby assumes the responsibility and liability for injury to or death of any and all persons, including the CONTRACTOR's employees, and for any and all damage to property caused by, resulting from, or arising out of any act, omission or neglect on the part of the CONTRACTOR, or of any Subcontractor or of anyone directly or indirectly employed by any of them or of anyone for whose acts, any of them may be liable. The Contractor hereby acknowledges its obligation under the foregoing paragraph to indemnify the Engineer and Owner against judgments suffered because of the contractor's work and to assume the cost of defending the Engineer and Owner against claims as described in the foregoing paragraph."

Delete paragraph 6.20C of the General Conditions in its entirety.

ARTICLE 8. OWNER'S RESPONSIBILITIES

SC-8.02

Delete the phrase "to whom the CONTRACTOR makes no reasonable objection."

SC-8.06

Delete paragraph 8.06A of the General Conditions in its entirety.

SC-8.09

Insert the following after the first sentence:

"However, the OWNER shall have the right to direct the CONTRACTOR to perform the Work according to any sequence schedule set forth in the Contract Documents or established pursuant thereto."

ARTICLE 9. ENGINEER'S STATUS DURING CONSTRUCTION SC-9.01

Add a new paragraph 9.01B after paragraph 9.01A of the General Conditions, which is to read as follows:

"B. Nothing contained in the Contract Documents shall be construed to create a contractual relationship of any kind (1) between the ENGINEER and CONTRACTOR, (2) between the OWNER and a Subcontractor or Subcontractors, or (3) between any person or entities other than the OWNER and CONTRACTOR. The ENGINEER shall, however, be entitled to performance and enforcement of obligations under the CONTRACT DOCUMENTS intended to facilitate performance of the ENGINEER'S duties."

SC-9.10

Insert the following after the first sentence on paragraph 9.10B:

"However, the ENGINEER shall have the right to direct the CONTRACTOR to perform the Work according to any sequence schedule set forth in the Contract Documents or established pursuant thereto."

ARTICLE 11. COST OF THE WORK; CASH ALLOWANCES; UNIT PRICE WORK

Delete Article 11 of the General Conditions in its entirety and replace with the following:

"A. The unit price of an item of Unit Price work shall be subject to reevaluation and adjustment under the following conditions:

(1) If the total extended bid price [Estimated Quantity times the Bid Unit Price] of a particular item of Unit Price Work amounts to 5 percent or more of the Original Contract Price and the variation in the quantity of the particular item of Unit Price Work performed by CONTRACTOR differs by more than 15 percent from the estimated quantity of such item indicated in the Agreement; and

(2) If there is no corresponding adjustment with respect to any other item of work; and

(3) If CONTRACTOR believes that CONTRACTOR has incurred additional expense as a result thereof, CONTRACTOR may make a claim for an adjustment in the Contract Price in accordance with Article 11 if the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed. If OWNER believes that the quantity variation entitles OWNER to an adjustment in the unit price, OWNER shall be entitled to an adjustment in the unit price in an amount determined by the ENGINEER. ENGINEER shall not be liable in connection with any determination relating to adjustments which is rendered in good faith."

ARTICLE 12. CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

SC-12.01

Delete paragraph 12.01 in its entirety.

SC-12.06

Add the following new paragraphs after paragraph 12.06 of the General Conditions: "12.07 Liquidated Damages:

"A. If the CONTRACTOR shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the OWNER, then the CONTRACTOR does hereby agree, as a part consideration for the awarding of this Contract, to pay to the OWNER the amount specified in the Contract, not as a penalty but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the Contract shall be in default after the time stipulated in the Contract for completing the work. Such damages may be retained from time to time by the OWNER from progress payments or any amounts owing to the CONTRACTOR, or otherwise collected.

B. The said amount is fixed and agreed upon by and between the CONTRACTOR and the OWNER because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the OWNER would in such event sustain, and said amount is agreed to be the amount of damages which the OWNER would sustain and said amount shall be retained from time to time by the OWNER from current periodical estimates.

C. It is further agreed that time is of the essence of each and every portion of this Contract and of the specifications wherein as definite and certain length of times if fixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this Contract. Provided that the CONTRACTOR shall not be charged with liquidated damages of any excess cost when the OWNER determines that the CONTRACTOR is without fault and the CONTRACTOR's reasons for the

time extension are acceptable to the OWNER; Provided, further, that the CONTRACTOR shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due:

1) to any preference, priority or allocation order duly issued by the Government;

2) to unforeseeable cause beyond the control and without the fault or negligence of the CONTRACTOR, including, but not restricted to, acts of God, or of the public enemy, acts of the OWNER, acts of another CONTRACTOR in the performance of a contract with the OWNER, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and severe weather; and

3) to any delays of subcontractors or suppliers occasioned by any of the causes specified in subsections C (1) and C (2) above;

D. Provided, further, that the CONTRACTOR shall, within thirty (30) days from the beginning of such delay, unless the OWNER shall grant a further period of time prior to the date of final settlement of the Contract, notify the OWNER, in writing, of the causes of the delay, who shall ascertain the facts and extent of the delay and notify the CONTRACTOR within a reasonable time of its decision in the matter."

ARTICLE 13. TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

SC-13.07

Delete paragraph 13.07A of the General Conditions and insert the following in its place:

"A. If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any work is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instructions: (i) correct such defective work, or, if it has been rejected by OWNER, remove it from the site and replace it with work that is not defective, and (ii) satisfactorily correct or remove and replace any damage to other work or the work of others therefrom. If CONTRACTOR does not begin the repairs within ten (10) days of receipt of written notification and promptly comply with the terms of OWNER's written instructions, or in an emergency where delay would cause serious risk, loss or damage, OWNER may have the defective work corrected or the rejected work removed and replaced, and all claims, costs, losses and damages caused by or resulting from such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by CONTRACTOR."

SC-13.09

Revise paragraph 13.09A of the General Conditions

"A. Delete the word "seven" and replace it with the word "ten" so that it reads "after ten days written notice to CONTRACTOR."

ARTICLE 14. PAYMENTS TO CONTRACTOR AND COMPLETION

SC-14.02

Delete paragraph 14.02A.3 and insert the following in its place:

"3. Retainage with respect to progress payments will be five percent or, if stipulated, the maximum allowed by law."

Add Paragraph 4. to read as follows:

"4. The CONTRACTOR shall submit Weekly Payroll Records Report and Statement of Compliance verifying compliance with the Minimum Prevailing Wage Law, MGL ch. 149, Sections 26-27H. These Statements of Compliance shall be submitted as a condition of payment for work performed during the period the reports apply."

SC-14.03

Delete paragraph 14.03A in its entirety and insert the following in its place:

"A. CONTRACTOR warrants and guarantees that title to all work, material and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER no later than at the time of Application for Payment free and clear of all liens. CONTRACTOR shall provide written transfer of title and a certified paid invoice provided by the supplier."

ARTICLE 15. SUSPENSION OF WORK AND TERMINATION

SC-15.02

Add a new paragraph immediately after paragraph 15.02 A.4 of the General Conditions which is to read as follows:

"5. If the Work to be done under this Contract shall be abandoned, or if this Contract or any part thereof shall be sublet, without the previous written consent of OWNER, or if the contract or any claim thereunder shall be assigned by CONTRACTOR otherwise than as herein specified;"

ARTICLE 17. MISCELLANEOUS

SC-17.06, 17.07, 17.08, 17.09

Add the following new paragraphs after paragraph 17.05 of the General Conditions:

"17.06 Assignment:

The CONTRACTOR shall not assign the whole or any part of this Contract or any moneys due or to become due hereunder until thirty (30) days prior notice in writing has been given to the OWNER of the intention to assign, which notice shall state the identity and address of the prospective assignee. No assignment shall be made without the OWNER's prior written consent. Such consent shall not be unreasonably withheld. In case the CONTRACTOR assigns all or any part of the moneys due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any moneys due or to become due to the CONTRACTOR shall be subject to prior claims of all persons, firms and corporations of services rendered or materials supplied for the performance of the work called for in this Contract.

17.07 Liability

It is understood and agreed that members of the OWNER or the ENGINEER or any agent or employees of the OWNER signing this Agreement shall not be personally liable hereunder for any action incurred in connection with this Agreement.

17.08 State Statutes and Regulations

See Section 00830 for further modifications of the General Conditions due to state statutes and regulations.

17.09 Severability

If any provision of this Agreement shall be invalid or unenforceable to any extent or in any application, then the remainder of this Agreement and of such terms and conditions, except to such extent or in such application, shall not be affected thereby, and each and every term and condition of this Agreement shall be valid and enforced to the fullest extent and in the broadest application permitted by law."

END OF DOCUMENT

SECTION 00830

STATE STATUTES AND REGULATIONS

COMMONWEALTH OF MASSACHUSETTS

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A. REVISIONS TO GENERAL CONDITIONS

1. Definitions

The term "AWARDING AUTHORITY," as used herein, shall be considered to be synonymous with the term "OWNER," described in definition 1.01 A.30.

Delete definition 1.01 A.43 entitled "Substantial Completion" in the General Conditions in its entirety and insert the following in its place:

"Substantial Completion shall be interpreted in accordance with Massachusetts General Law

Chapter 30, Section 39G or 39K as appropriate."

2. Subsurface Conditions Found Different

Add the following sentence to the end of paragraph 4.03A of the General Conditions:

"...to do so. Adjustments resulting from subsurface or latent physical conditions will be in accordance with Massachusetts General Law Chapter 30, Section 39N."

3. Subcontracting

Add the following language at the end of paragraph 6.06F of the General Conditions:

"Except as required otherwise by Massachusetts General Law Chapter 149, Section 44F, for

Work governed by Chapter 149, sections 44A through 44H.

4. Permits

Delete paragraph 6.08A of the General Conditions in its entirety and insert the following in its place:

"A. Unless otherwise provided for in Section 00890 PERMITS, the AWARDING AUTHORITY shall be responsible for identifying and obtaining all federal, state, and local permits required by the nature and location of construction, including but not limited to railroad permits, building construction permits, and permits for street and highway cuts and openings. CONTRACTOR shall be responsible for obtaining all permits required of its equipment, work force, or particular operations in the performance of the Work and not otherwise specified to be obtained by the AWARDING AUTHORITY. These permit fees shall be paid by CONTRACTOR. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work, which are applicable at the time of opening of bids, or, if there are no Bids, on the Effective Date of the Agreement. Town of Orleans building permit fees are waived."

5. Contractor Records

Add a new paragraph immediately after paragraph 6.09C of the General Conditions, which is to read as follows:

"D. The CONTRACTOR shall comply with all applicable provisions Chapter 30, Section 39R of the Massachusetts General Laws regarding, CONTRACTOR's records."

6. Massachusetts Sales and Use Tax

Add the following paragraph after paragraph 6.10A of the General Conditions:

"B. The materials and supplies to be used by the CONTRACTOR in the Work of this Contract are exempt from the Sales and Use Tax of the Commonwealth of Massachusetts. The AWARDING AUTHORITY tax exemption certificate number will be furnished to the CONTRACTOR."

7. Clarifications and Interpretations

Add the following language at the end of paragraph 9.04A of the General Conditions:

"The ENGINEER'S interpretation will be made in accordance with the requirements of Massachusetts General Law Chapter 30, Section 39P."

8. Change of Contract Price

Delete paragraphs 11.01, 11.02 and 12.01 of the General Conditions, having to do with Change of Contract Price. Changes in contract price will be governed by the section called "Change Orders," in Attachment D, Section 00830 and Article 11 in the Supplementary Conditions.

9.Payments

Delete paragraph 14.02B.1 of the General Conditions in its entirety and insert the following in its place:

"1. Progress Payments will be made in accordance with Massachusetts General Law Chapter 30, Section 39G, or 39K, as applicable."

Add the following new paragraph following paragraph 14.02C.1 of the General Conditions:

"2. The CONTRACTOR shall make payments to Subcontractors in accordance with the requirements of Massachusetts General Law Chapter 30, Section 39F."

Delete paragraph 14.07B of the General Conditions in its entirety and insert the following in its place:

"1. If, on the basis of the ENGINEER's observation of the Work during construction and final inspection and, upon the ENGINEER's review of the final Application for Payment and accompanying documentation, the ENGINEER is satisfied that the Work has been completed and that the CONTRACTOR's other obligations under the Contract Documents have been fulfilled, the ENGINEER will indicate in writing its recommendation of payment and present the Application to the AWARDING AUTHORITY for payment. Thereupon the ENGINEER will give written notice to the AWARDING AUTHORITY and the CONTRACTOR that the Work is acceptable subject to the provisions of paragraph 14.15. Otherwise, the ENGINEER will return the Application to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment. In such case the CONTRACTOR shall make the necessary corrections and resubmit the Application. If the Application and accompanying documentation are appropriate as to form and substance, the AWARDING AUTHORITY shall in accordance with the applicable provisions of the Massachusetts General Laws, make payment to the CONTRACTOR."

10. Suspension of Work and Termination

Delete paragraph 15.01A of the General Conditions in its entirety and insert the following in its place:

"A. The AWARDING AUTHORITY may order, at any time and without cause, the CONTRACTOR to suspend or delay the Work in accordance with Massachusetts General Law Chapter 30, Section 39O."

11. Labor Classifications and Minimum Wage Rates

Add the following paragraphs under the heading "Wage Rates" after paragraph 17.09 of the

Supplementary Conditions: "17.11 Wage Rates

A. Minimum Wage Rates as determined by the Commissioner of the Division of Occupational Safety of the Executive Office of Labor and Workforce Development under the provisions of Massachusetts General Laws Chapter 149, Sections 26-27D apply to this project. A copy of the wage schedule is included in Attachment A of Section 00830. If, after the Notice of Award, it becomes necessary to employ any person in a trade or occupation not classified in the wage determinations, such person shall be paid at not less than such rates as shall be determined by the Commissioner. Such approved minimum rate shall be retroactive to the time of the initial employment of such person in such trade or occupation. The CONTRACTOR shall notify the AWARDING AUTHORITY of its intention to employ persons in trades or occupations not classified in the wage determinations as soon as possible in order to allow sufficient time for the AWARDING AUTHORITY to obtain approved rates for such trades or occupations.

B. The schedule of wages referred to above are minimum rates only, and the AWARDING AUTHORITY will not consider any claims for additional compensation made by CONTRACTOR because of payment by the CONTRACTOR of any wage rate in excess of the applicable rate contained in the Contract.

C. The said schedule of wages shall continue to be the minimum rates to be paid during the life of this Agreement, except in the case of the duration of this Agreement exceeding one year, when the Contractor will be responsible for requesting and obtaining updated minimum wage rates from the Owner before the one-year anniversary of the project's start date, and a legible copy of said schedule shall be kept posted in a conspicuous place at the site of the Work.

D. CONTRACTOR and subcontractors shall submit a copy of weekly payroll records to the AWARDING AUTHORITY and the AWARDING AUTHORITY shall retain the records for a minimum of three years."

B. OTHER REGULATORY REQUIREMENTS:

1. Working Hours

No laborer, workman, mechanic, foreman, or inspector, working within the Commonwealth, in the employ of the CONTRACTOR, subcontractor, or other person doing or contracting to do the whole or a part of the work contemplated by this contract, shall be required or permitted to work more than eight hours in any one day or more than forty-eight hours in any one week, or more than six days in any one week, except in cases of emergency or required for this Project.

2. Commonwealth of Massachusetts Supplemental Equal Employment Opportunity, Non-Discrimination and Affirmative Action Program.

The Contractor shall abide by the Commonwealth of Massachusetts Supplemental Equal Employment Opportunity, Non-Discrimination and Affirmative Action Program, which is attached in its entirety on pages 00830-C.

3. MassDEP Community Sound Level Criteria

The Community Sound Level Criteria as established by the Commonwealth of Massachusetts' Department of Environmental Protection (MassDEP) must be conformed to prior to the AWARDING AUTHORITY's acceptance of the structure. The following sound level criteria must be met at the construction site:

A. The increase in the broadband noise level shall not be in excess of ten (10) dB(A) above ambient at the station boundary. The ambient level is defined as the A-weighted noise level that is exceeded ninety (90) percent of the time measured during the period in question.

B. The primary noise source(s) shall not produce a puretone condition. Puretone is any given octave band center frequency that exceeds the two adjacent center frequencies by three (3) or more decibels.

4. OSHA 10 Hour Certification Requirements

All employees of the Contractor who work at the jobsite must have received OSHA 10 Hour safety training, and have proof, at the jobsite, of being certified by OSHA as having received the training. The Contractor must provide written proof (copy of OSHA card each employee is required to carry is preferred) of this certification for every employee with submission of the first certified payroll report for each employee.

END OF DOCUMENT

SECTION 00830

ATTACHMENT A

MINIMUM WAGE RATES

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF LABOR AND WORKFORCE DEVELOPMENT
DEPARTMENT OF LABOR STANDARDS

Prevailing Wage Rates

CHARLES D. BAKER
Governor

KARYN E. POLITO
Lt. Governor

As determined by the Director under the provisions of the Massachusetts General Laws, Chapter 149, Sections 26 to 27H

ROSALIN ACOSTA
Secretary

WILLIAM D MCKINNEY
Director

Awarding Authority: Town of Orleans

Contract Number: 2019-02 **City/Town:** ORLEANS

Description of Work: Constructing approx. 32,200 lf of 8- to 18-inch gravity sewer, approx. 11,400 lf of 6- and 8-inch, approx. 2,100 lf of 2-inch low-pressure sewer and 3 Submersible Pumping Stations.

Job Location: Downtown Area

Information about Prevailing Wage Schedules for Awarding Authorities and Contractors

- This wage schedule applies only to the specific project referenced at the top of this page and uniquely identified by the "Wage Request Number" on all pages of this schedule.
- An Awarding Authority must request an updated wage schedule from the Department of Labor Standards ("DLS") if it has not opened bids or selected a contractor within 90 days of the date of issuance of the wage schedule. For CM AT RISK projects (bid pursuant to G.L. c.149A), the earlier of: (a) the execution date of the GMP Amendment, or (b) the bid for the first construction scope of work must be within 90-days of the wage schedule issuance date.
- The wage schedule shall be incorporated in any advertisement or call for bids for the project as required by M.G.L. c. 149, § 27. The wage schedule shall be made a part of the contract awarded for the project. The wage schedule must be posted in a conspicuous place at the work site for the life of the project in accordance with M.G.L. c. 149 § 27. The wages listed on the wage schedule must be paid to employees performing construction work on the project whether they are employed by the prime contractor, a filed sub-bidder, or any sub-contractor.
- All apprentices working on the project are required to be registered with the Massachusetts Department of Labor Standards, Division of Apprentice Standards (DLS/DAS). Apprentice must keep his/her apprentice identification card on his/her person during all work hours on the project. An apprentice registered with DAS may be paid the lower apprentice wage rate at the applicable step as provided on the prevailing wage schedule. **Any apprentice not registered with DLS/DAS regardless of whether or not they are registered with any other federal, state, local, or private agency must be paid the journeyworker's rate for the trade.**
- The wage rates will remain in effect for the duration of the project, except in the case of multi-year public construction projects. For construction projects lasting longer than one year, awarding authorities must request an updated wage schedule. Awarding authorities are required to request these updates no later than two weeks before the anniversary of the date the contract was executed by the awarding authority and the general contractor. For multi-year CM AT RISK projects, awarding authority must request an annual update no later than two weeks before the anniversary date, determined as the earlier of: (a) the execution date of the GMP Amendment, or (b) the execution date of the first amendment to permit procurement of construction services. Contractors are required to obtain the wage schedules from awarding authorities, and to pay no less than these rates to covered workers. The annual update requirement is not applicable to 27F "rental of equipment" contracts.
- Every contractor or subcontractor which performs construction work on the project is required to submit weekly payroll reports and a Statement of Compliance directly to the awarding authority by mail or email and keep them on file for three years. Each weekly payroll report must contain: the employee's name, address, occupational classification, hours worked, and wages paid. Do not submit weekly payroll reports to DLS. A sample of a payroll reporting form may be obtained at http://www.mass.gov/dols/pw.
- Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at (617) 626-6953.
- Employees not receiving the prevailing wage rate set forth on the wage schedule may report the violation to the Fair Labor Division of the office of the Attorney General at (617) 727-3465.
- Failure of a contractor or subcontractor to pay the prevailing wage rates listed on the wage schedule to all employees who perform construction work on the project is a violation of the law and subjects the contractor or subcontractor to civil and

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Construction						
(2 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2019	$34.25	$12.41	$13.72	$0.00	$60.38
	06/01/2020	$35.15	$12.41	$13.72	$0.00	$61.28
	08/01/2020	$35.15	$12.91	$13.72	$0.00	$61.78
	12/01/2020	$35.15	$12.91	$14.82	$0.00	$62.88
	06/01/2021	$35.95	$12.91	$14.82	$0.00	$63.68
	08/01/2021	$35.95	$13.41	$14.82	$0.00	$64.18
	12/01/2021	$35.95	$13.41	$16.01	$0.00	$65.37
(3 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2019	$34.32	$12.41	$13.72	$0.00	$60.45
	06/01/2020	$35.22	$12.41	$13.72	$0.00	$61.35
	08/01/2020	$35.22	$12.91	$13.72	$0.00	$61.85
	12/01/2020	$35.22	$12.91	$14.82	$0.00	$62.95
	06/01/2021	$36.02	$12.91	$14.82	$0.00	$63.75
	08/01/2021	$36.02	$13.41	$14.82	$0.00	$64.25
	12/01/2021	$36.02	$13.41	$16.01	$0.00	$65.44
(4 & 5 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2019	$34.44	$12.41	$13.72	$0.00	$60.57
	06/01/2020	$35.34	$12.41	$13.72	$0.00	$61.47
	08/01/2020	$35.34	$12.91	$13.72	$0.00	$61.97
	12/01/2020	$35.34	$12.91	$14.82	$0.00	$63.07
	06/01/2021	$36.14	$12.91	$14.82	$0.00	$63.87
	08/01/2021	$36.14	$13.41	$14.82	$0.00	$64.37
	12/01/2021	$36.14	$13.41	$16.01	$0.00	$65.56
ADS/SUBMERSIBLE PILOT *PILE DRIVER LOCAL 56 (ZONE 2)*	08/01/2019	$102.78	$9.90	$21.15	$0.00	$133.83
For apprentice rates see "Apprentice- PILE DRIVER"						
AIR TRACK OPERATOR *LABORERS - ZONE 2*	12/01/2019	$34.81	$8.10	$15.38	$0.00	$58.29
	06/01/2020	$35.70	$8.10	$15.38	$0.00	$59.18
	12/01/2020	$36.59	$8.10	$15.38	$0.00	$60.07
	06/01/2021	$37.51	$8.10	$15.38	$0.00	$60.99
	12/01/2021	$38.42	$8.10	$15.38	$0.00	$61.90
For apprentice rates see "Apprentice- LABORER"						
ASBESTOS REMOVER - PIPE / MECH. EQUIPT. *HEAT & FROST INSULATORS LOCAL 6 (BOSTON)*	12/01/2019	$37.00	$12.50	$8.85	$0.00	$58.35
	06/01/2020	$38.00	$12.50	$8.85	$0.00	$59.35
	12/01/2020	$39.00	$12.50	$8.85	$0.00	$60.35
ASPHALT RAKER *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.73	$12.50	$15.70	$0.00	$76.93
	06/01/2020	$49.83	$12.50	$15.70	$0.00	$78.03
	12/01/2020	$50.98	$12.50	$15.70	$0.00	$79.18
	06/01/2021	$52.08	$12.50	$15.70	$0.00	$80.28
	12/01/2021	$53.23	$12.50	$15.70	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
BACKHOE/FRONT-END LOADER *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.73	$12.50	$15.70	$0.00	$76.93
	06/01/2020	$49.83	$12.50	$15.70	$0.00	$78.03
	12/01/2020	$50.98	$12.50	$15.70	$0.00	$79.18
	06/01/2021	$52.08	$12.50	$15.70	$0.00	$80.28
	12/01/2021	$53.23	$12.50	$15.70	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BARCO-TYPE JUMPING TAMPER *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
BLOCK PAVER, RAMMER / CURB SETTER *LABORERS - ZONE 2*	12/01/2019	$34.81	$8.10	$15.38	$0.00	$58.29
	06/01/2020	$35.70	$8.10	$15.38	$0.00	$59.18
	12/01/2020	$36.59	$8.10	$15.38	$0.00	$60.07
	06/01/2021	$37.51	$8.10	$15.38	$0.00	$60.99
	12/01/2021	$38.42	$8.10	$15.38	$0.00	$61.90
For apprentice rates see "Apprentice- LABORER"						
BOILER MAKER *BOILERMAKERS LOCAL 29*	01/01/2020	$46.10	$7.07	$17.98	$0.00	$71.15

Apprentice - *BOILERMAKER - Local 29*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	65	$29.97	$7.07	$11.69	$0.00	$48.73
2	65	$29.97	$7.07	$11.69	$0.00	$48.73
3	70	$32.27	$7.07	$12.59	$0.00	$51.93
4	75	$34.58	$7.07	$13.49	$0.00	$55.14
5	80	$36.88	$7.07	$14.38	$0.00	$58.33
6	85	$39.19	$7.07	$15.29	$0.00	$61.55
7	90	$41.49	$7.07	$16.18	$0.00	$64.74
8	95	$43.80	$7.07	$17.09	$0.00	$67.96

Notes:

Apprentice to Journeyworker Ratio:1:4

BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING) *BRICKLAYERS LOCAL 3 (NEW BEDFORD)*	08/01/2019	$54.40	$10.75	$21.30	$0.00	$86.45
	02/01/2020	$54.40	$10.75	$21.94	$0.00	$87.09
	08/01/2020	$55.75	$10.75	$22.09	$0.00	$88.59
	02/01/2021	$56.39	$10.75	$22.09	$0.00	$89.23
	08/01/2021	$57.79	$10.75	$22.25	$0.00	$90.79
	02/01/2022	$58.38	$10.75	$22.25	$0.00	$91.38

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *BRICK/PLASTER/CEMENT MASON - Local 3 New Bedford*

Effective Date - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$27.20	$10.75	$21.30	$0.00	$59.25
2	60	$32.64	$10.75	$21.30	$0.00	$64.69
3	70	$38.08	$10.75	$21.30	$0.00	$70.13
4	80	$43.52	$10.75	$21.30	$0.00	$75.57
5	90	$48.96	$10.75	$21.30	$0.00	$81.01

Effective Date - 02/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$27.20	$10.75	$21.94	$0.00	$59.89
2	60	$32.64	$10.75	$21.94	$0.00	$65.33
3	70	$38.08	$10.75	$21.94	$0.00	$70.77
4	80	$43.52	$10.75	$21.94	$0.00	$76.21
5	90	$48.96	$10.75	$21.94	$0.00	$81.65

Notes:

Apprentice to Journeyworker Ratio:1:5

BULLDOZER/GRADER/SCRAPER *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
CAISSON & UNDERPINNING BOTTOM MAN *LABORERS - FOUNDATION AND MARINE*	12/01/2019	$40.25	$8.10	$16.80	$0.00	$65.15
	06/01/2020	$41.24	$8.10	$16.80	$0.00	$66.14
	12/01/2020	$42.22	$8.10	$16.80	$0.00	$67.12
	06/01/2021	$43.24	$8.10	$16.80	$0.00	$68.14
	12/01/2021	$44.25	$8.10	$16.80	$0.00	$69.15
For apprentice rates see "Apprentice- LABORER"						
CAISSON & UNDERPINNING LABORER *LABORERS - FOUNDATION AND MARINE*	12/01/2019	$39.10	$8.10	$16.80	$0.00	$64.00
	06/01/2020	$40.09	$8.10	$16.80	$0.00	$64.99
	12/01/2020	$41.07	$8.10	$16.80	$0.00	$65.97
	06/01/2021	$42.09	$8.10	$16.80	$0.00	$66.99
	12/01/2021	$43.10	$8.10	$16.80	$0.00	$68.00
For apprentice rates see "Apprentice- LABORER"						
CAISSON & UNDERPINNING TOP MAN *LABORERS - FOUNDATION AND MARINE*	12/01/2019	$39.10	$8.10	$16.80	$0.00	$64.00
	06/01/2020	$40.09	$8.10	$16.80	$0.00	$64.99
	12/01/2020	$41.07	$8.10	$16.80	$0.00	$65.97
	06/01/2021	$42.09	$8.10	$16.80	$0.00	$66.99
	12/01/2021	$43.10	$8.10	$16.80	$0.00	$68.00
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CARBIDE CORE DRILL OPERATOR *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
CARPENTER *CARPENTERS -ZONE 2 (Eastern Massachusetts)*	09/01/2019	$41.90	$9.40	$18.95	$0.00	$70.25
	03/01/2020	$42.50	$9.40	$18.95	$0.00	$70.85
	09/01/2020	$43.15	$9.40	$18.95	$0.00	$71.50
	03/01/2021	$43.75	$9.40	$18.95	$0.00	$72.10
	09/01/2021	$44.40	$9.40	$18.95	$0.00	$72.75
	03/01/2022	$45.00	$9.40	$18.95	$0.00	$73.35
	09/01/2022	$45.65	$9.40	$18.95	$0.00	$74.00
	03/01/2023	$46.25	$9.40	$18.95	$0.00	$74.60

Apprentice - *CARPENTER - Zone 2 Eastern MA*

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.95	$9.40	$1.73	$0.00	$32.08
2	60	$25.14	$9.40	$1.73	$0.00	$36.27
3	70	$29.33	$9.40	$13.76	$0.00	$52.49
4	75	$31.43	$9.40	$13.76	$0.00	$54.59
5	80	$33.52	$9.40	$15.49	$0.00	$58.41
6	80	$33.52	$9.40	$15.49	$0.00	$58.41
7	90	$37.71	$9.40	$17.22	$0.00	$64.33
8	90	$37.71	$9.40	$17.22	$0.00	$64.33

Effective Date - 03/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.25	$9.40	$1.73	$0.00	$32.38
2	60	$25.50	$9.40	$1.73	$0.00	$36.63
3	70	$29.75	$9.40	$13.76	$0.00	$52.91
4	75	$31.88	$9.40	$13.76	$0.00	$55.04
5	80	$34.00	$9.40	$15.49	$0.00	$58.89
6	80	$34.00	$9.40	$15.49	$0.00	$58.89
7	90	$38.25	$9.40	$17.22	$0.00	$64.87
8	90	$38.25	$9.40	$17.22	$0.00	$64.87

Notes:

% Indentured After 10/1/17; 45/45/55/55/70/70/80/80
Step 1&2 $29.99/ 3&4 $35.85/ 5&6 $54.22/ 7&8 $60.14

Apprentice to Journeyworker Ratio:1:5

CARPENTER WOOD FRAME *CARPENTERS -ZONE 2 (Wood Frame)*	10/01/2019	$27.95	$7.07	$7.86	$0.00	$42.88
All Aspects of New Wood Frame Work						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *CARPENTER (Wood Frame) - Zone 2*

Effective Date - 10/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$16.77	$7.07	$0.00	$0.00	$23.84
2	60	$16.77	$7.07	$0.00	$0.00	$23.84
3	65	$18.17	$7.07	$7.86	$0.00	$33.10
4	70	$19.57	$7.07	$7.86	$0.00	$34.50
5	75	$20.96	$7.07	$7.86	$0.00	$35.89
6	80	$22.36	$7.07	$7.86	$0.00	$37.29
7	85	$23.76	$7.07	$7.86	$0.00	$38.69
8	90	$25.16	$7.07	$7.86	$0.00	$40.09

Notes:

% Indentured After 10/1/17; 45/45/55/55/70/70/80/80
Step 1&2 $19.65/ 3&4 $27.19/ 5&6 $34.50/ 7&8 $37.29

Apprentice to Journeyworker Ratio:1:5

CEMENT MASONRY/PLASTERING *BRICKLAYERS LOCAL 3 (NEW BEDFORD)*	01/01/2020	$49.07	$12.75	$22.41	$0.62	$84.85

Apprentice - *CEMENT MASONRY/PLASTERING - Eastern Mass (New Bedford)*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.54	$12.75	$15.41	$0.00	$52.70
2	60	$29.44	$12.75	$17.41	$0.62	$60.22
3	65	$31.90	$12.75	$18.41	$0.62	$63.68
4	70	$34.35	$12.75	$19.41	$0.62	$67.13
5	75	$36.80	$12.75	$20.41	$0.62	$70.58
6	80	$39.26	$12.75	$21.41	$0.62	$74.04
7	90	$44.16	$12.75	$22.41	$0.62	$79.94

Notes:

Steps 3,4 are 500 hrs. All other steps are 1,000 hrs.

Apprentice to Journeyworker Ratio:1:3

CHAIN SAW OPERATOR *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$49.73	$12.50	$15.70	$0.00	$77.93
	06/01/2020	$50.83	$12.50	$15.70	$0.00	$79.03
	12/01/2020	$51.98	$12.50	$15.70	$0.00	$80.18
	06/01/2021	$53.08	$12.50	$15.70	$0.00	$81.28
	12/01/2021	$54.23	$12.50	$15.70	$0.00	$82.43

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
COMPRESSOR OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$32.47	$12.50	$15.70	$0.00	$60.67
	06/01/2020	$33.22	$12.50	$15.70	$0.00	$61.42
	12/01/2020	$34.00	$12.50	$15.70	$0.00	$62.20
	06/01/2021	$34.75	$12.50	$15.70	$0.00	$62.95
	12/01/2021	$35.54	$12.50	$15.70	$0.00	$63.74
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DELEADER (BRIDGE) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2020	$50.96	$8.20	$22.10	$0.00	$81.26
	07/01/2020	$52.06	$8.20	$22.10	$0.00	$82.36
	01/01/2021	$53.16	$8.20	$22.10	$0.00	$83.46

Apprentice - *PAINTER Local 35 - BRIDGES/TANKS*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.48	$8.20	$0.00	$0.00	$33.68
2	55	$28.03	$8.20	$5.94	$0.00	$42.17
3	60	$30.58	$8.20	$6.48	$0.00	$45.26
4	65	$33.12	$8.20	$7.02	$0.00	$48.34
5	70	$35.67	$8.20	$18.86	$0.00	$62.73
6	75	$38.22	$8.20	$19.40	$0.00	$65.82
7	80	$40.77	$8.20	$19.94	$0.00	$68.91
8	90	$45.86	$8.20	$21.02	$0.00	$75.08

Effective Date - 07/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.03	$8.20	$0.00	$0.00	$34.23
2	55	$28.63	$8.20	$5.94	$0.00	$42.77
3	60	$31.24	$8.20	$6.48	$0.00	$45.92
4	65	$33.84	$8.20	$7.02	$0.00	$49.06
5	70	$36.44	$8.20	$18.86	$0.00	$63.50
6	75	$39.05	$8.20	$19.40	$0.00	$66.65
7	80	$41.65	$8.20	$19.94	$0.00	$69.79
8	90	$46.85	$8.20	$21.02	$0.00	$76.07

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

DEMO: ADZEMAN *LABORERS - ZONE 2*	12/01/2019	$39.30	$8.10	$16.60	$0.00	$64.00
For apprentice rates see "Apprentice- LABORER"						
DEMO: BACKHOE/LOADER/HAMMER OPERATOR *LABORERS - ZONE 2*	12/01/2019	$40.30	$8.10	$16.60	$0.00	$65.00
For apprentice rates see "Apprentice- LABORER"						
DEMO: BURNERS *LABORERS - ZONE 2*	12/01/2019	$40.05	$8.10	$16.60	$0.00	$64.75
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DEMO: CONCRETE CUTTER/SAWYER *LABORERS - ZONE 2*	12/01/2019	$40.30	$8.10	$16.60	$0.00	$65.00
For apprentice rates see "Apprentice- LABORER"						
DEMO: JACKHAMMER OPERATOR *LABORERS - ZONE 2*	12/01/2019	$40.05	$8.10	$16.60	$0.00	$64.75
For apprentice rates see "Apprentice- LABORER"						
DEMO: WRECKING LABORER *LABORERS - ZONE 2*	12/01/2019	$39.30	$8.10	$16.60	$0.00	$64.00
For apprentice rates see "Apprentice- LABORER"						
DIRECTIONAL DRILL MACHINE OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DIVER *PILE DRIVER LOCAL 56 (ZONE 2)*	08/01/2019	$68.52	$9.90	$21.15	$0.00	$99.57
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER TENDER *PILE DRIVER LOCAL 56 (ZONE 2)*	08/01/2019	$48.94	$9.90	$21.15	$0.00	$79.99
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER TENDER (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 2)*	08/01/2019	$73.41	$9.90	$21.15	$0.00	$104.46
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER/SLURRY (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 2)*	08/01/2019	$102.78	$9.90	$21.15	$0.00	$133.83
For apprentice rates see "Apprentice- PILE DRIVER"						
ELECTRICIAN *ELECTRICIANS LOCAL 223*	09/01/2019	$42.26	$10.15	$13.54	$0.00	$65.95
	03/01/2020	$42.87	$10.40	$13.94	$0.00	$67.21

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ELECTRICIAN - Local 223*

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$16.90	$10.15	$0.51	$0.00	$27.56
2	42	$17.75	$10.15	$0.53	$0.00	$28.43
3	45	$19.02	$10.15	$0.57	$0.00	$29.74
4	48	$20.28	$10.15	$4.93	$0.00	$35.36
5	50	$21.13	$10.15	$4.97	$0.00	$36.25
6	55	$23.24	$10.15	$5.33	$0.00	$38.72
7	60	$25.36	$10.15	$5.64	$0.00	$41.15
8	65	$27.47	$10.15	$5.94	$0.00	$43.56
9	70	$29.58	$10.15	$6.25	$0.00	$45.98
10	75	$31.70	$10.15	$6.50	$0.00	$48.35

Effective Date - 03/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$17.15	$10.40	$0.51	$0.00	$28.06
2	42	$18.01	$10.40	$0.54	$0.00	$28.95
3	45	$19.29	$10.40	$0.58	$0.00	$30.27
4	48	$20.58	$10.40	$5.22	$0.00	$36.20
5	50	$21.44	$10.40	$5.26	$0.00	$37.10
6	55	$23.58	$10.40	$5.63	$0.00	$39.61
7	60	$25.72	$10.40	$5.93	$0.00	$42.05
8	65	$27.87	$10.40	$6.25	$0.00	$44.52
9	70	$30.01	$10.40	$6.54	$0.00	$46.95
10	75	$32.15	$10.40	$6.79	$0.00	$49.34

Notes:

Steps are 750 hours

Apprentice to Journeyworker Ratio:2:3***

ELEVATOR CONSTRUCTOR *ELEVATOR CONSTRUCTORS LOCAL 4*	01/01/2020	$61.42	$15.73	$18.41	$0.00	$95.56
	01/01/2021	$63.47	$15.88	$19.31	$0.00	$98.66
	01/01/2022	$65.62	$16.03	$20.21	$0.00	$101.86

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ELEVATOR CONSTRUCTOR - Local 4*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$30.71	$15.73	$0.00	$0.00	$46.44
2	55	$33.78	$15.73	$18.41	$0.00	$67.92
3	65	$39.92	$15.73	$18.41	$0.00	$74.06
4	70	$42.99	$15.73	$18.41	$0.00	$77.13
5	80	$49.14	$15.73	$18.41	$0.00	$83.28

Effective Date - 01/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$31.74	$15.88	$0.00	$0.00	$47.62
2	55	$34.91	$15.88	$19.31	$0.00	$70.10
3	65	$41.26	$15.88	$19.31	$0.00	$76.45
4	70	$44.43	$15.88	$19.31	$0.00	$79.62
5	80	$50.78	$15.88	$19.31	$0.00	$85.97

Notes:
Steps 1-2 are 6 mos.; Steps 3-5 are 1 year

Apprentice to Journeyworker Ratio:1:1

ELEVATOR CONSTRUCTOR HELPER *ELEVATOR CONSTRUCTORS LOCAL 4*	01/01/2020	$42.99	$15.73	$18.41	$0.00	$77.13
	01/01/2021	$44.43	$15.88	$19.31	$0.00	$79.62
	01/01/2022	$45.93	$16.03	$20.21	$0.00	$82.17
For apprentice rates see "Apprentice - ELEVATOR CONSTRUCTOR"						
FENCE & GUARD RAIL ERECTOR *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	11/01/2019	$44.18	$12.00	$15.60	$0.00	$71.78
	05/01/2020	$45.33	$12.00	$15.60	$0.00	$72.93
	11/01/2020	$46.33	$12.00	$15.60	$0.00	$73.93
	05/01/2021	$47.48	$12.00	$15.60	$0.00	$75.08
	11/01/2021	$48.48	$12.00	$15.60	$0.00	$76.08
	05/01/2022	$49.63	$12.00	$15.60	$0.00	$77.23
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	11/01/2019	$45.68	$12.00	$15.60	$0.00	$73.28
	05/01/2020	$46.83	$12.00	$15.60	$0.00	$74.43
	11/01/2020	$47.84	$12.00	$15.60	$0.00	$75.44
	05/01/2021	$49.00	$12.00	$15.60	$0.00	$76.60
	11/01/2021	$50.01	$12.00	$15.60	$0.00	$77.61
	05/01/2022	$51.17	$12.00	$15.60	$0.00	$78.77
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	11/01/2019	$22.57	$12.00	$15.60	$0.00	$50.17
	05/01/2020	$23.24	$12.00	$15.60	$0.00	$50.84
	11/01/2020	$23.83	$12.00	$15.60	$0.00	$51.43
	05/01/2021	$24.51	$12.00	$15.60	$0.00	$52.11
	11/01/2021	$25.11	$12.00	$15.60	$0.00	$52.71
	05/01/2022	$25.78	$12.00	$15.60	$0.00	$53.38
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIRE ALARM INSTALLER *ELECTRICIANS LOCAL 223*	09/01/2019	$42.26	$10.15	$13.54	$0.00	$65.95
	03/01/2020	$42.87	$10.40	$13.94	$0.00	$67.21
For apprentice rates see "Apprentice- ELECTRICIAN"						
FIRE ALARM REPAIR / MAINTENANCE / COMMISSIONING*ELECTRICIANS LOCAL 223*	09/01/2019	$35.78	$10.15	$11.45	$0.00	$57.38
	03/01/2020	$36.27	$10.40	$11.78	$0.00	$58.45
For apprentice rates see "Apprentice- TELECOMMUNICATIONS TECHNICIAN"						
FIREMAN (ASST. ENGINEER) *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$39.89	$12.50	$15.70	$0.00	$68.09
	06/01/2020	$40.80	$12.50	$15.70	$0.00	$69.00
	12/01/2020	$41.75	$12.50	$15.70	$0.00	$69.95
	06/01/2021	$42.66	$12.50	$15.70	$0.00	$70.86
	12/01/2021	$43.61	$12.50	$15.70	$0.00	$71.81
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FLAGGER & SIGNALER *LABORERS - ZONE 2*	12/01/2019	$23.50	$8.10	$15.38	$0.00	$46.98
	06/01/2020	$23.50	$8.10	$15.38	$0.00	$46.98
	12/01/2020	$24.50	$8.10	$15.38	$0.00	$47.98
	06/01/2021	$24.50	$8.10	$15.38	$0.00	$47.98
	12/01/2021	$24.50	$8.10	$15.38	$0.00	$47.98
For apprentice rates see "Apprentice- LABORER"						
FLOORCOVERER *FLOORCOVERERS LOCAL 2168 ZONE II*	09/01/2019	$43.94	$9.40	$19.25	$0.00	$72.59
	03/01/2020	$44.74	$9.40	$19.25	$0.00	$73.39
	09/01/2020	$45.54	$9.40	$19.25	$0.00	$74.19
	03/01/2021	$46.34	$9.40	$19.25	$0.00	$74.99
	09/01/2021	$47.14	$9.40	$19.25	$0.00	$75.79
	03/01/2022	$47.94	$9.40	$19.25	$0.00	$76.59

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *FLOORCOVERER - Local 2168 Zone II*

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.97	$9.40	$1.79	$0.00	$33.16
2	55	$24.17	$9.40	$1.79	$0.00	$35.36
3	60	$26.36	$9.40	$13.88	$0.00	$49.64
4	65	$28.56	$9.40	$13.88	$0.00	$51.84
5	70	$30.76	$9.40	$15.67	$0.00	$55.83
6	75	$32.96	$9.40	$15.67	$0.00	$58.03
7	80	$35.15	$9.40	$17.46	$0.00	$62.01
8	85	$37.35	$9.40	$17.46	$0.00	$64.21

Effective Date - 03/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$22.37	$9.40	$1.79	$0.00	$33.56
2	55	$24.61	$9.40	$1.79	$0.00	$35.80
3	60	$26.84	$9.40	$13.88	$0.00	$50.12
4	65	$29.08	$9.40	$13.88	$0.00	$52.36
5	70	$31.32	$9.40	$15.67	$0.00	$56.39
6	75	$33.56	$9.40	$15.67	$0.00	$58.63
7	80	$35.79	$9.40	$17.46	$0.00	$62.65
8	85	$38.03	$9.40	$17.46	$0.00	$64.89

Notes: Steps are 750 hrs.
% After 09/1/17; 45/45/55/55/70/70/80/80 (1500hr Steps)
Step 1&2 $30.96/ 3&4 $37.09/ 5&6 $55.83/ 7&8 $62.01

Apprentice to Journeyworker Ratio:1:1

FORK LIFT/CHERRY PICKER *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.73	$12.50	$15.70	$0.00	$76.93
	06/01/2020	$49.83	$12.50	$15.70	$0.00	$78.03
	12/01/2020	$50.98	$12.50	$15.70	$0.00	$79.18
	06/01/2021	$52.08	$12.50	$15.70	$0.00	$80.28
	12/01/2021	$53.23	$12.50	$15.70	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GENERATOR/LIGHTING PLANT/HEATERS *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$32.47	$12.50	$15.70	$0.00	$60.67
	06/01/2020	$33.22	$12.50	$15.70	$0.00	$61.42
	12/01/2020	$34.00	$12.50	$15.70	$0.00	$62.20
	06/01/2021	$34.75	$12.50	$15.70	$0.00	$62.95
	12/01/2021	$35.54	$12.50	$15.70	$0.00	$63.74
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS) *GLAZIERS LOCAL 1333*	06/01/2019	$38.18	$10.60	$9.90	$0.00	$58.68
	06/01/2020	$39.18	$10.80	$10.45	$0.00	$60.43

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *GLAZIER - Local 1333*

Effective Date - 06/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.09	$10.60	$1.80	$0.00	$31.49
2	56	$21.48	$10.60	$1.80	$0.00	$33.88
3	63	$23.86	$10.60	$2.40	$0.00	$36.86
4	69	$26.25	$10.60	$2.40	$0.00	$39.25
5	75	$28.64	$10.60	$2.90	$0.00	$42.14
6	81	$31.02	$10.60	$2.90	$0.00	$44.52
7	88	$33.41	$10.60	$9.90	$0.00	$53.91
8	94	$35.79	$10.60	$9.90	$0.00	$56.29

Effective Date - 06/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.59	$10.80	$1.80	$0.00	$32.19
2	56	$22.04	$10.80	$1.80	$0.00	$34.64
3	63	$24.49	$10.80	$2.45	$0.00	$37.74
4	69	$26.94	$10.80	$2.45	$0.00	$40.19
5	75	$29.39	$10.80	$3.15	$0.00	$43.34
6	81	$31.83	$10.80	$3.15	$0.00	$45.78
7	88	$34.28	$10.80	$10.45	$0.00	$55.53
8	94	$36.73	$10.80	$10.45	$0.00	$57.98

Notes:

Apprentice to Journeyworker Ratio:1:3

HOISTING ENGINEER/CRANES/GRADALLS *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.73	$12.50	$15.70	$0.00	$76.93
	06/01/2020	$49.83	$12.50	$15.70	$0.00	$78.03
	12/01/2020	$50.98	$12.50	$15.70	$0.00	$79.18
	06/01/2021	$52.08	$12.50	$15.70	$0.00	$80.28
	12/01/2021	$53.23	$12.50	$15.70	$0.00	$81.43

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *OPERATING ENGINEERS - Local 4*

Effective Date - 12/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$26.80	$12.50	$0.00	$0.00	$39.30
2	60	$29.24	$12.50	$15.70	$0.00	$57.44
3	65	$31.67	$12.50	$15.70	$0.00	$59.87
4	70	$34.11	$12.50	$15.70	$0.00	$62.31
5	75	$36.55	$12.50	$15.70	$0.00	$64.75
6	80	$38.98	$12.50	$15.70	$0.00	$67.18
7	85	$41.42	$12.50	$15.70	$0.00	$69.62
8	90	$43.86	$12.50	$15.70	$0.00	$72.06

Effective Date - 06/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$27.41	$12.50	$0.00	$0.00	$39.91
2	60	$29.90	$12.50	$15.70	$0.00	$58.10
3	65	$32.39	$12.50	$15.70	$0.00	$60.59
4	70	$34.88	$12.50	$15.70	$0.00	$63.08
5	75	$37.37	$12.50	$15.70	$0.00	$65.57
6	80	$39.86	$12.50	$15.70	$0.00	$68.06
7	85	$42.36	$12.50	$15.70	$0.00	$70.56
8	90	$44.85	$12.50	$15.70	$0.00	$73.05

Notes:

Apprentice to Journeyworker Ratio:1:6

HVAC (DUCTWORK) *SHEETMETAL WORKERS LOCAL 17 - B*	04/01/2019	$34.71	$13.20	$16.55	$1.93	$66.39
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (ELECTRICAL CONTROLS) *ELECTRICIANS LOCAL 223*	09/01/2019	$42.26	$10.15	$13.54	$0.00	$65.95
	03/01/2020	$42.87	$10.40	$13.94	$0.00	$67.21
For apprentice rates see "Apprentice- ELECTRICIAN"						
HVAC (TESTING AND BALANCING - AIR) *SHEETMETAL WORKERS LOCAL 17 - B*	04/01/2019	$34.71	$13.20	$16.55	$1.93	$66.39
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (TESTING AND BALANCING -WATER) *PLUMBERS & PIPEFITTERS LOCAL 51*	09/01/2018	$42.04	$10.00	$18.20	$0.00	$70.24
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HVAC MECHANIC *PLUMBERS & PIPEFITTERS LOCAL 51*	09/01/2018	$42.04	$10.00	$18.20	$0.00	$70.24
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
HYDRAULIC DRILLS *LABORERS - ZONE 2*	12/01/2019	$34.81	$8.10	$15.38	$0.00	$58.29
	06/01/2020	$35.70	$8.10	$15.38	$0.00	$59.18
	12/01/2020	$36.59	$8.10	$15.38	$0.00	$60.07
	06/01/2021	$37.51	$8.10	$15.38	$0.00	$60.99
	12/01/2021	$38.42	$8.10	$15.38	$0.00	$61.90
For apprentice rates see "Apprentice- LABORER"						
INSULATOR (PIPES & TANKS) *HEAT & FROST INSULATORS LOCAL 6 (BOSTON)*	09/01/2019	$48.44	$12.80	$16.40	$0.00	$77.64

Apprentice - *ASBESTOS INSULATOR (Pipes & Tanks) - Local 6 Boston*

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.22	$12.80	$11.90	$0.00	$48.92
2	60	$29.06	$12.80	$12.80	$0.00	$54.66
3	70	$33.91	$12.80	$13.70	$0.00	$60.41
4	80	$38.75	$12.80	$14.60	$0.00	$66.15

Notes:
Steps are 1 year

Apprentice to Journeyworker Ratio:1:4

IRONWORKER/WELDER *IRONWORKERS LOCAL 37*	09/16/2019	$39.71	$7.70	$17.10	$0.00	$64.51
	03/16/2020	$40.61	$7.70	$17.10	$0.00	$65.41
	09/16/2020	$41.51	$7.70	$17.10	$0.00	$66.31
	03/16/2021	$42.46	$7.70	$17.10	$0.00	$67.26

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *IRONWORKER - Local 37*

Effective Date - 09/16/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	70	$27.80	$7.70	$17.10	$0.00	$52.60
2	75	$29.78	$7.70	$17.10	$0.00	$54.58
3	80	$31.77	$7.70	$17.10	$0.00	$56.57
4	85	$33.75	$7.70	$17.10	$0.00	$58.55
5	90	$35.74	$7.70	$17.10	$0.00	$60.54
6	95	$37.72	$7.70	$17.10	$0.00	$62.52

Effective Date - 03/16/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	70	$28.43	$7.70	$17.10	$0.00	$53.23
2	75	$30.46	$7.70	$17.10	$0.00	$55.26
3	80	$32.49	$7.70	$17.10	$0.00	$57.29
4	85	$34.52	$7.70	$17.10	$0.00	$59.32
5	90	$36.55	$7.70	$17.10	$0.00	$61.35
6	95	$38.58	$7.70	$17.10	$0.00	$63.38

Notes:

Apprentice to Journeyworker Ratio:1:4

JACKHAMMER & PAVING BREAKER OPERATOR *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
LABORER *LABORERS - ZONE 2*	12/01/2019	$34.06	$8.10	$15.38	$0.00	$57.54
	06/01/2020	$34.95	$8.10	$15.38	$0.00	$58.43
	12/01/2020	$35.84	$8.10	$15.38	$0.00	$59.32
	06/01/2021	$36.76	$8.10	$15.38	$0.00	$60.24
	12/01/2021	$37.67	$8.10	$15.38	$0.00	$61.15

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *LABORER - Zone 2*

Effective Date - 12/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$20.44	$8.10	$15.38	$0.00	$43.92
2	70	$23.84	$8.10	$15.38	$0.00	$47.32
3	80	$27.25	$8.10	$15.38	$0.00	$50.73
4	90	$30.65	$8.10	$15.38	$0.00	$54.13

Effective Date - 06/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$20.97	$8.10	$15.38	$0.00	$44.45
2	70	$24.47	$8.10	$15.38	$0.00	$47.95
3	80	$27.96	$8.10	$15.38	$0.00	$51.44
4	90	$31.46	$8.10	$15.38	$0.00	$54.94

Notes:

Apprentice to Journeyworker Ratio:1:5

LABORER: CARPENTER TENDER *LABORERS - ZONE 2*	12/01/2019	$34.06	$8.10	$15.38	$0.00	$57.54
	06/01/2020	$34.95	$8.10	$15.38	$0.00	$58.43
	12/01/2020	$35.84	$8.10	$15.38	$0.00	$59.32
	06/01/2021	$36.76	$8.10	$15.38	$0.00	$60.24
	12/01/2021	$37.67	$8.10	$15.38	$0.00	$61.15
For apprentice rates see "Apprentice- LABORER"						
LABORER: CEMENT FINISHER TENDER *LABORERS - ZONE 2*	12/01/2019	$34.06	$8.10	$15.38	$0.00	$57.54
	06/01/2020	$34.95	$8.10	$15.38	$0.00	$58.43
	12/01/2020	$35.84	$8.10	$15.38	$0.00	$59.32
	06/01/2021	$36.76	$8.10	$15.38	$0.00	$60.24
	12/01/2021	$37.67	$8.10	$15.38	$0.00	$61.15
For apprentice rates see "Apprentice- LABORER"						
LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER *LABORERS - ZONE 2*	12/01/2019	$34.15	$8.10	$15.44	$0.00	$57.69
For apprentice rates see "Apprentice- LABORER"						
LABORER: MASON TENDER *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
LABORER: MULTI-TRADE TENDER *LABORERS - ZONE 2*	12/01/2019	$34.06	$8.10	$15.38	$0.00	$57.54
	06/01/2020	$34.95	$8.10	$15.38	$0.00	$58.43
	12/01/2020	$35.84	$8.10	$15.38	$0.00	$59.32
	06/01/2021	$36.76	$8.10	$15.38	$0.00	$60.24
	12/01/2021	$37.67	$8.10	$15.38	$0.00	$61.15
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
LABORER: TREE REMOVER *LABORERS - ZONE 2*	12/01/2019	$34.06	$8.10	$15.38	$0.00	$57.54
	06/01/2020	$34.95	$8.10	$15.38	$0.00	$58.43
	12/01/2020	$35.84	$8.10	$15.38	$0.00	$59.32
	06/01/2021	$36.76	$8.10	$15.38	$0.00	$60.24
	12/01/2021	$37.67	$8.10	$15.38	$0.00	$61.15
This classification applies to all tree work associated with the removal of standing trees, and trimming and removal of branches and limbs when the work is not done for a utility company for the purpose of operation, maintenance or repair of utility company equipment. For apprentice rates see "Apprentice- LABORER"						
LASER BEAM OPERATOR *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
MARBLE & TILE FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	08/01/2019	$41.49	$10.75	$19.61	$0.00	$71.85
	02/01/2020	$41.49	$10.75	$20.12	$0.00	$72.36
	08/01/2020	$42.57	$10.75	$20.27	$0.00	$73.59
	02/01/2021	$43.08	$10.75	$20.27	$0.00	$74.10
	08/01/2021	$44.20	$10.75	$20.43	$0.00	$75.38
	02/01/2022	$44.67	$10.75	$20.43	$0.00	$75.85

Apprentice - *MARBLE & TILE FINISHER - Local 3 Marble & Tile*

Effective Date - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.75	$10.75	$19.61	$0.00	$51.11
2	60	$24.89	$10.75	$19.61	$0.00	$55.25
3	70	$29.04	$10.75	$19.61	$0.00	$59.40
4	80	$33.19	$10.75	$19.61	$0.00	$63.55
5	90	$37.34	$10.75	$19.61	$0.00	$67.70

Effective Date - 02/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.75	$10.75	$20.12	$0.00	$51.62
2	60	$24.89	$10.75	$20.12	$0.00	$55.76
3	70	$29.04	$10.75	$20.12	$0.00	$59.91
4	80	$33.19	$10.75	$20.12	$0.00	$64.06
5	90	$37.34	$10.75	$20.12	$0.00	$68.21

Notes:

Apprentice to Journeyworker Ratio:1:3

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
MARBLE MASONS,TILELAYERS & TERRAZZO MECH *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	08/01/2019	$54.42	$10.75	$21.30	$0.00	$86.47
	02/01/2020	$54.42	$10.75	$21.93	$0.00	$87.10
	08/01/2020	$55.77	$10.75	$22.08	$0.00	$88.60
	02/01/2021	$56.41	$10.75	$22.08	$0.00	$89.24
	08/01/2021	$57.81	$10.75	$22.24	$0.00	$90.80
	02/01/2022	$58.38	$10.75	$22.24	$0.00	$91.37

Apprentice - *MARBLE-TILE-TERRAZZO MECHANIC - Local 3 Marble & Tile*

Effective Date - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$27.21	$10.75	$21.30	$0.00	$59.26
2	60	$32.65	$10.75	$21.30	$0.00	$64.70
3	70	$38.09	$10.75	$21.30	$0.00	$70.14
4	80	$43.54	$10.75	$21.30	$0.00	$75.59
5	90	$48.98	$10.75	$21.30	$0.00	$81.03

Effective Date - 02/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$27.21	$10.75	$21.93	$0.00	$59.89
2	60	$32.65	$10.75	$21.93	$0.00	$65.33
3	70	$38.09	$10.75	$21.93	$0.00	$70.77
4	80	$43.54	$10.75	$21.93	$0.00	$76.22
5	90	$48.98	$10.75	$21.93	$0.00	$81.66

Notes:

Apprentice to Journeyworker Ratio:1:5

MECH. SWEEPER OPERATOR (ON CONST. SITES) *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MECHANICS MAINTENANCE *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MILLWRIGHT (Zone 2) *MILLWRIGHTS LOCAL 1121 - Zone 2*	04/01/2019	$38.87	$9.90	$18.50	$0.00	$67.27

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *MILLWRIGHT - Local 1121 Zone 2*

Effective Date - 04/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$21.38	$9.90	$5.31	$0.00	$36.59
2	65	$25.27	$9.90	$15.13	$0.00	$50.30
3	75	$29.15	$9.90	$16.10	$0.00	$55.15
4	85	$33.04	$9.90	$17.06	$0.00	$60.00

Notes:

Steps are 2,000 hours

Apprentice to Journeyworker Ratio:1:5

MORTAR MIXER *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
OILER (OTHER THAN TRUCK CRANES,GRADALLS) *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$23.08	$12.50	$15.70	$0.00	$51.28
	06/01/2020	$23.63	$12.50	$15.70	$0.00	$51.83
	12/01/2020	$24.20	$12.50	$15.70	$0.00	$52.40
	06/01/2021	$24.75	$12.50	$15.70	$0.00	$52.95
	12/01/2021	$25.33	$12.50	$15.70	$0.00	$53.53
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OILER (TRUCK CRANES, GRADALLS) *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$27.64	$12.50	$15.70	$0.00	$55.84
	06/01/2020	$28.29	$12.50	$15.70	$0.00	$56.49
	12/01/2020	$28.97	$12.50	$15.70	$0.00	$57.17
	06/01/2021	$29.61	$12.50	$15.70	$0.00	$57.81
	12/01/2021	$30.29	$12.50	$15.70	$0.00	$58.49
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OTHER POWER DRIVEN EQUIPMENT - CLASS II *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PAINTER (BRIDGES/TANKS) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2020	$50.96	$8.20	$22.10	$0.00	$81.26
	07/01/2020	$52.06	$8.20	$22.10	$0.00	$82.36
	01/01/2021	$53.16	$8.20	$22.10	$0.00	$83.46

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 - BRIDGES/TANKS*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.48	$8.20	$0.00	$0.00	$33.68
2	55	$28.03	$8.20	$5.94	$0.00	$42.17
3	60	$30.58	$8.20	$6.48	$0.00	$45.26
4	65	$33.12	$8.20	$7.02	$0.00	$48.34
5	70	$35.67	$8.20	$18.86	$0.00	$62.73
6	75	$38.22	$8.20	$19.40	$0.00	$65.82
7	80	$40.77	$8.20	$19.94	$0.00	$68.91
8	90	$45.86	$8.20	$21.02	$0.00	$75.08

Effective Date - 07/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.03	$8.20	$0.00	$0.00	$34.23
2	55	$28.63	$8.20	$5.94	$0.00	$42.77
3	60	$31.24	$8.20	$6.48	$0.00	$45.92
4	65	$33.84	$8.20	$7.02	$0.00	$49.06
5	70	$36.44	$8.20	$18.86	$0.00	$63.50
6	75	$39.05	$8.20	$19.40	$0.00	$66.65
7	80	$41.65	$8.20	$19.94	$0.00	$69.79
8	90	$46.85	$8.20	$21.02	$0.00	$76.07

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SIGN, PICTORIAL & DISPLAY) *PAINTERS LOCAL 35 - ZONE 2*	06/01/2013	$25.81	$7.07	$7.05	$0.00	$39.93

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER SIGN - Local 35 Zone 2*

Effective Date - 06/01/2013

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$12.91	$7.07	$0.00	$0.00	$19.98
2	55	$14.20	$7.07	$2.45	$0.00	$23.72
3	60	$15.49	$7.07	$2.45	$0.00	$25.01
4	65	$16.78	$7.07	$2.45	$0.00	$26.30
5	70	$18.07	$7.07	$7.05	$0.00	$32.19
6	75	$19.36	$7.07	$7.05	$0.00	$33.48
7	80	$20.65	$7.07	$7.05	$0.00	$34.77
8	85	$21.94	$7.07	$7.05	$0.00	$36.06
9	90	$23.23	$7.07	$7.05	$0.00	$37.35

Notes:
Steps are 4 mos.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, NEW) *	01/01/2020	$41.86	$8.20	$22.10	$0.00	$72.16
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.*PAINTERS LOCAL 35 - ZONE 2*	07/01/2020	$42.96	$8.20	$22.10	$0.00	$73.26
	01/01/2021	$44.06	$8.20	$22.10	$0.00	$74.36

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - Spray/Sandblast - New*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.93	$8.20	$0.00	$0.00	$29.13
2	55	$23.02	$8.20	$5.94	$0.00	$37.16
3	60	$25.12	$8.20	$6.48	$0.00	$39.80
4	65	$27.21	$8.20	$7.02	$0.00	$42.43
5	70	$29.30	$8.20	$18.86	$0.00	$56.36
6	75	$31.40	$8.20	$19.40	$0.00	$59.00
7	80	$33.49	$8.20	$19.94	$0.00	$61.63
8	90	$37.67	$8.20	$21.02	$0.00	$66.89

Effective Date - 07/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.48	$8.20	$0.00	$0.00	$29.68
2	55	$23.63	$8.20	$5.94	$0.00	$37.77
3	60	$25.78	$8.20	$6.48	$0.00	$40.46
4	65	$27.92	$8.20	$7.02	$0.00	$43.14
5	70	$30.07	$8.20	$18.86	$0.00	$57.13
6	75	$32.22	$8.20	$19.40	$0.00	$59.82
7	80	$34.37	$8.20	$19.94	$0.00	$62.51
8	90	$38.66	$8.20	$21.02	$0.00	$67.88

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, REPAINT) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2020	$39.92	$8.20	$22.10	$0.00	$70.22
	07/01/2020	$41.02	$8.20	$22.10	$0.00	$71.32
	01/01/2021	$42.12	$8.20	$22.10	$0.00	$72.42

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - Spray/Sandblast - Repaint*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.96	$8.20	$0.00	$0.00	$28.16
2	55	$21.96	$8.20	$5.94	$0.00	$36.10
3	60	$23.95	$8.20	$6.48	$0.00	$38.63
4	65	$25.95	$8.20	$7.02	$0.00	$41.17
5	70	$27.94	$8.20	$18.86	$0.00	$55.00
6	75	$29.94	$8.20	$19.40	$0.00	$57.54
7	80	$31.94	$8.20	$19.94	$0.00	$60.08
8	90	$35.93	$8.20	$21.02	$0.00	$65.15

Effective Date - 07/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.51	$8.20	$0.00	$0.00	$28.71
2	55	$22.56	$8.20	$5.94	$0.00	$36.70
3	60	$24.61	$8.20	$6.48	$0.00	$39.29
4	65	$26.66	$8.20	$7.02	$0.00	$41.88
5	70	$28.71	$8.20	$18.86	$0.00	$55.77
6	75	$30.77	$8.20	$19.40	$0.00	$58.37
7	80	$32.82	$8.20	$19.94	$0.00	$60.96
8	90	$36.92	$8.20	$21.02	$0.00	$66.14

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (TRAFFIC MARKINGS) *LABORERS - ZONE 2*	12/01/2019	$34.06	$8.10	$15.38	$0.00	$57.54
	06/01/2020	$34.95	$8.10	$15.38	$0.00	$58.43
	12/01/2020	$35.84	$8.10	$15.38	$0.00	$59.32
	06/01/2021	$36.76	$8.10	$15.38	$0.00	$60.24
	12/01/2021	$37.67	$8.10	$15.38	$0.00	$61.15
For Apprentice rates see "Apprentice- LABORER"						
PAINTER / TAPER (BRUSH, NEW) * * If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.*PAINTERS LOCAL 35 - ZONE 2*	01/01/2020	$40.46	$8.20	$22.10	$0.00	$70.76
	07/01/2020	$41.56	$8.20	$22.10	$0.00	$71.86
	01/01/2021	$42.66	$8.20	$22.10	$0.00	$72.96

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER - Local 35 Zone 2 - BRUSH NEW*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.23	$8.20	$0.00	$0.00	$28.43
2	55	$22.25	$8.20	$5.94	$0.00	$36.39
3	60	$24.28	$8.20	$6.48	$0.00	$38.96
4	65	$26.30	$8.20	$7.02	$0.00	$41.52
5	70	$28.32	$8.20	$18.86	$0.00	$55.38
6	75	$30.35	$8.20	$19.40	$0.00	$57.95
7	80	$32.37	$8.20	$19.94	$0.00	$60.51
8	90	$36.41	$8.20	$21.02	$0.00	$65.63

Effective Date - 07/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.78	$8.20	$0.00	$0.00	$28.98
2	55	$22.86	$8.20	$5.94	$0.00	$37.00
3	60	$24.94	$8.20	$6.48	$0.00	$39.62
4	65	$27.01	$8.20	$7.02	$0.00	$42.23
5	70	$29.09	$8.20	$18.86	$0.00	$56.15
6	75	$31.17	$8.20	$19.40	$0.00	$58.77
7	80	$33.25	$8.20	$19.94	$0.00	$61.39
8	90	$37.40	$8.20	$21.02	$0.00	$66.62

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER / TAPER (BRUSH, REPAINT) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2020	$38.52	$8.20	$22.10	$0.00	$68.82
	07/01/2020	$39.62	$8.20	$22.10	$0.00	$69.92
	01/01/2021	$40.72	$8.20	$22.10	$0.00	$71.02

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - BRUSH REPAINT*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.26	$8.20	$0.00	$0.00	$27.46
2	55	$21.19	$8.20	$5.94	$0.00	$35.33
3	60	$23.11	$8.20	$6.48	$0.00	$37.79
4	65	$25.04	$8.20	$7.02	$0.00	$40.26
5	70	$26.96	$8.20	$18.86	$0.00	$54.02
6	75	$28.89	$8.20	$19.40	$0.00	$56.49
7	80	$30.82	$8.20	$19.94	$0.00	$58.96
8	90	$34.67	$8.20	$21.02	$0.00	$63.89

Effective Date - 07/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.81	$8.20	$0.00	$0.00	$28.01
2	55	$21.79	$8.20	$5.94	$0.00	$35.93
3	60	$23.77	$8.20	$6.48	$0.00	$38.45
4	65	$25.75	$8.20	$7.02	$0.00	$40.97
5	70	$27.73	$8.20	$18.86	$0.00	$54.79
6	75	$29.72	$8.20	$19.40	$0.00	$57.32
7	80	$31.70	$8.20	$19.94	$0.00	$59.84
8	90	$35.66	$8.20	$21.02	$0.00	$64.88

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PANEL & PICKUP TRUCKS DRIVER *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2019	$34.08	$12.41	$13.72	$0.00	$60.21
	06/01/2020	$34.98	$12.41	$13.72	$0.00	$61.11
	08/01/2020	$34.98	$12.91	$13.72	$0.00	$61.61
	12/01/2020	$34.98	$12.91	$14.82	$0.00	$62.71
	06/01/2021	$35.78	$12.91	$14.82	$0.00	$63.51
	08/01/2021	$35.78	$13.41	$14.82	$0.00	$64.01
	12/01/2021	$35.78	$13.41	$16.01	$0.00	$65.20
PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK) *PILE DRIVER LOCAL 56 (ZONE 2)* For apprentice rates see "Apprentice- PILE DRIVER"	08/01/2019	$44.61	$9.90	$21.15	$0.00	$75.66
PILE DRIVER *PILE DRIVER LOCAL 56 (ZONE 2)*	08/01/2019	$44.61	$9.90	$21.15	$0.00	$75.66

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PILE DRIVER - Local 56 Zone 2*

Effective Date - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	0	$0.00	$0.00	$0.00	$0.00	$0.00

Notes: Apprentice wages shall be no less than the following Steps;
(Same as set in Zone 1)
1$54.34/2$58.99/3$63.65/4$65.98/5$68.31/6$68.31/7$72.96/8$72.96

Apprentice to Journeyworker Ratio:1:5

PIPELAYER *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
PLUMBER & PIPEFITTER *PLUMBERS & PIPEFITTERS LOCAL 51*	09/01/2018	$42.04	$10.00	$18.20	$0.00	$70.24

Apprentice - *PLUMBER/PIPEFITTER - Local 51*

Effective Date - 09/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$16.82	$10.00	$2.50	$0.00	$29.32
2	50	$21.02	$10.00	$2.50	$0.00	$33.52
3	60	$25.22	$10.00	$7.85	$0.00	$43.07
4	70	$29.43	$10.00	$12.56	$0.00	$51.99
5	80	$33.63	$10.00	$15.70	$0.00	$59.33

Notes:
Steps 2000hrs. Prior 9/1/05; 40/40/45/50/55/60/65/75/80/85

Apprentice to Journeyworker Ratio:1:3

PNEUMATIC CONTROLS (TEMP.) *PLUMBERS & PIPEFITTERS LOCAL 51*	09/01/2018	$42.04	$10.00	$18.20	$0.00	$70.24
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
PNEUMATIC DRILL/TOOL OPERATOR *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
POWDERMAN & BLASTER *LABORERS - ZONE 2*	12/01/2019	$35.06	$8.10	$15.38	$0.00	$58.54
	06/01/2020	$35.95	$8.10	$15.38	$0.00	$59.43
	12/01/2020	$36.84	$8.10	$15.38	$0.00	$60.32
	06/01/2021	$37.76	$8.10	$15.38	$0.00	$61.24
	12/01/2021	$38.67	$8.10	$15.38	$0.00	$62.15
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
POWER SHOVEL/DERRICK/TRENCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.73	$12.50	$15.70	$0.00	$76.93
	06/01/2020	$49.83	$12.50	$15.70	$0.00	$78.03
	12/01/2020	$50.98	$12.50	$15.70	$0.00	$79.18
	06/01/2021	$52.08	$12.50	$15.70	$0.00	$80.28
	12/01/2021	$53.23	$12.50	$15.70	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (CONCRETE) *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.73	$12.50	$15.70	$0.00	$76.93
	06/01/2020	$49.83	$12.50	$15.70	$0.00	$78.03
	12/01/2020	$50.98	$12.50	$15.70	$0.00	$79.18
	06/01/2021	$52.08	$12.50	$15.70	$0.00	$80.28
	12/01/2021	$53.23	$12.50	$15.70	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (DEWATERING, OTHER) *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$32.47	$12.50	$15.70	$0.00	$60.67
	06/01/2020	$33.22	$12.50	$15.70	$0.00	$61.42
	12/01/2020	$34.00	$12.50	$15.70	$0.00	$62.20
	06/01/2021	$34.75	$12.50	$15.70	$0.00	$62.95
	12/01/2021	$35.54	$12.50	$15.70	$0.00	$63.74
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
READY-MIX CONCRETE DRIVER *TEAMSTERS 653 - Southeastern Concrete (Weymouth)*	08/01/2019	$23.00	$11.91	$6.90	$0.00	$41.81
	05/01/2020	$23.50	$11.91	$6.90	$0.00	$42.31
	08/01/2020	$23.50	$12.41	$6.90	$0.00	$42.81
	05/01/2021	$24.00	$12.41	$6.90	$0.00	$43.31
	08/01/2021	$24.00	$12.91	$6.90	$0.00	$43.81
	05/01/2022	$24.50	$12.91	$6.90	$0.00	$44.31
	08/01/2022	$24.50	$13.41	$6.90	$0.00	$44.81
	05/01/2023	$25.00	$13.41	$6.90	$0.00	$45.31
	08/01/2023	$25.00	$13.91	$6.90	$0.00	$45.81
RECLAIMERS *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
RIDE-ON MOTORIZED BUGGY OPERATOR *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
ROLLER/SPREADER/MULCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
ROOFER (Inc.Roofer Waterproofng &Roofer Damproofg) *ROOFERS LOCAL 33*	08/01/2019	$44.64	$11.50	$15.90	$0.00	$72.04
	02/01/2020	$45.92	$11.50	$15.90	$0.00	$73.32
	08/01/2020	$47.35	$11.50	$15.90	$0.00	$74.75
	02/01/2021	$48.78	$11.50	$15.90	$0.00	$76.18
	08/01/2021	$50.21	$11.50	$15.90	$0.00	$77.61
	02/01/2022	$51.64	$11.50	$15.90	$0.00	$79.04

Apprentice - *ROOFER - Local 33*

Effective Date - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$22.32	$11.50	$3.69	$0.00	$37.51
2	60	$26.78	$11.50	$15.90	$0.00	$54.18
3	65	$29.02	$11.50	$15.90	$0.00	$56.42
4	75	$33.48	$11.50	$15.90	$0.00	$60.88
5	85	$37.94	$11.50	$15.90	$0.00	$65.34

Effective Date - 02/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$22.96	$11.50	$3.69	$0.00	$38.15
2	60	$27.55	$11.50	$15.90	$0.00	$54.95
3	65	$29.85	$11.50	$15.90	$0.00	$57.25
4	75	$34.44	$11.50	$15.90	$0.00	$61.84
5	85	$39.03	$11.50	$15.90	$0.00	$66.43

Notes: ** 1:5, 2:6-10, the 1:10; Reroofing: 1:4, then 1:1
Step 1 is 2000 hrs.; Steps 2-5 are 1000 hrs.
(Hot Pitch Mechanics' receive $1.00 hr. above ROOFER)

Apprentice to Journeyworker Ratio:**

ROOFER SLATE / TILE / PRECAST CONCRETE *ROOFERS LOCAL 33*	08/01/2019	$44.89	$11.50	$15.90	$0.00	$72.29
	02/01/2020	$46.17	$11.50	$15.90	$0.00	$73.57
	08/01/2020	$47.60	$11.50	$15.90	$0.00	$75.00
	02/01/2021	$49.03	$11.50	$15.90	$0.00	$76.43
	08/01/2021	$50.46	$11.50	$15.90	$0.00	$77.86
	02/01/2022	$51.89	$11.50	$15.90	$0.00	$79.29
For apprentice rates see "Apprentice- ROOFER"						
SHEETMETAL WORKER *SHEETMETAL WORKERS LOCAL 17 - B*	04/01/2019	$34.71	$13.20	$16.55	$1.93	$66.39

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *SHEET METAL WORKER - Local 17-B*

Effective Date - 04/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$13.88	$13.20	$4.02	$0.95	$32.05
2	45	$15.62	$13.20	$4.52	$1.02	$34.36
3	50	$17.36	$13.20	$10.48	$1.26	$42.30
4	55	$19.09	$13.20	$10.48	$1.31	$44.08
5	60	$20.83	$13.20	$13.52	$1.43	$48.98
6	65	$22.56	$13.20	$13.78	$1.49	$51.03
7	70	$24.30	$13.20	$14.03	$1.55	$53.08
8	75	$26.03	$13.20	$14.28	$1.61	$55.12
9	80	$27.77	$13.20	$14.54	$1.67	$57.18
10	85	$29.50	$13.20	$14.79	$1.72	$59.21

Notes:

Apprentice to Journeyworker Ratio:1:3

SPECIALIZED EARTH MOVING EQUIP < 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2019	$34.54	$12.41	$13.72	$0.00	$60.67
	06/01/2020	$35.44	$12.41	$13.72	$0.00	$61.57
	08/01/2020	$35.44	$12.91	$13.72	$0.00	$62.07
	12/01/2020	$35.44	$12.91	$14.82	$0.00	$63.17
	06/01/2021	$36.24	$12.91	$14.82	$0.00	$63.97
	08/01/2021	$36.24	$13.41	$14.82	$0.00	$64.47
	12/01/2021	$36.24	$13.41	$16.01	$0.00	$65.66
SPECIALIZED EARTH MOVING EQUIP > 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2019	$34.83	$12.41	$13.72	$0.00	$60.96
	06/01/2020	$35.73	$12.41	$13.72	$0.00	$61.86
	08/01/2020	$35.73	$12.91	$13.72	$0.00	$62.36
	12/01/2020	$35.73	$12.91	$14.82	$0.00	$63.46
	06/01/2021	$36.53	$12.91	$14.82	$0.00	$64.26
	08/01/2021	$36.53	$13.41	$14.82	$0.00	$64.76
	12/01/2021	$36.53	$13.41	$16.01	$0.00	$65.95
SPRINKLER FITTER *SPRINKLER FITTERS LOCAL 550 - (Section B) Zone 2*	01/01/2020	$54.06	$9.68	$19.80	$0.00	$83.54
	03/01/2020	$55.78	$9.47	$19.60	$0.00	$84.85
	10/01/2020	$57.13	$9.47	$19.60	$0.00	$86.20
	03/01/2021	$58.48	$9.47	$19.60	$0.00	$87.55

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *SPRINKLER FITTER - Local 550 (Section B) Zone 2*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$18.92	$9.68	$11.35	$0.00	$39.95
2	40	$21.62	$9.68	$12.00	$0.00	$43.30
3	45	$24.33	$9.68	$12.65	$0.00	$46.66
4	50	$27.03	$9.68	$13.30	$0.00	$50.01
5	55	$29.73	$9.68	$13.95	$0.00	$53.36
6	60	$32.44	$9.68	$14.60	$0.00	$56.72
7	65	$35.14	$9.68	$15.25	$0.00	$60.07
8	70	$37.84	$9.68	$15.90	$0.00	$63.42
9	75	$40.55	$9.68	$16.55	$0.00	$66.78
10	80	$43.25	$9.68	$17.20	$0.00	$70.13

Notes: Apprentice entered prior 9/30/10:
40/45/50/55/60/65/70/75/80/85
Steps are 850 hours

Apprentice to Journeyworker Ratio:1:3

STEAM BOILER OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TAMPERS, SELF-PROPELLED OR TRACTOR DRAWN *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TELECOMMUNICATION TECHNICIAN *ELECTRICIANS LOCAL 223*	09/01/2019	$35.78	$10.15	$11.45	$0.00	$57.38
	03/01/2020	$36.27	$10.40	$11.78	$0.00	$58.45

Apprentice - *TELECOMMUNICATION TECHNICIAN - Local 223*

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	0	$0.00	$0.00	$0.00	$0.00	$0.00

Notes: See Electrician Apprentice Wages
Steps are 750hrs
Telecom Apprentice Wages shall be the same as the Electrician Apprentice Wages

Apprentice to Journeyworker Ratio:2:3***

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TERRAZZO FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	08/01/2019	$53.34	$10.75	$21.30	$0.00	$85.39
	02/01/2020	$53.34	$10.75	$21.94	$0.00	$86.03
	08/01/2020	$54.69	$10.75	$22.09	$0.00	$87.53
	02/01/2021	$55.33	$10.75	$22.09	$0.00	$88.17
	08/01/2021	$56.73	$10.75	$22.25	$0.00	$89.73
	02/01/2022	$57.32	$10.75	$22.25	$0.00	$90.32

Apprentice - *TERRAZZO FINISHER - Local 3 Marble & Tile*

Effective Date - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.67	$10.75	$21.30	$0.00	$58.72
2	60	$32.00	$10.75	$21.30	$0.00	$64.05
3	70	$37.34	$10.75	$21.30	$0.00	$69.39
4	80	$42.67	$10.75	$21.30	$0.00	$74.72
5	90	$48.01	$10.75	$21.30	$0.00	$80.06

Effective Date - 02/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.67	$10.75	$21.94	$0.00	$59.36
2	60	$32.00	$10.75	$21.94	$0.00	$64.69
3	70	$37.34	$10.75	$21.94	$0.00	$70.03
4	80	$42.67	$10.75	$21.94	$0.00	$75.36
5	90	$48.01	$10.75	$21.94	$0.00	$80.70

Notes:

Apprentice to Journeyworker Ratio:1:3

TEST BORING DRILLER *LABORERS - FOUNDATION AND MARINE*	12/01/2019	$40.50	$8.10	$16.80	$0.00	$65.40
	06/01/2020	$41.49	$8.10	$16.80	$0.00	$66.39
	12/01/2020	$42.47	$8.10	$16.80	$0.00	$67.37
	06/01/2021	$43.49	$8.10	$16.80	$0.00	$68.39
	12/01/2021	$44.50	$8.10	$16.80	$0.00	$69.40
For apprentice rates see "Apprentice- LABORER"						
TEST BORING DRILLER HELPER *LABORERS - FOUNDATION AND MARINE*	12/01/2019	$39.22	$8.10	$16.80	$0.00	$64.12
	06/01/2020	$40.21	$8.10	$16.80	$0.00	$65.11
	12/01/2020	$41.19	$8.10	$16.80	$0.00	$66.09
	06/01/2021	$42.21	$8.10	$16.80	$0.00	$67.11
	12/01/2021	$43.22	$8.10	$16.80	$0.00	$68.12
For apprentice rates see "Apprentice- LABORER"						
TEST BORING LABORER *LABORERS - FOUNDATION AND MARINE*	12/01/2019	$39.10	$8.10	$16.80	$0.00	$64.00
	06/01/2020	$40.09	$8.10	$16.80	$0.00	$64.99
	12/01/2020	$41.07	$8.10	$16.80	$0.00	$65.97
	06/01/2021	$42.09	$8.10	$16.80	$0.00	$66.99
	12/01/2021	$43.10	$8.10	$16.80	$0.00	$68.00
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TRACTORS/PORTABLE STEAM GENERATORS *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TRAILERS FOR EARTH MOVING EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2019	$35.12	$12.41	$13.72	$0.00	$61.25
	06/01/2020	$36.02	$12.41	$13.72	$0.00	$62.15
	08/01/2020	$36.02	$12.91	$13.72	$0.00	$62.65
	12/01/2020	$36.02	$12.91	$14.82	$0.00	$63.75
	06/01/2021	$36.82	$12.91	$14.82	$0.00	$64.55
	08/01/2021	$36.82	$13.41	$14.82	$0.00	$65.05
	12/01/2021	$36.82	$13.41	$16.01	$0.00	$66.24
TUNNEL WORK - COMPRESSED AIR *LABORERS (COMPRESSED AIR)*	12/01/2019	$51.38	$8.10	$17.20	$0.00	$76.68
	06/01/2020	$52.37	$8.10	$17.20	$0.00	$77.67
	12/01/2020	$53.35	$8.10	$17.20	$0.00	$78.65
	06/01/2021	$54.37	$8.10	$17.20	$0.00	$79.67
	12/01/2021	$55.38	$8.10	$17.20	$0.00	$80.68
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE) *LABORERS (COMPRESSED AIR)*	12/01/2019	$53.38	$8.10	$17.20	$0.00	$78.68
	06/01/2020	$54.37	$8.10	$17.20	$0.00	$79.67
	12/01/2020	$55.35	$8.10	$17.20	$0.00	$80.65
	06/01/2021	$56.37	$8.10	$17.20	$0.00	$81.67
	12/01/2021	$57.38	$8.10	$17.20	$0.00	$82.68
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR *LABORERS (FREE AIR TUNNEL)*	12/01/2019	$43.45	$8.10	$17.20	$0.00	$68.75
	06/01/2020	$44.44	$8.10	$17.20	$0.00	$69.74
	12/01/2020	$45.42	$8.10	$17.20	$0.00	$70.72
	06/01/2021	$46.44	$8.10	$17.20	$0.00	$71.74
	12/01/2021	$47.45	$8.10	$17.20	$0.00	$72.75
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR (HAZ. WASTE) *LABORERS (FREE AIR TUNNEL)*	12/01/2019	$45.45	$8.10	$17.20	$0.00	$70.75
	06/01/2020	$46.44	$8.10	$17.20	$0.00	$71.74
	12/01/2020	$47.42	$8.10	$17.20	$0.00	$72.72
	06/01/2021	$48.44	$8.10	$17.20	$0.00	$73.74
	12/01/2021	$49.45	$8.10	$17.20	$0.00	$74.75
For apprentice rates see "Apprentice- LABORER"						
VAC-HAUL *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2019	$34.54	$12.41	$13.72	$0.00	$60.67
	06/01/2020	$35.44	$12.41	$13.72	$0.00	$61.57
	08/01/2020	$35.44	$12.91	$13.72	$0.00	$62.07
	12/01/2020	$35.44	$12.91	$14.82	$0.00	$63.17
	06/01/2021	$36.24	$12.91	$14.82	$0.00	$63.97
	08/01/2021	$36.24	$13.41	$14.82	$0.00	$64.47
	12/01/2021	$36.24	$13.41	$16.01	$0.00	$65.66

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
WAGON DRILL OPERATOR	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
LABORERS - ZONE 2	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
WASTE WATER PUMP OPERATOR	12/01/2019	$48.73	$12.50	$15.70	$0.00	$76.93
OPERATING ENGINEERS LOCAL 4	06/01/2020	$49.83	$12.50	$15.70	$0.00	$78.03
	12/01/2020	$50.98	$12.50	$15.70	$0.00	$79.18
	06/01/2021	$52.08	$12.50	$15.70	$0.00	$80.28
	12/01/2021	$53.23	$12.50	$15.70	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
WATER METER INSTALLER	09/01/2018	$42.04	$10.00	$18.20	$0.00	$70.24
PLUMBERS & PIPEFITTERS LOCAL 51						
For apprentice rates see "Apprentice- PLUMBER/PIPEFITTER" or "PLUMBER/GASFITTER"						
Outside Electrical - East						
CABLE TECHNICIAN (Power Zone)	09/01/2019	$28.83	$8.75	$1.86	$0.00	$39.44
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	08/30/2020	$29.67	$9.25	$1.89	$0.00	$40.81
For apprentice rates see "Apprentice- LINEMAN"						
CABLEMAN (Underground Ducts & Cables)	09/01/2019	$40.84	$8.75	$10.02	$0.00	$59.61
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	08/30/2020	$42.03	$9.25	$10.27	$0.00	$61.55
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN CDL	09/01/2019	$33.64	$8.75	$9.86	$0.00	$52.25
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	08/30/2020	$34.62	$9.25	$10.07	$0.00	$53.94
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN -Inexperienced (<2000 Hrs)	09/01/2019	$26.43	$8.75	$1.79	$0.00	$36.97
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	08/30/2020	$27.20	$9.25	$1.82	$0.00	$38.27
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class A CDL)	09/01/2019	$40.84	$8.75	$14.10	$0.00	$63.69
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	08/30/2020	$42.03	$9.25	$14.35	$0.00	$65.63
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class B CDL)	09/01/2019	$36.04	$8.75	$10.65	$0.00	$55.44
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	08/30/2020	$37.09	$9.25	$10.87	$0.00	$57.21
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN	09/01/2019	$21.62	$8.75	$1.65	$0.00	$32.02
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	08/30/2020	$22.25	$9.25	$1.67	$0.00	$33.17
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN -Inexperienced (<2000 Hrs.)	09/01/2019	$26.43	$8.75	$1.79	$0.00	$36.97
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	08/30/2020	$27.20	$9.25	$1.82	$0.00	$38.27
For apprentice rates see "Apprentice- LINEMAN"						
JOURNEYMAN LINEMAN	09/01/2019	$48.05	$8.75	$17.19	$0.00	$73.99
OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104	08/30/2020	$49.45	$9.25	$17.48	$0.00	$76.18

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *LINEMAN (Outside Electrical) - East Local 104*

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$28.83	$8.75	$3.36	$0.00	$40.94
2	65	$31.23	$8.75	$3.44	$0.00	$43.42
3	70	$33.64	$8.75	$3.51	$0.00	$45.90
4	75	$36.04	$8.75	$5.08	$0.00	$49.87
5	80	$38.44	$8.75	$5.15	$0.00	$52.34
6	85	$40.84	$8.75	$5.23	$0.00	$54.82
7	90	$43.25	$8.75	$7.30	$0.00	$59.30

Effective Date - 08/30/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$29.67	$9.25	$3.39	$0.00	$42.31
2	65	$32.14	$9.25	$3.46	$0.00	$44.85
3	70	$34.62	$9.25	$3.54	$0.00	$47.41
4	75	$37.09	$9.25	$5.11	$0.00	$51.45
5	80	$39.56	$9.25	$5.19	$0.00	$54.00
6	85	$42.03	$9.25	$5.26	$0.00	$56.54
7	90	$44.51	$9.25	$7.34	$0.00	$61.10

Notes:

Apprentice to Journeyworker Ratio:1:2

TELEDATA CABLE SPLICER *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	02/04/2019	$30.73	$4.70	$3.17	$0.00	$38.60
TELEDATA LINEMAN/EQUIPMENT OPERATOR *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	02/04/2019	$28.93	$4.70	$3.14	$0.00	$36.77
TELEDATA WIREMAN/INSTALLER/TECHNICIAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	02/04/2019	$28.93	$4.70	$3.14	$0.00	$36.77
TREE TRIMMER *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/31/2016	$18.51	$3.55	$0.00	$0.00	$22.06

This classification applies only to tree work done: (a) for a utility company, R.E.A. cooperative, or railroad or coal mining company, and (b) for the purpose of operating, maintaining, or repairing the utility company's equipment, and (c) by a person who is using hand or mechanical cutting methods and is not on the ground. This classification does not apply to wholesale tree removal.

TREE TRIMMER GROUNDMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/31/2016	$16.32	$3.55	$0.00	$0.00	$19.87

This classification applies only to tree work done: (a) for a utility company, R.E.A. cooperative, or railroad or coal mining company, and (b) for the purpose of operating, maintaining, or repairing the utility company's equipment, and (c) by a person who is using hand or mechanical cutting methods and is on the ground. This classification does not apply to wholesale tree removal.

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Additional Apprentice Information:

Minimum wage rates for apprentices employed on public works projects are listed above as a percentage of the pre-determined hourly wage rate established by the Commissioner under the provisions of the M.G.L. c. 149, ss. 26-27D. Apprentice ratios are established by the Division of Apprenticeship Training pursuant to M.G.L. c. 23, ss. 11E-11L.

All apprentices must be registered with the Division of Apprenticeship Training in accordance with M.G.L. c. 23, ss. 11E-11L.

All steps are six months (1000 hours.)
Ratios are expressed in allowable number of apprentices to journeymen or fraction thereof, unless otherwise specified.

** Multiple ratios are listed in the comment field.
*** APP to JM; 1:1, 2:2, 2:3, 3:4, 4:4, 4:5, 4:6, 5:7, 6:7, 6:8, 6:9, 7:10, 8:10, 8:11, 8:12, 9:13, 10:13, 10:14, etc.
**** APP to JM; 1:1, 1:2, 2:3, 2:4, 3:5, 4:6, 4:7, 5:8, 6:9, 6:10, 7:11, 8:12, 8:13, 9:14, 10:15, 10:16, etc.

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ATTACHMENT B

Excerpts from Chapters 30, Section 39F of the Massachusetts General Laws

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Chapter 30: Section 39O. Contracts for construction and materials; suspension, delay or interruption due to order of awarding authority; adjustment in contract price; written claim 5

NOTICE *- These are* ***NOT*** *the official versions of the Massachusetts General Laws (MGL). While reasonable efforts have been made to assure the accuracy of the excerpts provided, do not rely on this information without first checking an official edition of the MGL. If you are in need of legal advice or counsel, consult a lawyer.*

Certain excerpts from the Massachusetts General Laws are applicable to Construction contracts. Attention is directed to the following Sections of Chapter 30 as amended.

Chapter 30: Section 39F. Construction contracts; assignment and subrogation; subcontractor defined; enforcement of claim for direct payment; deposit, reduction of disputed amounts

Section 39F. (1) Every contract awarded pursuant to sections forty-four A to L, inclusive, of chapter one hundred and forty-nine shall contain the following subparagraphs (a) through (i) and every contract awarded pursuant to section thirty-nine M of chapter thirty shall contain the following subparagraphs (a) through (h) and in each case those subparagraphs shall be binding between the general contractor and each subcontractor.

(a) Forthwith after the general contractor receives payment on account of a periodic estimate, the general contractor shall pay to each subcontractor the amount paid for the labor performed and the materials furnished by that subcontractor, less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

(b) Not later than the sixty-fifth day after each subcontractor substantially completes his work in accordance with the plans and specifications, the entire balance due under the subcontract less amounts retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, shall be due the subcontractor; and the awarding authority shall pay that amount to the general contractor. The general contractor shall forthwith pay to the subcontractor the full amount received from the awarding authority less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

(c) Each payment made by the awarding authority to the general contractor pursuant to subparagraphs (a) and (b) of this paragraph for the labor performed and the materials furnished by a subcontractor shall be made to the general contractor for the account of that subcontractor; and the awarding authority shall take reasonable steps to compel the general contractor to make each such payment to each such subcontractor. If the awarding authority has received a demand for direct payment from a subcontractor for any amount which has already been included in a payment to the general contractor or which is to be included in a payment to the general contractor for payment to the subcontractor as provided in subparagraphs (a) and (b), the awarding authority shall act upon the demand as provided in this section.

(d) If, within seventy days after the subcontractor has substantially completed the subcontract work, the subcontractor has not received from the general contractor the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, the subcontractor may demand direct payment of that balance from the awarding authority. The demand shall be by a sworn statement delivered to or sent by certified mail to the awarding authority, and a copy shall be delivered to or sent by certified mail to the general contractor at the same time. The demand shall

contain a detailed breakdown of the balance due under the subcontract and also a statement of the status of completion of the subcontract work. Any demand made after substantial completion of the subcontract work shall be valid even if delivered or mailed prior to the seventieth day after the subcontractor has substantially completed the subcontract work. Within ten days after the subcontractor has delivered or so mailed the demand to the awarding authority and delivered or so mailed a copy to the general contractor, the general contractor may reply to the demand. The reply shall be by a sworn statement delivered to or sent by certified mail to the awarding authority and a copy shall be delivered to or sent by certified mail to the subcontractor at the same time. The reply shall contain a detailed breakdown of the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor and of the amount due for each claim made by the general contractor against the subcontractor.

(e) Within fifteen days after receipt of the demand by the awarding authority, but in no event prior to the seventieth day after substantial completion of the subcontract work, the awarding authority shall make direct payment to the subcontractor of the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount (i) retained by the awarding authority as the estimated cost of completing the incomplete or unsatisfactory items of work, (ii) specified in any court proceedings barring such payment, or (iii) disputed by the general contractor in the sworn reply; provided, that the awarding authority shall not deduct from a direct payment any amount as provided in part (iii) if the reply is not sworn to, or for which the sworn reply does not contain the detailed breakdown required by subparagraph (d). The awarding authority shall make further direct payments to the subcontractor forthwith after the removal of the basis for deductions from direct payments made as provided in parts (i) and (ii) of this subparagraph.

(f) The awarding authority shall forthwith deposit the amount deducted from a direct payment as provided in part (iii) of subparagraph (e) in an interest-bearing joint account in the names of the general contractor and the subcontractor in a bank in Massachusetts selected by the awarding authority or agreed upon by the general contractor and the subcontractor and shall notify the general contractor and the subcontractor of the date of the deposit and the bank receiving the deposit. The bank shall pay the amount in the account, including accrued interest, as provided in an agreement between the general contractor and the subcontractor or as determined by decree of a court of competent jurisdiction.

(g) All direct payments and all deductions from demands for direct payments deposited in an interest-bearing account or accounts in a bank pursuant to subparagraph (f) shall be made out of amounts payable to the general contractor at the time of receipt of a demand for direct payment from a subcontractor and out of amounts which later become payable to the general contractor and in the order of receipt of such demands from subcontractors. All direct payments shall discharge the obligation of the awarding authority to the general contractor to the extent of such payment.

(h) The awarding authority shall deduct from payments to a general contractor amounts which, together with the deposits in interest-bearing accounts pursuant to subparagraph (f), are sufficient to satisfy all unpaid balances of demands for direct payment received from subcontractors. All such amounts shall be earmarked for such direct payments, and the subcontractors shall have a right in such deductions prior to any claims against such amounts by creditors of the general contractor.

(i) If the subcontractor does not receive payment as provided in subparagraph (a) or if the general contractor does not submit a periodic estimate for the value of the labor or materials performed or furnished by the subcontractor and the subcontractor does not receive payment for same when due less the deductions provided for in subparagraph (a), the subcontractor may demand direct payment by following the procedure in subparagraph (d) and the general contractor may file a sworn reply as provided in that same subparagraph. A demand made after the first day of the month following that for which the subcontractor performed or furnished the labor and materials for which the subcontractor seeks payment shall be valid even if delivered or mailed prior to the time payment was due on a periodic estimate from the general contractor. Thereafter the awarding authority shall proceed as provided in subparagraph (e), (f), (g) and (h).

(2) Any assignment by a subcontractor of the rights under this section to a surety company furnishing a bond under the provisions of section twenty-nine of chapter one hundred forty-nine shall be invalid. The assignment and subrogation rights of the surety to amounts included in a demand for direct payment which are in the possession of the awarding authority or which are on deposit pursuant to subparagraph (f) of paragraph (1) shall be subordinate to the rights of all subcontractors who are entitled to be paid under this section and who have not been paid in full.

(3) "Subcontractor" as used in this section (i) for contracts awarded as provided in sections forty-four A to forty-four H, inclusive, of chapter one hundred forty-nine shall mean a person who files a sub-bid and receives a subcontract as a result of that filed sub- bid or who is approved by the awarding authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the general contractor, (ii) for contracts awarded as provided in paragraph (a) of section thirty-nine M of chapter thirty shall mean a person approved by the awarding authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the general contractor, and (iii) for contracts with the commonwealth not awarded as provided in forty-four A to forty-four H, inclusive, of chapter one hundred forty-nine shall also mean a person contracting with the general contractor to supply materials used or employed in a public works project for a price in excess of five thousand dollars.

(4) A general contractor or a subcontractor shall enforce a claim to any portion of the amount of a demand for direct payment deposited as provided in subparagraph (f) of paragraph 1 by a petition in equity in the superior court against the other and the bank shall not be a necessary party. A subcontractor shall enforce a claim for direct payment or a right to require a deposit as provided in subparagraph (f) of paragraph 1 by a petition in equity in the superior court against the awarding authority and the general contractor shall not be a necessary party. Upon motion of any party the court shall advance for speedy trial any petition filed as provided in this paragraph. Sections fifty-nine and fifty- nine B of chapter two hundred thirty-one shall apply to such petitions. The court shall enter an interlocutory decree upon which execution shall issue for any part of a claim found due pursuant to sections fifty-nine and fifty-nine B and, upon motion of any party, shall advance for speedy trial the petition to collect the remainder of the claim. Any party aggrieved by such interlocutory decree shall have the right to appeal therefrom as from a final decree. The court shall not consolidate for trial the petition of any subcontractor with the petition of one or more subcontractors or the same general contract unless the court finds that a substantial portion of the evidence of the same events during the course of construction (other than the fact that the claims sought to be consolidated arise under the same general contract) is applicable to the petitions sought to be consolidated and that such consolidation will prevent unnecessary duplication of evidence. A decree in any such proceeding shall not include interest on the disputed amount deposited in excess of the interest earned for the period of any such deposit. No person except a subcontractor filing a demand for direct payment for which no funds due the general contractor are available for direct payment shall have a right to file a petition in court of equity against the awarding authority claiming a demand for direct payment is premature and such subcontractor must file the petition before the awarding authority has made a direct payment to the subcontractor and has made a deposit of the disputed portion as provided in part (iii) of subparagraph (e) and in subparagraph (f) of paragraph (1).

(5) In any petition to collect any claim for which a subcontractor has filed a demand for direct payment the court shall, upon motion of the general contractor, reduce by the amount of any deposit of a disputed amount by the awarding authority as provided in part (iii) of subparagraph (e) and in subparagraph (f) of paragraph (1) any amount held under a trustee writ or pursuant to a restraining order or injunction.

Chapter 30: Section 39K. Public building construction contracts; payments

Section 39K. Every contract for the construction, reconstruction, alteration, remodeling, repair or demolition of any public building by the commonwealth, or by any county, city, town, district, board, commission or other public body, when the amount is more than five thousand dollars in the case of the commonwealth and more than two thousand dollars in the case of any county, city, town, district, board, commission or other public body, shall contain the following paragraph:— Within fifteen days (30 days in the case of the commonwealth, including local housing authorities) after receipt from the contractor, at the place designated by the awarding authority if such a place is so designated, of a periodic estimate requesting payment of the amount due for the preceding month, the awarding authority will make a periodic payment to the contractor for the workperformed during the preceding month and for the materials not incorporated in the work but delivered and suitably stored at the site (or at some location agreed upon in writing) to which the contractor has title or to which a subcontractor has title and has authorized the contractor to transfer title to the awarding authority, upon certification by the contractor that he is the lawful owner and that the materials are free from all encumbrances, but less (1) a retention based on its estimate of the fair value of its claims against the contractor and less (2) a retention for direct payments to subcontractors based on demands for same in accordance with the provisions of section thirty-nine F, and less (3) a retention not exceeding five per cent of the approved amount of the periodic payment. After the receipt of a periodic estimate requesting final payment and within sixty-five days after (a) the contractor fully completes the work or substantially completes the work so that the value of the work remaining to be done is, in the estimate of the awarding authority, less than one per cent of the original contract price, or (b) the contractor substantially completes the work and the awarding authority takes possession

for occupancy, whichever occurs first, the awarding authority shall pay the contractor the entire balance due on the contract less (1) a retention based on its estimate of the fair value of its claims against the contractor and of the cost of completing the

incomplete and unsatisfactory items of work and less (2) a retention for direct payments to subcontractors based on demands for same in accordance with the provisions of section thirty-nine F, or based on the record of payments by the contractor to the subcontractors under this contract if such record of payment indicates that the contractor has not paid subcontractors as provided in section thirty-nine F. If the awarding authority fails to make payment as herein provided, there shall be added to each such payment daily interest at the rate of three percentage points above the rediscount rate than charged by the Federal Reserve Bank of Boston commencing on the first day after said payment is due and continuing until the payment is delivered or mailed to the contractor; provided, that no interest shall be due, in any event, on the amount due on a periodic estimate for final payment until fifteen days (twenty-four days in the case of the commonwealth) after receipt of such a periodic estimate from the contractor, at the place designated by the awarding authority if such a place is so designated. The contractor agrees to pay to each subcontractor a portion of any such interest paid in accordance with the amount due each subcontractor.

The awarding authority may make changes in any periodic estimate submitted by the contractor and the payment due on said periodic estimate shall be computed in accordance with the changes so made, but such changes or any requirement for a corrected periodic estimate shall not affect the due date for the periodic payment or the date for the commencement of interest charges on the amount of the periodic payment computed in accordance with the changes made, as provided herein; provided, that the awarding authority may, within seven days after receipt, return to the contractor for correction, any periodic estimate which is not in the required form or which contains computations not arithmetically correct and, in that event, the date of receipt of such periodic estimate shall be the date of receipt of the corrected periodic estimate in proper form and with arithmetically correct computations. The date of receipt of a periodic estimate received on a Saturday shall be the first working day thereafter. The provisions of section thirty-nine G shall not apply to any contract for the construction, reconstruction, alteration, remodeling, repair or demolition of any public building to which this section applies.

All periodic estimates shall be submitted to the awarding authority, or to its designee as set forth in writing to the contractor, and the date of receipt by the awarding authority or its designee shall be marked on the estimate. All periodic estimates shall contain a separate item for each filed subtrade and each sub-subtrade listed in sub-bid form as required by specifications and a column listing the amount paid to each subcontractor and sub-subcontractor as of the date the periodic estimate is filed. The person making payment for the awarding authority shall add the daily interest provided for herein to each payment for each day beyond the due date based on the date of receipt marked on the estimate.

A certificate of the architect to the effect that the contractor has fully or substantially completed the work shall, subject to the provisions of section thirty-nine J, be conclusive for the purposes of this section.

Notwithstanding the provisions of this section, at any time after the value of the work remaining to be done is, in the estimation of the awarding authority, less than 1 per cent of the adjusted contract price, or the awarding authority has determined that the contractor has substantially completed the work and the awarding authority has taken possession for occupancy, the awarding authority may send to the general contractor by certified mail, return receipt requested, a complete and final list of all incomplete and unsatisfactory work items, including, for each item on the list, a good faith estimate of the fair and reasonable cost of completing such item. The general contractor shall then complete all such work items within 30 days of receipt of such list or before the contract completion date, whichever is later. If the general contractor fails to complete all incomplete and unsatisfactory work items within 45 days after receipt of such items furnished by the awarding authority or before the contract completion date, whichever is later, subsequent to an additional 14 days' written notice to the general contractor by certified mail, return receipt requested, the awarding authority may terminate the contract and complete the incomplete and unsatisfactory work items and charge the cost of same to the general contractor and such termination shall be without prejudice to any other rights or remedies the awarding authority may have under the contract. The awarding authority shall note any such termination in the evaluation form to be filed by the awarding authority pursuant to the provisions of section 44D of chapter 149.

Chapter 30: Section 39N. Construction contracts; equitable adjustment in contract price for differing subsurface or latent physical conditions

Section 39N. Every contract subject to section forty-four A of chapter one hundred and forty-nine or subject to section thirty-nine M of chapter thirty shall contain the following paragraph in its entirety and an awarding authority may adopt reasonable rules or regulations in conformity with that paragraph concerning the filing, investigation and settlement of such claims:

If, during the progress of the work, the contractor or the awarding authority discovers that the actual subsurface or latent physical conditions encountered at the site differ substantially or materially from those shown on the plans or indicated in the contract documents either the contractor or the contracting authority may request an equitable adjustment in the contract price of the contract applying to work affected by the differing site conditions. A request for such an adjustment shall be in writing and shall be delivered by the party making such claim to the other party as soon as possible after such conditions are discovered. Upon receipt of such a claim from a contractor, or upon its own initiative, the contracting authority shall make an investigation of such physical conditions, and, if they differ substantially or materially from those shown on the plans or indicated in the contract documents or from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the plans and contract documents and are of such a nature as to cause an increase or decrease in the cost of performance of the work or a change in the construction methods required for the performance of the work which results in an increase or decrease in the cost of the work, the contracting authority shall make an equitable adjustment in the contract price and the contract shall be modified in writing accordingly.

Chapter 30: Section 39O. Contracts for construction and materials; suspension, delay or interruption due to order of awarding authority; adjustment in contract price; written claim

Section 39O. Every contract subject to the provisions of section thirty-nine M of this chapter or subject to section forty-four A of chapter one hundred forty-nine shall contain the following provisions (a) and (b) in their entirety and, in the event a suspension, delay, interruption or failure to act of the awarding authority increases the cost of performance

to any subcontractor, that subcontractor shall have the same rights against the general contractor for payment for an increase in the cost of his performance as provisions (a) and (b) give the general contractor against the awarding authority, but nothing in provisions (a) and (b) shall in any way change, modify or alter any other rights which the general contractor or the subcontractor may have against each other.

(a) The awarding authority may order the general contractor in writing to suspend, delay, or interrupt all or any part of the work for such period of time as it may determine to be appropriate for the convenience of the awarding authority; provided however, that if there is a suspension, delay or interruption for fifteen days or more or due to a failure of the awarding authority to act within the time specified in this contract, the awarding authority shall make an adjustment in the contract price for any increase in the cost of performance of this contract but shall not include any profit to the general contractor on such increase; and provided further, that the awarding authority shall not make any adjustment in the contract price under this provision for any suspension, delay, interruption or failure to act to the extent that such is due to any cause for which this contract provides for an equitable adjustment of the contract price under any other contract provisions.

(b) The general contractor must submit the amount of a claim under provision (a) to the awarding authority in writing as soon as practicable after the end of the suspension, delay, interruption or failure to act and, in any event, not later than the date of final payment under this contract and, except for costs due to a suspension order, the awarding authority shall not approve any costs in the claim incurred more than twenty days before the general contractor notified the awarding authority in writing of the act or failure to act

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ATTACHMENT C

CHANGE ORDERS

Policy:

This section supplements Article 12, Change of Contract Price, in the General Conditions and Supplementary Conditions.

All executed change orders submitted to the Engineer for review and processing must be prepared in accordance with the attached change order format (Appendix A) with the appropriate number of copies, calculation sheet(s) (Appendix B) and all other supporting documentation necessary for evaluation. Failure to comply with these instructions will result in delays in processing the change order.

In order to avoid possible delays with approval of change orders, at the beginning of the project and as circumstances warrant, the Contractor shall submit a list of construction equipment, identifying major pieces of equipment to be utilized on the project. The list shall include the Contractor's designation, if any, the manufacturer, model, year of manufacture, serial number, size and horsepower of equipment. The Contractor shall also provide for approval a proposed bluebook equipment rental rate development that separately lists for each piece of equipment the monthly rental rate, area adjustment factor, depreciation factor, estimated operating cost per hour and total hourly rate. In the event the Contractor fails or is unable to provide appropriate rate information the Engineer may develop equipment rental rates for use on change orders.

Payment of Change Orders:

Payment of all change orders shall be in accordance with the relevant provisions of Massachusetts General Laws, Chapter 30, Section 39G for non-building construction and Section 39K for building construction as amended from time to time.

Payment of change orders shall be made in accordance with one of the following three methods:

A. Existing unit prices as set forth in the contract; or

B. Agreed upon lump sum or unit prices; or

C. Time and materials

A. Payment for work for which there is a unit price in the contract:

Where the contract contains a unit price for work and the Engineer orders a change for work of the same kind as other work contained in the contract and is performed under similar physical conditions, the Contractor shall accept full and final payment at the contract unit price(s) for the acceptable quantities. Under certain circumstances, the unit prices may be subject to revaluation and adjustment. See Article 11 in the Supplementary Conditions.

B. Payment for work or materials for which no price is contained in the contract:

If the Engineer directs, the Contractor shall submit promptly in writing to the Engineer an offer to do the required work on a lump sum or unit price basis, as specified by the Engineer. The stated price, either lump sum or unit price, shall be divided so as to show that it is the sum of:

1. The estimated cost of Labor, plus
2. Direct Labor Cost, plus
3. Material and Freight Costs, plus
4. Equipment Costs, plus
5. An amount not to exceed 20% of the sum of items 1 through 4 for overhead and profit, plus (if applicable),
6. In the case of work done by a subcontractor an amount not to exceed 7 ½%, for the general contractor of the sum of the cost (not including subcontractor's overhead and profit) of items 1 through 4 for his overhead and profit (less, if applicable),
7. Credits for work deleted from the contract, including actual costs of the deleted work plus the percentage of overhead, profit, bonds and insurance attributable to such credit amount.

C. Payment for work on a time and materials basis:

Unless an agreed lump sum and/or unit price is obtained as noted above and is so stated in the change price, the Contractor shall accept as full payment for which no agreement is contained in contract, an amount equal to:

1. The estimated cost of Labor, plus
2. The Direct Labor Costs, plus
3. Equipment Costs, plus
4. Material and Freight Costs, plus
5. An amount not to exceed 20% of the sum of items 1 through 4 for overhead and profit, plus, if applicable,
6. In the case of work done by a subcontractor an amount not to exceed 7 ½%, for the general contractor of the sum of the cost (not including subcontractor's overhead and profit) of items 1 through 4 for his overhead and profit (less, if applicable),
7. Credit for work deleted from the Contract, including actual costs of the deleted work plus the percentage of overhead, profit, bonds and insurance attributable to such credit amount.

Explanation of items 1 through 7 as outlined in "B" and "C" above:

1. Labor - Only those workers employed on the project who are doing the extra work, including the foreman in charge, are allowable. General foremen, superintendents, or other supervisory personnel are considered to be included in the overhead markup as provided in items 5 and/or 6. Hourly labor rates in excess of those as listed in the contract wage rates require documentation. As a minimum, an explanation and the appropriate copy of the certified payroll are required.
2. Direct Labor Costs - These costs are limited to those which are required in the contract document. Coverage in excess of the contract provisions, secured by the contractor/subcontractor(s) at his option, are ineligible. The following list of typical direct labor charges is provided for your assistance and is in no way intended to be complete or all encompassing:

   Workman's Compensation

   Federal/State: Social Security Tax and Unemployment Tax;

   Health, Welfare and Pension Benefits; (this cost is included in the wage rates appearing in the Attachment A Massachusetts Wage Rates.

Liability insurance:	Bodily injury; excess umbrella; property damage; public liability
Blasters insurance:	If applied to any required direct labor costs
Builders risk insurance:	If applied to any required direct labor costs
Experience modification insurance:	If applied to any required direct labor costs
Surcharges:	If applied to any required direct labor costs

   Following award and prior to execution of a construction contract, the Contractor and filed subbidders (where applicable) shall submit for review by the Owner, documentation to establish the markup percentage(s).

   The documented direct labor markup for this contract may be adjusted on an annual basis as measured from the date the contract is executed. The contract agreement will provide for the establishment of the Direct Labor Cost percentage.
3. Material and Freight - Only those materials required as a result of the change order and reasonable freight charges for delivery of same are allowable.
4. Equipment - Only the equipment required as a result of the change order is allowable.

Equipment rental rates shall be governed by the current Equipment Watch, division of Intertec Publishing [Formerly Nielson/Dataquest] Rental Rate Bluebook for Construction Equipment (the "Bluebook"). In determining the rental rate the following shall apply:

a. For equipment already on the project - the monthly prorated rental rate by the hourly use shall be applicable;

b. For equipment not on the project the daily rate, the weekly rate, or monthly rate will prevail, whichever will prove to be most cost effective. Small tools and manual equipment are examples of costs not allowable under this item. These costs are considered to be included in the overhead markup as provided in items 5 and/or 6.

(1 Month (Normal Use) = 176 hours)

5. Overhead and Profit - All other costs not previously mentioned are considered to be included in this item, be it for the general contractor or subcontractor(s).

6. Overhead and Profit - All other costs not previously mentioned are considered to be included in this item, be it for the general contractor or subcontractor(s).

7. Credits - Work deleted, material and equipment removed from the contract, stored and/or returned shall be credited to the cost of the change order, less documented costs.

This change order will be prepared in such manner as to clearly separate Eligible and Ineligible Costs (as applicable to state-funded projects).

The Contractor shall furnish itemized statements of the cost of the work ordered and shall give the Engineer access to all accounts, bills and vouchers relating thereto; and unless the Contractor shall furnish such itemized statements, and access to all accounts, bills and vouchers, he shall not be entitled to payment for any items of extra work for which such information is sought by the Engineer.

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APPENDIX A

CHANGE ORDER

Date	
Project Name	Downtown Area Collection System and Pumping Stations Contract No. 2019-02 and SRF No. 4486
Change Order No.	
Owner's Name:	Town of Orleans, MA
Owner's Address:	19 School Road, Orleans, Massachusetts, 02653
Contractor's Name:	
Contractor's Address:	

Change Order Summary

Item Number	Description	Amount
1		
2		
	Total	

Item 1

Description of Change:

Reason for Change:

Backup Information:

Cost:

Item 2

Description of Change:

Reason for Change:

Backup Information:

Cost:

Contract Amount (As Bid)	
Amount of Previous Change Orders	
Net Change in Contract Price (this Change Order)	
Total Adjusted Contract Price (including this Change Order	
This Change Order extends the time to complete the work by	
The extended completion date for Phase I is	
The extended completion date for Phase II is	

This Change Order checked by:

AECOM Technical Services, Inc.		
Consultant Engineer	Martin (Reggie) Donoghue, P.E. Resident Representative	Date

This Change Order is requested by: Town of Orleans, MA

This Change Order is recommended by:

AECOM Technical Services, Inc.		
Consultant Engineer	Thomas E. Parece, P.E. Associate Vice President	Date

The undersigned agree to the terms of the Change Order.

Contractor		Date
Town of Orleans, MA		
Owner	John F. Kelly Orleans Town Administrator	Date

Certification of Appropriation under M.G.L. c.44, s.31C: Adequate funding in an amount sufficient to cover the total cost of this change order is available.

By: _____ _____
Cathy Doane, Orleans Finance Director — Date

Do not write below this space: this space reserved for STATE AGENCY APPROVAL

APPENDIX B

EXAMPLE CALCULATION SHEET

1.Labor

Foreman	10 hours @	$10.00/hour	$100.00
Engineer	10 hours @	$8.80/hour	$85.00
Operator	10 hours @	$9.50/hour	$95.00
Laborers	24 hours @	$7.00/hour	$168.00
			$448.00

2.Direct Labor Cost (use the agreed upon Direct Labor Cost)

*(30)% of $448.

*(used for example purposes only) $134.00

3.Materials & Freight

150 1.f. of 12” pipe @ $2.00/1.f.	$300.00
15 v.f. precast SMH	$1,700.00
Freight (slip 652-1 enclosed)	$25.00
	$2,025.00

EXAMPLE

4.Equipment

1 Backhoe - 10 hours @ $80.00/hour	$800.00
1 Truck-crane - 10 hours @ $100.00/hour	$1,000.00
	$1,800.00
TOTAL (items 1 through 4):	**$4,407.00**

5.(20%) markup for Overhead, Profit

(20%) of $4,407 $881.00

6.(7½ %) markup on subcontractor's cost for general contractor(if subcontractor is involved)

(7½ %) of $4,407 $331.00

7.Credits (deductibles)-$323.00

TOTAL COST: $5,296.00

Reminder: Provide support documentation as necessary i.e. vouchers, correspondence, calculation, photographs, reports**.**

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DOCUMENT 00852

SPECIAL CONDITIONS - GENERAL

1.01 STATUTORY REQUIREMENTS IN GENERAL

A. Keep fully informed of all existing and future state and federal laws and municipal ordinances and regulations in any manner affecting those engaged or employed in the Work, or the materials used or employed in the Work, or in any way affecting the conduct of the Work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same and of all provisions required by law to be made a part of this Contract, all of which provisions are hereby incorporated by reference and made a part thereof. If any discrepancy or inconsistency is discovered in the Contract Documents for this Work in relation to any such law, ordinance, regulation, order or decree, report the same to the Engineer in writing. At all times observe and comply with, and cause all agents and employees to observe and comply with all such existing and future laws, ordinances, regulations, orders and decrees; and protect and indemnify the Owner and Engineer and all of its and their officers, agents, and servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by itself or its employees or subcontractors.

B. All materials furnished and Work done are to comply with all state and federal laws and regulations.

1.02 POLICE OFFICERS

A. Any police officers, reserve, special or otherwise, employed by the Contractor, shall be paid the prevailing wage rates paid to regular police officers of the municipality in which the Work is to be performed.

1.03 RELATION OF SEWER MAINS TO WATER LINES

A. Horizontal Separation

1. Whenever possible, sewers should be laid at least 10 feet, horizontally, from any existing or proposed water mains.

2. Should local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet to a water main if:

a. It is laid in a separate trench.

b. It is laid in the same trench with the water mains located at one side on a bench of undisturbed earth.

c. In either case the elevation of the crown of the sewer is at least 18 inches below the invert of the water main.

B. Vertical Separation

1. Whenever sewers must cross under water mains, the sewer shall be laid at such elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be buried to meet the above requirement, the water main shall be relocated to provide this separation or reconstruction with slip-on or mechanical-joint cast-iron pipe, or prestressed concrete cylinder pipe for a distance of 10 feet on each side of the sewer. One full length of water main shall be centered over the sewer so that both joints will be as far from the sewer as possible.

2. When a sewer crosses above a water main, the following measures will be taken:

a. Both pipes will be encased in concrete for a distance of 10 feet on either side of the crossing, or

b. The sewer will be encased in concrete and the water main will be constructed of mechanical joint ductile iron pipe for a distance of 10 feet on either side of the crossing.

C. Special Conditions

1. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, the water main shall be constructed of slip-on or mechanical-joint cast-iron pipe or prestressed concrete cylinder pipe and the sewer constructed of mechanical-joint cast-iron pipe and both services shall be pressure tested to assure water tightness.

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DOCUMENT 00855

SPECIAL CONDITIONS

COMMONWEALTH OF MASSACHUSETTS

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Article 1. Payment to Subcontractor (MGL Chapter 30, Section 39F)

Section 39F: Construction contracts; assignment and subrogation; subcontractor defined; enforcement of claim for direct payment; deposit, reduction of disputed amounts

(1) Every contract awarded pursuant to sections forty-four A to L, inclusive, of chapter one hundred and forty-nine shall contain the following subparagraphs (a) through (i) and every contract awarded pursuant to section thirty-nine M of chapter thirty shall contain the following subparagraphs (a) through (h) and in each case those subparagraphs shall be binding between the general contractor and each subcontractor.

(a) Forthwith after the general contractor receives payment on account of a periodic estimate, the general contractor shall pay to each subcontractor the amount paid for the labor performed and the materials furnished by that subcontractor, less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

(b) Not later than the sixty-fifth day after each subcontractor substantially completes his work in accordance with the plans and specifications, the entire balance due under the subcontract less amounts retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, shall be due the subcontractor; and the awarding authority shall pay that amount to the general contractor. The general contractor shall forthwith pay to the subcontractor the full amount received from the awarding authority less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

(c) Each payment made by the awarding authority to the general contractor pursuant to subparagraphs (a) and (b) of this paragraph for the labor performed and the materials furnished by a subcontractor shall be made to the general contractor for the account of that subcontractor; and the awarding authority shall take reasonable steps to compel the general contractor to make each such payment to each such subcontractor. If the awarding authority has received a demand for direct payment from a subcontractor for any amount which has already been included in a payment to the general contractor or which is to be included in a payment to the general contractor for payment to the subcontractor as provided in subparagraphs (a) and (b), the awarding authority shall act upon the demand as provided in this section.

(d) If, within seventy days after the subcontractor has substantially completed the subcontract work, the subcontractor has not received from the general contractor the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, the subcontractor may demand direct payment of that balance from the awarding authority. The demand shall be by a sworn statement delivered to or sent by certified mail to the awarding authority, and a copy shall be delivered to or sent by certified mail to the general contractor at the same time. The demand shall contain a detailed breakdown of the balance due under the subcontract and also a statement of the status of completion of the subcontract work. Any demand made after substantial completion of the subcontract work shall be valid even if delivered or mailed prior to the seventieth day after the subcontractor has substantially completed the subcontract work. Within ten days after the subcontractor has delivered or so mailed the demand to the awarding authority and delivered or so mailed a copy to the general contractor, the general contractor may reply to the demand. The reply shall be by a sworn statement delivered to or sent by certified mail to the awarding authority and a copy shall be delivered to or sent by certified mail to the subcontractor at the same time. The reply shall contain a detailed breakdown of the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor and of the amount due for each claim made by the general contractor against the subcontractor.

(e) Within fifteen days after receipt of the demand by the awarding authority, but in no event prior to the seventieth day after substantial completion of the subcontract work, the awarding authority shall make direct payment to the subcontractor of the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount (i) retained by the awarding authority as the estimated cost of completing the incomplete or unsatisfactory items of work, (ii) specified in any court proceedings barring such payment, or (iii) disputed by the general contractor in the sworn reply; provided, that the awarding authority shall not deduct from a direct payment any amount as provided in part (iii) if the reply is not sworn to, or for which the sworn reply does not contain the detailed breakdown required by subparagraph (d). The awarding authority shall make further direct payments to the subcontractor forthwith after the removal of the basis for deductions from direct payments made as provided in parts (i) and (ii) of this subparagraph.

(f) The awarding authority shall forthwith deposit the amount deducted from a direct payment as provided in part (iii) of subparagraph (e) in an interest-bearing joint account in the names of the general contractor and the subcontractor in a bank in Massachusetts selected by the awarding authority or agreed upon by the general contractor and the subcontractor and shall notify the general contractor and the subcontractor of the date of the deposit and the bank receiving the deposit. The bank shall pay the amount in the account, including accrued interest, as provided in an agreement between the general contractor and the subcontractor or as determined by decree of a court of competent jurisdiction.

(g) All direct payments and all deductions from demands for direct payments deposited in an interest-bearing account or accounts in a bank pursuant to subparagraph (f) shall be made out of amounts payable to the general contractor at the time of receipt of a demand for direct payment from a subcontractor and out of amounts which later become payable to the general contractor and in the order of receipt of such demands from subcontractors. All direct payments shall discharge the obligation of the awarding authority to the general contractor to the extent of such payment.

(h) The awarding authority shall deduct from payments to a general contractor amounts which, together with the deposits in interest-bearing accounts pursuant to subparagraph (f), are sufficient to satisfy all unpaid balances of demands for direct payment received from subcontractors. All such amounts shall be earmarked for such direct payments, and the subcontractors shall have a right in such deductions prior to any claims against such amounts by creditors of the general contractor.

(i) If the subcontractor does not receive payment as provided in subparagraph (a) or if the general contractor does not submit a periodic estimate for the value of the labor or materials performed or furnished by the subcontractor and the subcontractor does not receive payment for same when due less the deductions provided for in subparagraph (a), the subcontractor may demand direct payment by following the procedure in subparagraph (d) and the general contractor may file a sworn reply as provided in that same subparagraph. A demand made after the first day of the month following that for which the subcontractor performed or furnished the labor and materials for which the subcontractor seeks payment shall be valid even if delivered or mailed prior to the time payment was due on a periodic estimate from the general contractor. Thereafter the awarding authority shall proceed as provided in subparagraph (e), (f), (g) and (h).

(2) Any assignment by a subcontractor of the rights under this section to a surety company furnishing a bond under the provisions of section twenty-nine of chapter one hundred forty-nine shall be invalid. The assignment and subrogation rights of the surety to amounts included in a demand for direct payment which are in the possession of the awarding authority or which are on deposit pursuant to subparagraph (f) of paragraph (1) shall be subordinate to the rights of all subcontractors who are entitled to be paid under this section and who have not been paid in full.

(3) "Subcontractor" as used in this section (i) for contracts awarded as provided in sections forty-four A to forty-four H, inclusive, of chapter one hundred forty-nine shall mean a person who files a sub-bid and receives a subcontract as a result of that filed sub-bid or who is approved by the awarding authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the general contractor, (ii) for contracts awarded as provided in paragraph (a) of section thirty-nine M of chapter thirty shall mean a person approved by the awarding authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the general contractor, and (iii) for contracts with the commonwealth not awarded as provided in forty-four A to forty-four H, inclusive, of chapter one hundred forty-nine shall also mean a person contracting with the general contractor to supply materials used or employed in a public works project for a price in excess of five thousand dollars.

(4) A general contractor or a subcontractor shall enforce a claim to any portion of the amount of a demand for direct payment deposited as provided in subparagraph (f) of paragraph 1 by a petition in equity in the superior court against the other and the bank shall not be a necessary party. A subcontractor shall enforce a claim for direct payment or a right to require a deposit as provided in subparagraph (f) of paragraph 1 by a petition in equity in the superior court against the awarding authority and the general contractor shall not be a necessary party. Upon motion of any party the court shall advance for speedy trial any petition filed as provided in this paragraph. Sections fifty-nine and fifty-nine B of chapter two hundred thirty-one shall apply to such petitions. The court shall enter an interlocutory decree upon which execution shall issue for any part of a claim found due pursuant to sections fifty-nine and fifty-nine B and, upon motion of any party, shall advance for speedy trial the petition to collect the remainder of the claim. Any party aggrieved by such interlocutory decree shall have the right to appeal therefrom as from a final decree. The court shall not consolidate for trial the petition of any subcontractor with the petition of one or more subcontractors or the same general contract unless the court finds that a substantial portion of the evidence of the same events during the course of construction (other than the fact that the claims sought to be consolidated arise under the same general contract) is applicable to the petitions sought to be consolidated and that such consolidation will prevent unnecessary duplication of evidence. A decree in any such proceeding shall not include interest on the disputed amount deposited in excess of the interest earned for the period of any such deposit. No person except a subcontractor filing a demand for direct payment for which no funds due the general contractor are available for direct payment shall have a right to file a petition in court of equity against the awarding authority claiming a demand for direct payment is premature and such subcontractor must file the petition before the awarding authority has made a direct payment to the subcontractor and has made a deposit of the disputed portion as provided in part (iii) of subparagraph (e) and in subparagraph (f) of paragraph (1).

(5) In any petition to collect any claim for which a subcontractor has filed a demand for direct payment the court shall, upon motion of the general contractor, reduce by the amount of any deposit of a disputed amount by the awarding authority as provided in part (iii) of subparagraph (e) and in subparagraph (f) of paragraph (1) any amount held under a trustee writ or pursuant to a restraining order or injunction.

Article 2. Deviations from Plans and Specifications (MGL Chapter 30, Section 39I)

Section 39I: Deviations from plans and specifications

Every contractor having a contract for the construction, alteration, maintenance, repair or demolition of, or addition to, any public building or public works for the commonwealth, or of any political subdivision thereof, shall perform all the work required by such contract in conformity with the plans and specifications contained therein. No willful and substantial deviation from said plans and specifications shall be made unless authorized in writing by the awarding authority or by the engineer or architect in charge of the work who is duly authorized by the awarding authority to approve such deviations. In order to avoid delays in the prosecution of the work required by such contract such deviation from the plans or specifications may be authorized by a written order of the awarding authority or such engineer or architect so authorized to approve such deviation. Within thirty days thereafter, such written order shall be confirmed by a certificate of the awarding authority stating: (1) If such deviation involves any substitution or elimination of materials, fixtures or equipment, the reasons why such materials, fixtures or equipment were included in the first instance and the reasons for substitution or elimination, and, if the deviation is of any other nature, the reasons for such deviation, giving justification therefor; (2) that the specified deviation does not materially injure the project as a whole; (3) that either the work substituted for the work specified is of the same cost and quality, or that an equitable adjustment has been agreed upon between the contracting agency and the contractor and the amount in dollars of said adjustment; and (4) that the deviation is in the best interest of the contracting authority.

Such certificate shall be signed under the penalties of perjury and shall be a permanent part of the file record of the work contracted for.

Whoever violates any provision of this section willfully and with intent to defraud shall be punished by a fine of not more than five thousand dollars or by imprisonment for not more than six months, or both.

Article 3. No Arbitrary Decisions are Final (MGL Chapter 30, Section 39J)

Section 39J: Public construction contracts; effect of decisions of contracting body or administrative board

Notwithstanding any contrary provision of any contract for the construction, reconstruction, alteration, remodeling, repair or demolition of any public building or public works by the commonwealth, or by any county, city, town, district, board, commission or other public body, when the amount of the contract is more than five thousand dollars in the case of the commonwealth and more than two thousand dollars in the case of any county, city, town, district, board, commission or other public body, a decision, by the contracting body or by any administrative board, official or agency, or by any architect or engineer, on a dispute, whether of fact or of law, arising under said contract shall not be final or conclusive if such decision is made in bad faith, fraudulently, capriciously, or arbitrarily is unsupported by substantial evidence, or is based upon error of law.

Article 4. Construction Work by Foreign Corporations (MGL Chapter 30, Section 39L)

Section 39L: Public construction work by foreign corporations; restrictions and reports

Section 39L. The commonwealth and every county, city, town, district, board, commission or other public body which, as the awarding authority, requests proposals, bids or sub-bids for any work in the construction, reconstruction, alteration, remodeling, repair or demolition of any public building or other public works (1) shall not enter into a contract for the work with, and shall not approve as a subcontractor furnishing labor and materials for a part of the work, a foreign corporation which has not filed with the awarding authority a certificate of the state secretary stating that the corporation has complied with requirements of section 15.03 of subdivision A of Part 15 of chapter 156D and the date of compliance, and further has filed all annual reports required by section 16.22 of subdivision B of Part 16 of said chapter 156D, and (2) shall report to the state secretary and to the department of corporations and taxation any foreign corporation performing work under such contract or subcontract, and any person, other than a corporation, performing work under such contract or subcontract, and residing or having a principal place of business outside the commonwealth.

Article 5. Substitution of Equal Products (MGL Chapter 30, Section 39M (b))

Section 39M: Contracts for construction and materials; manner of awarding

(a) Every contract for the construction, reconstruction, alteration, remodeling or repair of any public work, or for the purchase of any material, as hereinafter defined, by the commonwealth, or political subdivision thereof, or by any county, city, town, district or housing authority that is and estimated by the awarding authority to cost less than $10,000 dollars shall be obtained through the exercise of sound business practices as defined in section 2 of chapter 30B. The awarding authority shall make and keep a record of each procurement that, at a minimum, shall include the name and address of the person from whom the services were procured. An awarding authority that utilizes a vendor on a statewide contract procured through the operational services division, or a blanket contract procured by the awarding authority pursuant to this section, shall be deemed to have obtained the contract through sound business practices.

Every contract for the construction, reconstruction, alteration, remodeling or repair of any public work, or for the purchase of any material, as hereinafter defined, by the commonwealth, or political subdivision thereof, or by any county, city, town, district or housing authority that is estimated by the awarding authority to cost not less than $10,000 but not more than $50,000 shall be awarded to the responsible bidder offering to perform the contract at the lowest price. The awarding authority shall make public notification of the contract and shall seek written responses from no fewer than 3 persons who customarily perform such work. For purposes of this subsection, the term "public notification" shall include, but need not be limited to, posting, at least 2 weeks before the time specified in the notification for the receipt of responses, the contract and scope-of-work statement: (1) on the website of the awarding authority, (2) on the COMMBUYS system administered by the operational services division, (3) in the central register published pursuant to section 20A of chapter 9 and (4) in a conspicuous place in or near the primary office of the awarding authority; provided, however, that if the awarding authority obtains a minimum of 2 written responses from a vendor list established through a blanket contract or a statewide contract procured through the operational services division, and the lowest of those written responses is deemed acceptable to the awarding authority, public notification is not required. The solicitation shall include a scope-of-work statement that defines the work to be performed and provides potential responders with sufficient information regarding the objectives and requirements of the awarding authority and the time period within which the work shall be completed. The awarding authority shall record the names and addresses of all persons from whom written responses were sought, the names of the persons submitting written responses and the date and amount of each written response.

An awarding authority may utilize a vendor list established through a statewide contract procured through the operational services division to identify 1 or more of the persons from whom it will seek written responses for purposes of this subsection. An awarding authority may also procure a blanket contract to establish a listing of vendors in certain defined categories of work that are under contract to provide services for multiple individual tasks of not more than $50,000 each, and from whom written responses will be sought. Any such blanket contract procured by the awarding authority shall be procured pursuant to this section or sections 44A to 44J, inclusive, of chapter 149 which are applicable to projects over $50,000.

Every contract for the construction, reconstruction, alteration, remodeling or repair of any public work, or for the purchase of any material, as hereinafter defined, by the commonwealth, or political subdivision thereof, or by any county, city, town, district or housing authority that is estimated by the awarding authority to cost more than $50,000, and every contract for the construction, reconstruction, installation, demolition, maintenance or repair of any building by a public agency, as defined by subsection (1) of section 44A of chapter 149, estimated to cost more than $50,000 but not more than $150,000, shall be awarded to the lowest eligible responsible bidder on the basis of competitive bids publicly opened and read by the awarding authority forthwith upon expiration of the time for the filing thereof; provided, however, that such awarding authority may reject any and all bids, if it is in the public interest to do so. Every bid for such contract shall be accompanied by a bid deposit in the form of: (1) a bid bond, (2) cash, or (3) a certified check on, or a treasurer's or cashier's check issued by, a responsible bank or trust company, payable to the awarding authority. The amount of the bid deposit shall be 5 per cent of the value of the bid. Any person submitting a bid pursuant to this section shall, on such bid, certify as follows:

The undersigned certifies under penalties of perjury that this bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this paragraph the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity.

_____

(Name of person signing bid)

_____

(Company)

This subsection shall not apply to the award of any contract subject to the provisions of sections 44A to 44J, inclusive, of chapter 149 and every such contract shall continue to be awarded as provided therein. In cases of extreme emergency: (1) caused by enemy attack, sabotage or other such hostile actions or (2) resulting from an imminent security threat explosion, fire, flood, earthquake, hurricane, tornado or other such catastrophe, an awarding authority may, without competitive bids and notwithstanding any general or special law, award contracts otherwise subject to this subsection to perform work and to purchase or rent materials and equipment, all as may be necessary for temporary repair and restoration to service of any and all public work in order to preserve the health and safety of persons or property; provided, that this exception shall not apply to any permanent reconstruction, alteration, remodeling or repair of any public work.

(b) Specifications for such contracts, and specifications for contracts awarded pursuant to the provisions of said sections forty-four A to forty-four L of said chapter one hundred and forty-nine, shall be written to provide for full competition for each item of material to be furnished under the contract; except, however, that said specifications may be otherwise written for sound reasons in the public interest stated in writing in the public records of the awarding authority or promptly given in writing by the awarding authority to anyone making a written request therefor, in either instance such writing to be prepared after reasonable investigation. Every such contract shall provide that an item equal to that named or described in the said specifications may be furnished; and an item shall be considered equal to the item so named or described if, in the opinion of the awarding authority: (1) it is at least equal in quality, durability, appearance, strength and design, (2) it will perform at least equally the function imposed by the general design for the public work being contracted for or the material being purchased, and (3) it conforms substantially, even with deviations, to the detailed requirements for the item in the said specifications. For each item of material the specifications shall provide for either a minimum of three named brands of material or a description of material which can be met by a minimum of three manufacturers or producers, and for the equal of any one of said name or described materials.

(c) The term "lowest responsible and eligible bidder" shall mean the bidder: (1) whose bid is the lowest of those bidders possessing the skill, ability and integrity necessary for the faithful performance of the work; (2) who shall certify, that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed in the work; (3) who shall certify that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee; (4) who, where the provisions of section 8B of chapter 29 apply, shall have been determined to be qualified thereunder; and (5) who obtains within 10 days of the notification of contract award the security by bond required under section 29 of chapter 149; provided that for the purposes of this section the term "security by bond" shall mean the bond of a surety company qualified to do business under the laws of the commonwealth and satisfactory to the awarding authority; provided further, that if there is more than 1 surety company, the surety companies shall be jointly and severally liable.

(d) The provisions of this section shall not apply (1) to the extent that they prevent the approval of such specifications by any contributing federal agency, (2) to materials purchased under specifications of the state department of highways at prices established by the said department pursuant to advertisement and bidding in connection with work to be performed under the provisions of chapter eighty-one or chapter ninety, (3) to any transaction between the commonwealth and any of its political subdivisions or between the commonwealth and any public service corporation, and (4) to any contract of not more than $50,000 awarded by a governmental body, as defined by section two of chapter thirty B, in accordance with the provisions of section five of said chapter thirty B; and (5) to any contract solely for the purchase of material awarded by a governmental body, as defined by section 2 of chapter 30B, in accordance with section 5 of said chapter 30B, or procured through the operational services division pursuant to sections 22 and 52 of chapter 7.

(e) The word "material" as used in this section shall mean and include any article, assembly, system, or any component part thereof.

Article 6. Differing Site Conditions (MGL Chapter 30, Section 39N)

Section 39N: Construction contracts; equitable adjustment in contract price for differing subsurface or latent physical conditions

Section 39N. Every contract subject to section forty-four A of chapter one hundred and forty-nine or subject to section thirty-nine M of chapter thirty shall contain the following paragraph in its entirety and an awarding authority may adopt reasonable rules or regulations in conformity with that paragraph concerning the filing, investigation and settlement of such claims:

If, during the progress of the work, the contractor or the awarding authority discovers that the actual subsurface or latent physical conditions encountered at the site differ substantially or materially from those shown on the plans or indicated in the contract documents either the contractor or the contracting authority may request an equitable adjustment in the contract price of the contract applying to work affected by the differing site conditions. A request for such an adjustment shall be in writing and shall be delivered by the party making such claim to the other party as soon as possible after such conditions are discovered. Upon receipt of such a claim from a contractor, or upon its own initiative, the contracting authority shall make an investigation of such physical conditions, and, if they differ substantially or materially from those shown on the plans or indicated in the contract documents or from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the plans and contract documents and are of such a nature as to cause an increase or decrease in the cost of performance of the work or a change in the construction methods required for the performance of the work which results in an increase or decrease in the cost of the work, the contracting authority shall make an equitable adjustment in the contract price and the contract shall be modified in writing accordingly.

Article 7. Equitable Adjustments for Delays (MGL Chapter 30, Section 39O)

Section 39O: Contracts for construction and materials; suspension, delay or interruption due to order of awarding authority; adjustment in contract price; written claim

Section 39O. Every contract subject to the provisions of section thirty-nine M of this chapter or subject to section forty-four A of chapter one hundred forty-nine shall contain the following provisions (a) and (b) in their entirety and, in the event a suspension, delay, interruption or failure to act of the awarding authority increases the cost of performance to any subcontractor, that subcontractor shall have the same rights against the general contractor for payment for an increase in the cost of his performance as provisions (a) and (b) give the general contractor against the awarding authority, but nothing in provisions (a) and (b) shall in any way change, modify or alter any other rights which the general contractor or the subcontractor may have against each other.

(a) The awarding authority may order the general contractor in writing to suspend, delay, or interrupt all or any part of the work for such period of time as it may determine to be appropriate for the convenience of the awarding authority; provided however, that if there is a suspension, delay or interruption for fifteen days or more or due to a failure of the awarding authority to act within the time specified in this contract, the awarding authority shall make an adjustment in the contract price for any increase in the cost of performance of this contract but shall not include any profit to the general contractor on such increase; and provided further, that the awarding authority shall not make any adjustment in the contract price under this provision for any suspension, delay, interruption or failure to act to the extent that such is due to any cause for which this contract provides for an equitable adjustment of the contract price under any other contract provisions.

(b) The general contractor must submit the amount of a claim under provision (a) to the awarding authority in writing as soon as practicable after the end of the suspension, delay, interruption or failure to act and, in any event, not later than the date of final payment under this contract and, except for costs due to a suspension order, the awarding authority shall not approve any costs in the claim incurred more than twenty days before the general contractor notified the awarding authority in writing of the act or failure to act involved in the claim.

Article 8. Decisions on Interpretation of Specifications (MGL Chapter 30, Section 39P)

Section 39P: Contracts for construction and materials; awarding authority's decisions on interpretation of specifications, etc.; time limit; notice

Section 39P. Every contract subject to section thirty-nine M of this chapter or section forty-four A of chapter one hundred forty-nine which requires the awarding authority, any official, its architect or engineer to make a decision on interpretation of the specifications, approval of equipment, material or any other approval, or progress of the work, shall require that the decision be made promptly and, in any event, no later than thirty days after the written submission for decision; but if such decision requires extended investigation and study, the awarding authority, the official, architect or engineer shall, within thirty days after the receipt of the submission, give the party making the submission written notice of the reasons why the decision cannot be made within the thirty day period and the date by which the decision will be made.

Article 9. Contractor’s Records (MGL Chapter 30, Section 39R)

Section 39R: Keeping and maintaining of books, records and accounts; statement of management on internal accounting control; financial statements; enforcement

Section 39R. (a) The words defined herein shall have the meaning stated below whenever they appear in this section:

(1) "Contractor" means any person, corporation, partnership, joint venture, sole proprietorship, or other entity awarded a contract pursuant to sections thirty-eight A1/2 to thirty-eight O, inclusive, of chapter seven and any contract awarded or executed pursuant to section eleven C of chapter twenty-five A, section thirty-nine M of chapter thirty, or sections forty-four A to forty-four H, inclusive, of chapter one hundred and forty-nine, which is for an amount or estimated amount greater than one hundred thousand dollars.

(2) "Contract" means any contract awarded or executed pursuant to sections thirty-eight A1/2 to thirty-eight O, inclusive, of chapter seven and any contract awarded or executed pursuant to section eleven C of chapter twenty-five A, section thirty-nine M of chapter thirty, or sections forty-four A through forty-four H, inclusive, of chapter one hundred and forty-nine, which is for amount or estimated amount greater than one hundred thousand dollars.

(3) "Records" means books of original entry, accounts, checks, bank statements and all other banking documents, correspondence, memoranda, invoices, computer printouts, tapes, discs, papers and other documents or transcribed information of any type, whether expressed in ordinary or machine language.

(4) "Independent Certified Public Accountant" means a person duly registered in good standing and entitled to practice as a certified public accountant under the laws of the place of his residence or principal office and who is in fact independent. In determining whether an accountant is independent with respect to a particular person, appropriate consideration should be given to all relationships between the accountant and that person or any affiliate thereof. Determination of an accountant's independence shall not be confined to the relationships existing in connection with the filing of reports with the awarding authority.

(5) "Audit", when used in regard to financial statements, means an examination of records by an independent certified public accountant in accordance with generally accepted accounting principles and auditing standards for the purpose of expressing a certified opinion thereon, or, in the alternative, a qualified opinion or a declination to express an opinion for stated reasons.

(6) "Accountant's Report", when used in regard to financial statements, means a document in which an independent certified public accountant indicates the scope of the audit which he has made and sets forth his opinion regarding the financial statements taken as a whole with a listing of noted exceptions and qualifications, or an assertion to the effect that an overall opinion cannot be expressed. When an overall opinion cannot be expressed the reason therefor shall be stated. An accountant's report shall include as a part thereof a signed statement by the responsible corporate officer attesting that management has fully disclosed all material facts to the independent certified public accountant, and that the audited financial statement is a true and complete statement of the financial condition of the contractor.

(7) "Management", when used herein, means the chief executive officers, partners, principals or other person or persons primarily responsible for the financial and operational policies and practices of the contractor.

(8) Accounting terms, unless otherwise defined herein, shall have a meaning in accordance with generally accepted accounting principles and auditing standards.

(b) Subsection (a)(2) hereof notwithstanding, every agreement or contract awarded or executed pursuant to sections thirty-eight A1/2 to thirty-eight O, inclusive, of chapter seven, or eleven C of chapter twenty-five A, and pursuant to section thirty-nine M of chapter thirty or to section forty-four A through H, inclusive, of chapter one hundred and forty-nine, shall provide that:

(1) The contractor shall make, and keep for at least six years after final payment, books, records, and accounts which in reasonable detail accurately and fairly reflect the transactions and dispositions of the contractor, and

(2) until the expiration of six years after final payment, the office of inspector general, and the commissioner of capital asset management and maintenance shall have the right to examine any books, documents, papers or records of the contractor or of his subcontractors that directly pertain to, and involve transactions relating to, the contractor or his subcontractors, and

(3) if the agreement is a contract as defined herein, the contractor shall describe any change in the method of maintaining records or recording transactions which materially affect any statements filed with the awarding authority, including in his description the date of the change and reasons therefor, and shall accompany said description with a letter from the contractor's independent certified public accountant approving or otherwise commenting on the changes, and

(4) if the agreement is a contract as defined herein, the contractor has filed a statement of management on internal accounting controls as set forth in paragraph (c) below prior to the execution of the contract, and

(5) if the agreement is a contract as defined herein, the contractor has filed prior to the execution of the contracts and will continue to file annually, an audited financial statement for the most recent completed fiscal year as set forth in paragraph (d) below.

(c) Every contractor awarded a contract shall file with the awarding authority a statement of management as to whether the system of internal accounting controls of the contractor and its subsidiaries reasonably assures that:

(1) transactions are executed in accordance with management's general and specific authorization;

(2) transactions are recorded as necessary

i. to permit preparation of financial statements in conformity with generally accepted accounting principles, and

ii. to maintain accountability for assets;

(3) access to assets is permitted only in accordance with management's general or specific authorization; and

(4) the recorded accountability for assets is compared with the existing assets at reasonable intervals and appropriate action was taken with respect to any difference.

Every contractor awarded a contract shall also file with the awarding authority a statement prepared and signed by an independent certified public accountant, stating that he has examined the statement of management on internal accounting controls, and expressing an opinion as to

(1) whether the representations of management in response to this paragraph and paragraph (b) above are consistent with the result of management's evaluation of the system of internal accounting controls; and

(2) whether such representations of management are, in addition, reasonable with respect to transactions and assets in amounts which would be material when measured in relation to the applicant's financial statements.

(d) Every contractor awarded a contract by the commonwealth or by any political subdivision thereof shall annually file with the commissioner of capital asset management and maintenance during the term of the contract a financial statement prepared by an independent certified public accountant on the basis of an audit by such accountant. The final statement filed shall include the date of final payment. All statements shall be accompanied by an accountant's report. Such statements shall be made available to the awarding authority upon request.

(e) The office of inspector general, the commissioner of capital asset management and maintenance and any other awarding authority shall enforce the provisions of this section. The commissioner of capital asset management and maintenance may after providing an opportunity for the inspector general and other interested parties to comment, promulgate pursuant to the provisions of chapter thirty A such rules, regulations and guidelines as are necessary to effectuate the purposes of this section. Such rules, regulations and guidelines may be applicable to all awarding authorities. A contractor's failure to satisfy any of the requirements of this section may be grounds for debarment pursuant to section forty-four C of chapter one hundred and forty-nine.

(f) Records and statements required to be made, kept or filed under the provisions of this section shall not be public records as defined in section seven of chapter four and shall not be open to public inspection; provided, however, that such records and statements shall be made available pursuant to the provisions of clause (2) of paragraph (b).

Article 10. Limitations on Hours of Work (MGL Chapter 149, Section 34)

Section 34: Public contracts; stipulation as to hours and days of work; void contracts

Section 34. Every contract, except for the purchase of material or supplies, involving the employment of laborers, workmen, mechanics, foremen or inspectors, to which the commonwealth or any county or any town, subject to section thirty, is a party, shall contain a stipulation that no laborer, workman, mechanic, foreman or inspector working within the commonwealth, in the employ of the contractor, sub-contractor or other person doing or contracting to do the whole or a part of the work contemplated by the contract, shall be required or permitted to work more than eight hours in any one day or more than forty-eight hours in any one week, or more than six days in any one week, except in cases of emergency, or, in case any town subject to section thirty-one is a party to such a contract, more than eight hours in any one day, except as aforesaid; provided, that in contracts entered into by the department of highways for the construction or reconstruction of highways there may be inserted in said stipulation a provision that said department, or any contractor or sub-contractor for said department, may employ laborers, workmen, mechanics, foremen and inspectors for more than eight hours in any one day in such construction or reconstruction when, in the opinion of the commissioner, public necessity so requires. Every such contract not containing the aforesaid stipulation shall be null and void.

Article 11. Advertising Invitations to Bid (MGL Chapter 149, Section 44J)

Section 44J: Invitations to bid; notice; contents; violations; penalty

(1) No public agency or authority of the commonwealth or any political subdivision thereof shall award any contract for which competitive bids are required pursuant to section forty-four A of this chapter or section thirty-nine M of chapter thirty, or for which competitive proposals are required pursuant to subsection (4) of section forty-four E of this chapter or section eleven C of chapter twenty-five A, unless a notice inviting bids or proposals therefor shall have been posted no less than one week prior to the time specified in such notice for the receipt of said bids or proposals in a conspicuous place in or near the offices of the awarding authority, and shall have remained posted until the time so specified, and unless such notice shall also have been published at least once not less than two weeks prior to the time so specified in the central register published by the secretary of state pursuant to section twenty A of chapter nine and in a newspaper of general circulation in the locality of the proposed project, and on the COMMBUYS system administered by the operational services division. Said notice shall also be published at such other times and in such other newspapers or trade periodicals as the commissioner of capital asset management and maintenance may require, having regard to the locality of the work involved.

(2) Said notice shall specify the time and place where plans and specifications of the proposed work may be had; the time and place of submission of general bids; and the time and place for opening of the general bids. For contracts subject to the provisions of sections forty-four A to H, inclusive, of this chapter, said notice shall also specify the time and place for submission of filed sub-bids, where required pursuant to section forty-four F; and the time and place for opening of said filed sub-bids.

Said notice shall also provide sufficient facts concerning the nature and scope of such project, the type and elements of construction, and such other information as will assist applicants in deciding to bid on such contract.

(3) No contract or preliminary plans and specifications shall be split or divided for the purpose of evading the provisions of this section.

(4) General bids and filed sub-bids for any contract subject to this section shall be in writing and shall be opened in public at the time and place specified in the posted or published notice, and after being so opened shall be open to public inspection.

(5) The provisions of this section shall not apply to any transaction between the commonwealth and any public service corporation.

(6) The provisions of this section may be waived in cases of extreme emergency involving the health and safety of the people and their property, upon the written approval of said commissioner. The written approval shall contain a description of the circumstances and the reasons for the commissioner's determination.

(7) Whoever violates any provision of this section shall be punished by a fine of not more than ten thousand dollars or by imprisonment in the state prison for not more than three years or in a jail or house of correction for not more than two and one-half years, or by both said fine and imprisonment; and in the event of final conviction, said person shall be incapable of holding any office of honor, trust or profit under the commonwealth or under any county, district of municipal agency.

Each and every person who shall cause or conspire to cause any contract or preliminary plans and specifications to be split or divided for the purpose of evading the provisions of this section shall forfeit and pay to the commonwealth, a political subdivision thereof or other awarding authority subject to this section, the sum of not more than five thousand dollars and, in addition, such person or persons shall pay, apportioned among them, double the amount of damages which the commonwealth or political subdivision thereof or other awarding authority may have sustained by reason of the doing of such act, together with the costs of the action.

(8) If an awarding authority rejects all general bids or does not receive any general bids, and advertises for a second opening of general bids with the original filed sub-bids as set forth in subsection (1) of section forty-four E the notice for receipt of such general bids may be published in the central register and elsewhere as required not less than one week prior to the time specified for such second opening of general bids.

(9) No request for proposals or invitation for bids issued under sections 38A 1/2 to 38O, inclusive, of chapter 7, section 11C of chapter 25A, section 39M of chapter 30, this section and sections 44A to 44H, inclusive, shall be advertised if the awarding authority's cost estimate is greater than 1 year old.

Article 12. Excavations; Notice; Penalties (MGL Chapter 82, Section 40)

Section 40: Definitions

Section 40. The following words, as used in this section and sections 40A to 40E, inclusive, shall have the following meanings:

"Company", natural gas pipeline company, petroleum or petroleum products pipeline company, public utility company, cable television company, and municipal utility company or department that supply gas, electricity, telephone, communication or cable television services or private water companies within the city or town where such excavation is to be made.

"Description of excavation location", such description shall include the name of the city or town, street, way, or route number where appropriate, the name of the streets at the nearest intersection to the excavation, the number of the buildings closest to the excavation or any other description, including landmarks, utility pole numbers or other information which will accurately define the location of the excavation.

"Emergency", a condition in which the safety of the public is in imminent danger, such as a threat to life or health or where immediate correction is required to maintain or restore essential public utility service.

"Excavation", an operation for the purpose of movement or removal of earth, rock or the materials in the ground including, but not limited to, digging, blasting, augering, backfilling, test boring, drilling, pile driving, grading, plowing in, hammering, pulling in, jacking in, trenching, tunneling and demolition of structures, excluding excavation by tools manipulated only by human power for gardening purposes and use of blasting for quarrying purposes.

"Excavator", any entity including, but not limited to, a person, partnership, joint venture, trust, corporation, association, public utility, company or state or local government body which performs excavation operations.

"Premark", to delineate the general scope of the excavation or boring on the paved surface of the ground using white paint, or stakes or other suitable white markings on nonpaved surfaces. No premarking shall be acceptable if such marks can reasonably interfere with traffic or pedestrian control or are misleading to the general public. Premarking shall not be required of any continuous excavation that is over 500 feet in length.

"Safety zone", a zone designated on the surface by the use of standard color-coded markings which contains the width of the facilities plus not more than 18 inches on each side.

"Standard color-coded markings", red - electric power lines, cables, conduit or light cables; yellow - gas, oil, street petroleum, or other gaseous materials; orange - communications cables or conduit, alarm or signal lines; blue - water, irrigation and slurry lines; green - sewer and drain lines; white - premark of proposed excavation.

"System", the underground plant damage prevention system as defined in section 76D of chapter 164.

Section 40A: Excavations; notice

Section 40A. No excavator installing a new facility or an addition to an existing facility or the relay or repair of an existing facility shall, except in an emergency, make an excavation, in any public or private way, any company right-of-way or easement or any public or privately owned land or way, unless at least 72 hours, exclusive of Saturdays, Sundays and legal holidays but not more than 30 days before the proposed excavation is to be made, such excavator has premarked not more than 500 feet of the proposed excavation and given an initial notice to the system. Such initial notice shall set forth a description of the excavation location in the manner as herein defined. In addition, such initial notice shall indicate whether any such excavation will involve blasting and, if so, the date and the location at which such blasting is to occur.

The notice requirements shall be waived in an emergency as defined herein; provided, however, that before such excavation begins or during a life-threatening emergency, notification shall be given to the system and the initial point of boring or excavation shall be premarked. The excavator shall ensure that the underground facilities of the utilities in the area of such excavation shall not be damaged or jeopardized.

In no event shall any excavation by blasting take place unless notice thereof, either in the initial notice or a subsequent notice accurately specifying the date and location of such blasting shall have been given and received at least 72 hours in advance, except in the case of an unanticipated obstruction requiring blasting when such notice shall be not less than four hours prior to such blasting. If any such notice cannot be given as aforesaid because of an emergency requiring blasting, it shall be given as soon as may be practicable but before any explosives are discharged.

Section 40B: Designation of location of underground facilities

Section 40B. Within 72 hours, exclusive of Saturdays, Sundays and legal holidays, from the time the initial notice is received by the system or at such time as the company and the excavator agree, such company shall respond to the initial notice or subsequent notice by designating the location of the underground facilities within 15 feet in any direction of the premarking so that the existing facilities are to be found within a safety zone. Such safety zone shall be so designated by the use of standard color-coded markings. The providing of such designation by the company shall constitute prima facie evidence of an exercise of reasonable precaution by the company as required by this section; provided, however, that in the event that the excavator has given notice as aforesaid at a location at which because of the length of excavation the company cannot reasonably designate the entire location of its facilities within such 72 hour period, then such excavator shall identify for the company that portion of the excavation which is to be first made and the company shall designate the location of its facilities in such portion within 72 hours and shall designate the location of its facilities in the remaining portion of the location within a reasonable time thereafter. When an emergency notification has been given to the system, the company shall make every attempt to designate its facilities as promptly as possible.

Section 40C: Excavator's responsibility to maintain designation markings; damage caused by excavator

Section 40C. After a company has designated the location of its facilities at the location in accordance with section 40B, the excavator shall be responsible for maintaining the designation markings at such locations, unless such excavator requests remarking at the location due to the obliteration, destruction or other removal of such markings. The company shall then remark such location within 24 hours following receipt of such request.

When excavating in close proximity to the underground facilities of any company when such facilities are to be exposed, non-mechanical means shall be employed, as necessary, to avoid damage in locating such facility and any further excavation shall be performed employing reasonable precautions to avoid damage to any underground facilities including, but not limited to, any substantial weakening of structural or lateral support of such facilities, penetration or destruction of any pipe, main, wire or conduit or the protective coating thereof, or damage to any pipe, main, wire or conduit.

If any damage to such pipe, main, wire or conduit or its protective coating occurs, the company shall be notified immediately by the excavator responsible for causing such damage.

The making of an excavation without providing the notice required by section 40A with respect to any proposed excavation which results in any damage to a pipe, main, wire or conduit, or its protective coating, shall be prima facie evidence in any legal or administrative proceeding that such damage was caused by the negligence of such person.

Section 40D: Local laws requiring excavation permits; public ways

Section 40D. Nothing in this section shall affect or impair local ordinances or by-laws requiring a permit to be obtained before excavation in a public way or on private property; but notwithstanding any general or special law, ordinance or by-law to the contrary, to the extent that any permit issued under the provisions of the state building code or state fire code requires excavation by an excavator on a public way or on private property, the permit shall not be valid unless the excavator notifies the system as required pursuant to sections 40 and 40A, before the commencement of the excavation, and has complied with the permitting requirements of chapter 82A.

Section 40E: Violations of Secs. 40A to 40E; punishment

Section 40E. Any person or company found by the department of telecommunications and energy, after a hearing, to have violated any provision of sections 40A to 40E, inclusive, shall be fined $1,000 for the first offense and not less than $5,000 nor more than $10,000 for any subsequent offense within 12 consecutive months as set forth by the rules of said department; provided, however, that nothing herein shall be construed to require forfeiture of any penal sum by a state or local government body for violation of section 40A or 40C; and provided, further, that nothing herein shall be construed to require the forfeiture of any penal sum by a residential property owner for the failure to premark for an excavation on such person's residential property.

Article 13. Price Adjustments for Certain Materials in Construction Projects (MGL Chapter 30, Section 38A)

Section 38A: Price adjustment clause in contracts for road, bridge, water and sewer projects awarded under Sec. 39M

Section 38A. Contracts for road and bridge projects awarded as a result of a proposal or invitation for bids under section 39M shall include a price adjustment clause for each of the following materials: fuel, both diesel and gasoline; asphalt; concrete; and steel. Contracts for water and sewer projects awarded as a result of a proposal or invitation for bids under said section 39M shall include a price adjustment clause for fuel, both diesel and gasoline; liquid asphalt; and portland cement contained in cast-in-place concrete. A base price for each material shall be set by the awarding authority or agency and shall be included in the bid documents at the time the project is advertised. The awarding authority or agency shall also identify in the bid documents the price index to be used for each material. The price adjustment clause shall provide for a contract adjustment to be made on a monthly basis when the monthly cost change exceeds plus or minus 5 per cent.

END OF DOCUMENT

DOCUMENT 00858

SPECIAL CONDITIONS - PERMITS AND LICENSES

1.01 LIST OF PERMITS AND/OR LICENSES

A. The Town of Orleans has received the following Permits and Licenses:

1. Cape Cod Commission – Consistency Review
2. Massachusetts Historical Commission (MHC)
3. Massachusetts Department of Environmental Protection – CWMP Approval
4. Orleans, MA - Conservation Commission - Order of Conditions
5. United States Army Corps of Engineers
6. Massachusetts Department of Transportation (MassDOT) - Road Opening
7. Massachusetts Department of Transportation (MassDOT) - Roadway 6 Crossing

The Applications and Permits and Licenses are included as an Attachment and are made part of the Contract Documents.

The Contractor is responsible for comping with the terms, conditions and any special conditions specified in the Permits and Licensees.

B. The Town of Orleans has applied for and anticipates obtaining the following Permits and Licenses prior to the bid date.

1. Not used

C. ATTACHMENTS

1. The Town of Orleans has obtained various easements for the Project. The Easements are included as an Attachment and are made part of the Contract Documents.
2. MassDOT Permit No. 5-2019-0473, as attached.
3. MassDOT Permit No. 5-2019-0487, as attached.

D. Town of Orleans, MA Trench and Road Opening Permit (To be issued after the Contract is awarded).

END OF TEXT

See Attachments

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Cape Cod Commission – Consistency Review

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Massachusetts Historical Commission (MHC)

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Massachusetts Department of Environmental Protection – CWMP Approval

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Orleans, MA - Conservation Commission - Order of Conditions

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United States Army Corps of Engineers

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Massachusetts Department of Transportation (MassDOT) - Roadway 6 Crossing

5-2019-0473

PERMIT – ORLEANS

Subject to all terms, conditions, and restrictions printed or written below, permission is hereby granted to the **TOWN OF ORLEANS,** Tom Daley, 19 School Road, Orleans, MA 02653 to enter upon the State Highway in the Town of **ORLEANS** on Auto Route 6, locally known as Mid-Cape Highway, for the purpose of installing three (3) 8" sewer force mains and conduits in a 48" sleeve under Route 6 (Mid-Cape Highway) to be installed by Horizontal Directional Drilling. The purpose of the proposed work is to extend sewer force main service to a new Sanitary Sewer Collection, Treatment, and Disposal System to serve the Downtown Area of the Town of Orleans, Massachusetts.

The sewer force main installation will enter the State Highway Layout by the use of horizontal directional drilling from two (2) jacking pits, one on each side of Route 6 between Exit 12 and Rock Harbor Road, at approximate Station 99+25. Both the southerly pit (30'x12'), and northerly pit (20'x12'), will be located outside the SHLO on Town-owned property.

THE SEWER FORCE MAIN MUST BE INSTALLED UNDER THE STATE HIGHWAY BY THE USE OF TRENCHLESS TECHNOLOGY.

This Permit is being issued on the condition that the grant of a utility easement by MassDOT, Highway Division will be conveyed to the Town of Orleans once the necessary protocols for disposition are met. Additionally, the Grantee(s) must meet all conditions described in the Standard Operating Procedures S.O.P. NO. ROW-10-10-1-000 for "State Highway Layout Alterations or Easements needed for State Highway Access Permits".

This work will include survey work to monitor road surface settlement during the installation of the underground pipeline. Survey work includes the installation of monitoring points for road surface settlement. All points should be surveyed prior to initiating any construction to establish a baseline record. Subsequent surveying must take place at the completion of each day and should continue until the pipe is successfully installed and work is complete. Additionally, the Grantee(s) must inform MassDOT, Highway Division, District 5 Permits Office and Boston Geotechnical Section whenever monitoring points indicate a vertical change in elevation of one-half (1/2) inch or more or any surface disruption is observed. All drilling and pipe installation operations will stop until the problem is resolved.

The Grantee(s) must fulfill all conditions described in the document for "Geotechnical Section Application Requirements and Permit Conditions: Trenchless Pipe Installation" by the Massachusetts Department of Transportation, dated June 1996 and March 2015.

PRIOR TO THE COMMENCEMENT OF SAID WORK, THE GRANTEE(S) SHALL CONTACT THE DISTRICT PERMITS ENGINEER AT (508) 884-4306 TO SET UP A PRECONSTRUCTION CONFERENCE. THE CONFERENCE MUST BE HELD AT LEAST FIVE (5) BUSINESS DAYS PRIOR TO PERFORMING WORK WITHIN THE S.H.L.O.

Due to the fact that a second Permit (#5-2019-0487) is also to be issued to you to install gravity sewer, sewer manholes, sewer force mains, sewer services and communications conduit on Routes 6A and 28 and within the State Highway Layout, only one Preconstruction Conference will therefore be required for both Permits.

District 5, 1000 County Street Taunton, MA 02780
Tel: (508) 824-6633, FAX: (508) 880-6102
www.mass.gov/orgs/highway-division

All work is to be done as described herein and as shown on the plan(s) entitled "Town of Orleans, MA – Downtown Area Collection System and Pump Stations, Contract No. 2019-02" as drafted by AECOM Technical Services, Inc., 9 Jonathan Bourne Drive, Pocasset, MA 02559, tel.: (508) 833-6950 and last revised December 09, 2019.

BE ADVISED THAT THE GEOTECHNICAL REVIEW DID NOT INCLUDE THE PROPOSED HORIZONTAL DIRECTIONAL DRILLING AREAS THAT ARE LOCATED OUTSIDE OF ROUTE 6 HIGHWAY EMBANKMENTS.

THIS PERMIT IS BEING ISSUED FOR WORK WITHIN THE STATE HIGHWAY LAYOUT (S.H.L.O.) ONLY. AUTHORIZATION TO PERFORM ASSOCIATED WORK OUTSIDE OF S.H.L.O. MUST BE GRANTED BY IMPACTED PROPERTY OWNERS.

MASSDOT, HIGHWAY DIVISION, DISTRICT 5 RESERVES THE RIGHT TO REQUIRE THE TOWN OF ORLEANS TO PERFORM NECESSARY REPAIRS IN THE EVENT THAT THE EXISTING MASSDOT OWNED 18-INCH DRAINAGE MAIN IS IMPACTED BY THIS WORK.

ADDITIONALLY, IF ANY SETTLEMENT OCCURS ON THE ROADWAY DUE TO THIS WORK, THE GRANTEE WILL BE RESPONSIBLE TO PERFORM REPAIR OF THE SETTLED AREA PLUS MILLING AND OVERLAYING THE ENTIRE PAVEMENT CURB TO CURB (LENGTH TO BE DETERMINED AT THE DISCRETION OF THE DEPARTMENT).

Prior to any work being done within the State Highway Layout, the Grantee(s) must upload/submit a Work Request in State Highway Access Permit System (SHAPS) to obtain approval for the proposed work schedule. Said form to be completed/uploaded can be found under the Forms and Sample Submission Documents tab and is entitled "Work Request Form D1 - D5". One (1) of these forms must be uploaded by the close of business every Thursday for the entire duration of the project in order to request approval for the following week's work schedule.

The Grantee(s) must adhere to 520 CMR 14.00: Excavation and Trench Safety as promulgated by the Department of Public Safety in conjunction with the Division of Occupational Safety pursuant to authority granted by M.G.L. c. 82a § 1. If not already approved, a Trench Permit Rider must be completed and uploaded to SHAPS before any trench work is performed under this Permit.

The Grantee(s) must strictly adhere to the Order of Conditions issued by the Orleans Conservation Commission (D.E.P. #SE 54-2481) which is considered an integral part of this Permit.

The Grantee(s) shall be responsible for all litter and debris generated from their property during the work as described herein and/or from all prospective residents, visitors or patrons of all existing or proposed facilities mentioned herein. This responsibility shall remain in effect for the entirety of all current or future owners of said property. The Grantee(s) shall perform routine inspections and upkeep within the State Highway Layout. If conditions warrant an individual to enter in or within the proximity of a travelled way, the Grantee(s) shall assume all liability and responsibility for the removal of all litter and debris or the hiring of an appropriate party to perform such duties. Significant work within the travelled way may require a police detail. In consideration to all abutters, the Grantee(s) must take notice to the drifting of debris and the removal thereof. If it is found that this requirement is not being fulfilled in a satisfactory manner, MassDOT, Highway Division may decide to clean the area at the Grantee's expense.

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THE BACKFILLING METHOD FOR WORK WITHIN THE SHOULDER AREA WILL BE AS FOLLOWS:

Backfill for conduit or pipe shall be selected from excavation free from large lumps, clods, or rock placed between the pipe and the walls of the trench in layers not exceeding 6-inch in depth and thoroughly compacted. Each layer, if dry, shall be moistened and then compacted by rolling or by tamping with mechanical rammers. Special care should be taken to thoroughly compact the fill under the haunches of the pipe or conduit. This method of filling and compacting shall be continued until the material is level with the top of the pipe or conduit. The remainder of the filling shall consist of suitable material placed in successive layers not more than 6-inch in depth. Each layer shall be thoroughly compacted as specified above.

If the work is to be performed within the soft shoulder, the excavation might be performed within the immediate area along the edge of road and may diminish the integrity of the hardened surface. Therefore, if the excavation directly abuts or tapers under the hardened surface of the roadway, the opening must be backfilled with Controlled Density Fill (CDF) to prevent undermining and preserve the roadway.

The Grantee(s) shall be responsible for the shoulder and roadway areas affected by the proposed work to be performed as described herein and shall routinely inspect said areas for deficiencies such as settling, heaving, cracks etc. This responsibility shall remain until work is performed at the subject location by MassDOT, Highway Division.

TIME RESTRICTIONS AND NOTIFICATIONS

DUE TO HEAVY SUMMER TRAFFIC, NO WORK SHALL BE PERFORMED ON THIS PROJECT BETWEEN MEMORIAL DAY WEEKEND AND LABOR DAY WEEKEND WITHOUT PRIOR APPROVAL FROM THE DISTRICT HIGHWAY DIRECTOR.

Special attention shall be given when performing work that will impact MassDOT, Highway Division, snow and ice operations.

No work shall be performed in the hardened surface of the roadway between November 15th and April 1st of any year without prior written approval from the District Highway Director.

No pavement shall be laid between November 15th and April 1st of any year without prior written approval from the District Highway Director.

No work shall be performed on this project on Saturdays, Sundays, and Holidays, or on the Friday after a Thursday Holiday. Work is also restricted on the day before and the day after a long Holiday weekend without prior written approval by the District Highway Director.

No equipment, trucks, etc., shall occupy any part of the travelled way except between the hours of **9:00 a.m. and 3:00 p.m., Monday - Friday**. In no case will operations exceed the specified hours. This includes the placement of traffic control devices, equipment, or anything that restricts the flow of traffic through the construction zone. Any change in work hours will require prior written approval by the District Highway Director. The 12-minute rule will remain in effect for the duration of the permit.

All other work, off the pavement on this project is restricted to a normal 8-hour day, Monday - Friday, with the prime Contractor and all subcontractors working on the same shift. Any change in work hours will require prior written approval by the District Highway Director.

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GENERAL TRAFFIC MANAGEMENT AND SAFETY REQUIREMENTS

If required by MassDOT, Highway Division District 5, variable message boards (VMBs) shall be utilized as part of the approved traffic management plan under this Permit which must be properly secured with regards to hacking and unauthorized tampering prevention. The Grantee(s) shall adhere to all appropriate security specifications and take all necessary precautions to mitigate the risk of the boards being hacked. All VMBs shall be stored in a secured area and shall have a lockable, weatherproof enclosure for the operator interface, removable local keyboards which shall be removed whenever possible, and a password protected controller with local administrative passwords changed on a regular basis.

When any portion of the roadway will be blocked with equipment to facilitate the proposed work, the Grantee(s) will be required to adhere to the attached Traffic Management Plan (TMP) or submit a proposed TMP to MassDOT, Highway Division, to be reviewed and approved by the District Traffic Maintenance Engineer prior to working within or impacting the roadway. The plan must include information relating to proper signing, traffic control device placement and police details.

It is imperative to maintain two-way traffic at all times and these operations are managed so that motorists travel "delay" is minimized. At any time during the operation when a traffic delay of over twelve (12) minutes occurs and the situation is worsening, the Resident Engineer, Contractor, or Police Detail will begin to suspend operations. Continuously increasing "delays" of over twelve (12) minutes are not to be permitted.

If traffic must be "stopped", the duration shall not be more than five (5) minutes.

Uniformed State/Local Police Officer(s) and their official vehicle(s) may be necessary to provide protection for those installing and removing all temporary traffic warning signs and devices and to perform all traffic management as required.

The Grantee(s) will monitor the flow of traffic during peak traffic volumes and if necessary, shall suspend all operations. Work will resume at the discretion of the Police detail officer and/or to the satisfaction of the supervising MassDOT, Highway Division, Engineer.

In the event of inclement weather or dense fog, which lessens the visibility of advance warning signs, vehicles and workers, the Grantee(s) will suspend all operations so as not to interfere with the safety of the motoring public and the operations of work. In the event of snow or icing conditions, all vehicles and equipment must be removed from the roadway and/or shoulder area so as not to interfere with Snow and Ice Operations.

The Grantee(s) shall provide safe and ready means of access and egress to all public and private roads and drives 24 hours per day. Every effort must be made as not to interfere with or inconvenience all abutters throughout the duration of this project.

Signs and traffic control devices are required for advance notice of the work and within the work area.

The Grantee(s) or Applicant will supply all required signs and traffic warning devices and shall be in accordance with the Massachusetts Manual on Uniform Traffic Control Devices. The number and location of all signs and devices shall be as deemed necessary by the Engineer for the safe and efficient performance of the work and the safety of the travelling public.

All warning devices shall be subject to removal, replacement, and/or repositioning by the applicant as often as deemed necessary by the Engineer.

Cones or non-reflectorized warning devices shall not be left in operating position on the highway when the daytime operations have ceased. If it becomes necessary for MassDOT, Highway Division, to remove the construction warning devices or their appurtenances from the project due to negligence by the applicant, all costs for this work will be charged to the Grantee(s).

All vehicles, except passenger's cars, which are assigned to the permitted project and which operate on the site at speeds of 25 MPH or less, shall have an official SLOW-MOVING VEHICLE emblem displayed. All vehicles and equipment on this project must be equipped with back-up alarms.

All personnel who are working on the travelled way or breakdown lanes shall wear approved safety vests and hard hats.

GENERAL CONDITIONS AND APPROVED PROCEDURES

The Grantee(s) must contact the "Dig Safe" Center at 811 to obtain a "Dig Safe" number prior to starting the proposed excavation for the purpose of identifying the location of underground utilities.

IF THE PROPOSED WORK FALLS WITHIN THE AREA OF A SIGNALIZED INTERSECTION, the Grantee(s) must contact the District Traffic Maintenance Engineer at (508) 884-4208 at least two (2) weeks prior to the commencement of said work to locate the existing traffic signal conduit/detectors and to coordinate this work so as not to disturb the traffic signals. The Grantee(s) will be responsible to repair/replace all damaged items and will be billed for any cost incurred to restore normal operation to MassDOT, Highway Division, signal equipment to the satisfaction of the Engineer.

Unless otherwise stated, no hardened surface of the State Highway may be disturbed.

When an opening in the roadway is required and permitted herein, the opening must be as small as possible to perform the proposed work.

If the integrity of any existing sidewalks, catch basins, manholes or any other underground structures or equipment is compromised, the Grantee(s) will reconstruct and/or replace all items according to MassDOT, Highway Division, Standards at the cost of the Grantee(s) and to the satisfaction of the Engineer.

The Grantee(s) must not disturb or remove any MassDOT, Highway Division, bound(s) (MHB) associated with this project. If so disturbed or missing, the bound(s) must be reset/replaced by a Registered Land Surveyor. All procedures and materials must be in compliance with Massachusetts Design and Construction Standards. A copy of the paid bill must be submitted to this office upon completion of said work.

All traffic safety lines if disturbed shall be replaced in kind.

All disturbed areas within the State Highway Layout must be graded, loamed, and seeded to the Engineer's satisfaction.

All debris and litter remaining from the proposed construction shall be removed by the Grantee(s) and the area left clean daily.

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DRAINAGE AND UTILITY CASTINGS

"The use of risers to adjust drainage and utility structures will not be allowed. All adjustment work done to existing or new drainage structures shall conform to Section 220 of MassDOT, Highway Division, Standard Specifications and according to Plates 201.3.0 and 202.9.0 of MassDOT, Highway Division, Construction Standards."

ENVIRONMENTAL LIABILITY AND COMPLIANCE

The Grantee(s) assumes all risk associated with any environmental condition within the subject property and shall be solely responsible for all costs associated with evaluating, assessing, and remediating, in accordance with all applicable laws, any environmental contamination (1) discovered during Grantee's work or activities under this Permit to the extent such evaluation, assessment or remediation is required for Grantee's work, or (2) resulting from the Grantee's work or activities under this Permit. The Grantee(s) shall notify MassDOT, Highway Division, of any such assessment and remediation activities.

The Grantee(s) is hereby held solely responsible for obtaining and maintaining any and all environmental compliance permits required by local, state, and federal laws and regulations when regular or emergency work is proposed within, or in close proximity to, any wetland area. These environmental compliance requirements include, but are not limited to, a Negative Determination of Applicability or Order of Conditions from the local Conservation Commission, a Water Quality Certificate from the Department of Environmental Protection, and a Programmatic General Permit from the U.S. Army Corps of Engineers. The Grantee(s) shall forward to MassDOT, Highway Division, a copy of each such environmental compliance permit.

CLOSING CONDITIONS

All of said work shall comply with the terms and conditions herein and must be done as directed by and to the satisfaction of the engineer.

All work done under this contract shall be in conformance with the 2020 Edition of the MassDOT Highway Division Standard Specifications for Highways and Bridges. All construction shall conform to the October 2017 edition of the Massachusetts Department of Transportation, Highway Division "Construction Standard Details (English Edition)"; the latest Manual on Uniform Traffic Control Devices with Massachusetts Amendments; the latest edition to the following: the 1996 Construction and Traffic Standard Details (as related to Traffic Standard details only); the 1990 Standard Drawings for Traffic Signs and Supports; the 1968 Standard Drawings for Traffic Signals and Highway Lighting; the latest edition of American Standard for Nursery Stock; the Plans and these Special Provisions.

The Grantee(s) shall indemnify and save harmless the Commonwealth and MassDOT, Highway Division, against all suits, claims or liability of every name and nature arising at the time out of or in consequence of the acts of the Grantee(s) in the performance of the work covered by this Permit and/or failure to comply with the terms and conditions of this Permit whether by themselves or their employees or subcontractors.

It is noted that the Grantee(s) will be responsible for future corrective actions resulting from defective work under the subject permit. Any damage to roadway and/or shoulder as a result of the permitted work is the Grantee's responsibility and shall be repaired at his/her expense.

The Completion of Work Form and supporting photos shall be electronically uploaded, via the State Highway Access Permit System (SHAPS), as soon as possible after the completion of the physical work to begin the sign-off process.

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MassDOT, Highway Division, will hold the Permit on file for a period of not less than three (3) years. If the Completion of Work Form is not uploaded, the liability assumed under this Permit will continue.

A copy of this Permit must be on the job site at all times for inspection. Failure to have this Permit available at the site will result in suspension of the rights granted by the Permit.

"FOLLOWING CONDITIONS APPLY TO PERMITS"
Conditions Relating Particularly to Permits for the Laying of Pipes, Conduits, etc.

After any pipes, conduits, drains or other underground structures are laid, or any excavation is made in the roadway, the trenches or openings shall be properly backfilled with suitable material, the back-filling shall be thoroughly tamped, and the surface of the road over said structures shall be left even with the adjoining ground. If the work is done in cold weather no frozen material shall be used for backfilling.

Wherever the hardened surface of the roadway, gutters, or any part of the surface of the highway is disturbed it shall be replaced in as good condition as before it was disturbed, and if new materials are required they shall correspond with those already in place on the road.

Where service pipes are to cross the highway, the connections shall be made without disturbing the hardened surface of the roadway, by driving the pipes under the roadway, or the service pipes shall be carried under and across the road in a larger pipe, unless otherwise ordered by the Director.

The Grantee shall maintain the surface of the roadway over said structures as long as MassDOT may deem necessary, until all signs of the trenches shall have been eliminated.

CONDITIONS RELATING PARTICULARLY TO PERMITS FOR THE ERECTION OF POLES, WIRES, AND OVERHEAD STRUCTURES, AND THE CUTTING AND TRIMMING OF TREES

In the erection of pole lines, unless otherwise herein provided, no trees located within the limits of the State Highway shall be cut or trimmed. No guy wires shall be attached to trees without a special permit from MassDOT, and in no event shall they be so attached as to girdle the trees or in any way interfere with their growth. The wires shall be so protected at all time and places that they shall not interfere with or injure the trees either inside or outside the location of the highway.

Where the cutting or trimming of trees is authorized by this permit, only such cutting and trimming shall be done as may be designated by the Director.

In the construction or reconstruction of pole lines no guy wires shall be erected nearer to the surface of the ground than six feet; provided, however, that the owners of such lines may maintain such guy wires at a lower elevation than six feet from the ground until such time as MassDOT shall notify them to remove said wires or to the elevation first stated.

In order to protect the trees through which any wires may pass, said wires shall be insulated and such other tree guards used as may be directed by the Director.

Where high tension wires are erected under this permit, they shall be so located that, under conditions of maximum severity as regards a coating of ice or snow, there shall be a space of at least eight feet between such high-tension wires and other wires.

The Grantee shall, within sixty days from the date of completion of the work, file in the office of MassDOT a plan showing the location of each pole erected in accordance with the permit, said plan to be of such size and in such form as MassDOT may direct.

GENERAL AND ADDITIONAL CONDITIONS

Whenever the word "MassDOT" is used herein it shall mean the Massachusetts Department of Transportation of the Commonwealth of Massachusetts.

Whenever the word "Director" is used herein it shall mean the District Highway Director or other authorized representative of MassDOT.

Whenever the word "Grantee" is used herein it shall mean the person or persons, corporation or municipality to whom this permit is granted, or their legal representatives.

During the progress of the work all structures underground and above ground shall be properly protected from damage or injury; such barriers shall be erected and maintained as may be necessary for the protection of the traveling public; the same shall be properly lighted at night; and the Grantee shall be responsible for the damages to persons or property due to or resulting from any work done under this permit.

Except as herein authorized, no excavation shall be made, or obstacle placed within the limits of the State highways in such a manner as to interfere unnecessarily with the travel over said road.

lf any grading of sidewalk work done under this permit interferes with the drainage of the State highway in any way, such catch basins and outlets shall be constructed as may be necessary, in the opinion of the Director, to take proper care of such drainage.

Wherever the hardened surface of the roadway is disturbed and the Director may consider it necessary or advisable to do so, said surface will be restored by the employees of MassDOT, at such time as MassDOT may direct, and the expense thereof shall be borne by the Grantee, who shall purchase and deliver on the road the materials necessary for said work if and when directed by the Director. All payments to the supplier and to laborers, inspectors, etc., employed by MassDOT for or on account of the work herein contemplated shall be made by said Grantee forthwith on receipt of written orders, pay rolls, or vouchers approved by MassDOT.

IF THE GRANTEE DOES ANY WORK CONTRARY TO THE ORDERS OF THE DIRECTOR, AND, AFTER DUE NOTICE, FAILS TO CORRECT SUCH WORK OR TO REMOVE STRUCTURES OR MATERIALS ORDERED TO BE REMOVED, OR FAILS TO COMPLETE WITHIN THE SPECIFIED TIME THE WORK AUTHORIZED BY TIDS PERMIT, MASSDOT MAY, WITH OR WITHOUT NOTICE, CORRECT OR COMPLETE SUCH WORK IN WHOLE OR IN PART, OR REMOVE SUCH STRUCTURES OR MATERIALS, AND THE GRANTEE SHALL REIMBURSE MASSDOT FOR ANY EXPENSE INCURRED IN CORRECTING AND/OR COMPLETING THE WORK OR REMOVING THE STRUCTURES OR MATERIALS.

ALL OF THE WORK HEREIN CONTEMPLATED SHALL BE DONE UNDER THE SUPERVISION AND TO THE SATISFACTION OF THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, AND THE ENTIRE EXPENSE THEREOF SHALL BE BORNE BY THE GRANTEE.

On the completion of the work herein contemplated all rubbish and debris shall be removed and the roadway and roadsides shall be left neat and presentable and satisfactory to the Director.

MassDOT hereby reserves the right to order the change of location or the removal of any structure or' structures authorized by this permit at any time, said change or removal to be made by and at the expense of the Grantee or its I their successors or assigns.

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This permit may be modified or revoked at any time by MassDOT without rendering said MassDOT or the Commonwealth of Massachusetts liable in any way.

The Grantee shall pay the salary, subsistence and travel expenses of any inspector appointed by MassDOT to supervise the work herein contemplated.

All of the above conditions shall be applicable to the work herein authorized, unless the same are inconsistent with the conditions on the face of the permit, in which case the conditions written or printed on the face of the permit shall apply.

The acceptance of this permit or the doing of any work thereunder shall constitute an agreement by the Grantee to comply with all of the conditions and restrictions printed or written herein.

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www.mass.gov/orgs/highway-division

Charles D. Baker. Governor
Karyn E. Polito, Lieutenant Governor
Stephanie Pollack, Secretary & CEO
Jonathan L. Gulliver, Highway Administrator

massDOT
Massachusetts Department of Transportation
Highway Division

Approved Signature



Mary-Joe Perry by B.T.
District Highway Director

Date of Issue: February 19, 2020

Permit Expiration: Saturday, February 20, 2021

District 5, 1000 County Street Taunton, MA 02780
Tel: (508) 824-6633, FAX: (508) 880-6102
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Massachusetts Department of Transportation (MassDOT) - Road Opening

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5-2019-0487

PERMIT - ORLEANS

Subject to all terms, conditions, and restrictions printed or written below, permission is hereby granted to the **TOWN OF ORLEANS**, Tom Daley, 19 School Road, Orleans, MA 02653 to enter upon the State Highway in the Town of **ORLEANS** on Auto Routes 6A and 28, locally known as Cranberry Highway and South Orleans Road respectively, for the purpose of installing a gravity sewer main, sewer force mains, forty (40) sewer manholes, sewer services, and communications conduit within the State Highway Layout as follows:

This work is being granted to install the sewer force mains and gravity sewer mains, with appurtenances, to accommodate a new sanitary sewer collection system and pump stations in the Downtown Area.

SEWER FORCE MAIN

ROUTE 6A – BETWEEN WEST ROAD AND #119 CRANBERRY HIGHWAY (ROUTE 6A)

The first sewer force main installation will begin at a proposed sewer manhole (SMH G-03-11) to be located at the intersection of Cranberry Highway (Route 6A) and West Road, at approximate Station 0+00. The installation will proceed easterly within an open cut trench along Cranberry Highway (Route 6A) approximately 1,083 ft. where it will end at proposed sewer manhole (SMH G-04-2), at approximate Station 10+83.

The second sewer force main installation will begin at proposed sewer manhole (SMH G-04-03) to be located in the middle of Cranberry Highway (Route 6A), at approximate Station 11+50. The installation will proceed easterly within an open cut trench along Cranberry Highway (Route 6A) approximately 1,950 ft. where it will end at proposed sewer manhole (SMH F-04-54), at approximate Station 30+50.

ROUTE 6A – BETWEEN #96 CRANBERRY HIGHWAY (ROUTE 6A) AND THE EASTHAM TOWN LINE

The first sewer force main installation will begin at an existing sewer manhole (SMH F-04-14) located in the middle of Cranberry Highway (Route 6A) in front of the property at #96 Cranberry Highway, at approximate Station 42+20. The installation will proceed easterly within an open cut trench along Cranberry Highway (Route 6A) approximately 580 ft. where it will end at proposed sewer manhole (SMH E-04-30), at approximate Station 48+00.

The second sewer force main installation will begin at proposed sewer manhole (SMH E-04-10) to be located in the middle of Cranberry Highway (Route 6A), at approximate Station 48+75. The installation will proceed easterly within an open cut trench along Cranberry Highway (Route 6A), to approximate Station 55+00 where it will cross southerly to the sewer manhole (SMH E-04-01) located on South Orleans Road, at approximate Station 6+75 = 56+06 and proceed

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northerly along South Orleans Road where it will be tied to a proposed sewer manhole (SMH D-05-03), at approximate Station 77+57.

ROUTE 28 – BETWEEN ROUTE 6A AND CUMMINGS ROAD

The first sewer force main installation will extend from the existing sewer manhole (SMH E-04-01) located at the westerly corner of South Orleans Road, at approximate Station 6+75. The installation will proceed southerly within an open cut trench along South Orleans Road (Route 28) approximately 675 ft. where it will be tied to an existing sewer manhole (SMH E-04-05), at approximate Station 0+00.

The second sewer force main installation will begin at a proposed sewer manhole (SMH E-04-06) to be located in front of #25 South Orleans Road, at approximate Station 0+00. The installation will proceed southerly within an open cut trench along South Orleans Road (Route 28) approximately 928 ft. where it will be tied to an existing sewer manhole (SMH F-04-31), at approximate Station 9+28. The installation will then proceed westerly along Cummings Road and out of the State Highway Layout.

SEWER MANHOLES

The following sewer manholes will be installed along Cranberry Highway (Route 6A) and South Orleans Road (Route 28), at locations/Stations as shown on the approved plans, within the State Highway Layout.

CRANBERRY HIGHWAY: SMH G-03-15, SMH G-03-16, SMH G-03-17, SMH G-03-18, SMH G-03-19, SMH G-04-2, SMH G-04-03, SMH G-04-04, SMH G-04-05, SMH G-04-06, SMH G-04-07, SMH F-04-23, SMH F-04-22, SMH F-04-52, SMH F-04-53, SMH F-04-54, SMH E-04-31, SMH E-04-30, SMH E-04-10, SMH E-04-09, SMH E-04-08, SMH E-04-07, SMH E-05-07, SMH E-05-06, SMH E-05-05, SMH E-05-04, SMH E-05-09, SMH E-05-10, SMH D-05-01, SMH D-05-02 and SMH D-05-03.

SOUTH ORLEANS ROAD: SMH E-04-06, SMH F-04-34, SMH F-04-33. SMH F-04-32, SMH E-04-01, SMH E-04-13, SMH E-04-05, SMH E-04-04, SMH E-04-03, SMH E-04-02 and SMH E-04-01.

All other proposed sewer manholes shown on the approved plans are located outside the State Highway Layout.

LATERAL SEWER SERVICE CONNECTIONS - CRANBERRY HIGHWAY (ROUTE 6A)

There are seven (7) sewer service connections which will extend from the newly installed 8-inch gravity sewer main, three (3) in a southerly direction and four (4) northerly, as is shown on the approved plans.

LATERAL SEWER SERVICE CONNECTIONS - SOUTH ORLEANS ROAD (ROUTE 28)

There are three (3) sewer service connections which will extend from the newly installed 8-inch gravity sewer main, two (2) will extend in an easterly direction, and one (1) will extend both easterly and westerly along Cove Road and out of the State Highway Layout, as is shown on the approved plans.

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In conjunction with this work, the Grantee will replace numerous water services and water main connections as shown on the approved plans.

The proposed work requires temporary and permanent easements for the construction, installation, maintenance, improvement, repair, replacement and/or relocation of subsurface sanitary sewer force main, gravity sewer lines, pipes, and appurtenances. Therefore, the recorded documentation has been submitted and is considered an integral part of this Permit.

IT IS NOTED THAT THE LONGITUDINAL SEWER MAIN IS WITHIN THE TRAVEL LANE(S) AND IMPACTS THE TRAVEL LANE(S) OF MOTORISTS. THE PAVEMENT REPAIR WILL THEREFORE REQUIRE MILLING AND OVERLAYING WITH 2" (INCHES) OF SURFACE COURSE (CURB TO CURB). THE PERMANENT REPAIR OF THE TRENCH, INCLUDING THE MILLING AND OVERLAYING, MUST BE DONE AFTER COMPLETION OF THE 90-DAY SETTLEMENT PERIOD AS DESCRIBED IN THIS PERMIT.

FINAL PAVEMENT REPAIR JOINTS MUST BE SQUARE AND PERPENDICULAR TO THE DIRECTION OF TRAVEL.

The permanent trench repair shall be done as indicated below. Please note that the final trench repair must include a minimum of 7" (inches) of Hot Mix Asphalt or match the existing thickness of the Hot Mix Asphalt for the roadway, whichever is larger.

1. 8" (inches) of gravel plus 4" (inches) Dense Graded Crushed Stone (DGCS) over it.
2. 3" (inch) Intermediate or Base Course
3. 2" (inch) Intermediate Course
4. 2" (inch) Surface Course
5. Asphalt emulsion tack coat (RS-1H) must be placed between each course.
6. All vertical edges must be coated with hot poured joint sealer.
7. All damaged pavement markings shall be restriped in kind.

All pavement compositions must meet MassDOT's latest Standards and Specifications for Highways and Bridges.

THE TOWN MUST COORDINATE THIS WORK WITH THE WORK INVOLVED UNDER PERMIT #5-2019 -0473, ISSUED TO THE TOWN OF ORLEANS ON FEBRUARY 19, 2020 FOR THE EXTENSION OF A SEWER FORCE MAIN TO ACCOMMODATE A NEW SANITARY SEWER COLLECTION, TREATMENT AND DISPOSAL SYSTEM FOR THE DOWNTOWN AREA OF THE TOWN OF ORLEANS, MASSACHUSETTS.
A THREE-YEAR PERFORMANCE BOND FOR THE AMOUNT OF $3,000,000.00 IS REQUIRED PRIOR TO STARTING ANY CONSTRUCTION WORK WITHIN THE STATE HIGHWAY LAYOUT.

All work is to be done as described herein and as shown on the plan(s) entitled "Town of Orleans, MA – Downtown Area Collection System and Pump Station, MassDOT Permit Plans Route 6A & 28, Contract No. 2019-02" as drafted by AECOM Technical Services, Inc., 9 Jonathan Bourne Drive, Pocasset, MA 02559, tel.: (508) 833-6950 and last revised February 26, 2020.

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THIS PERMIT IS BEING ISSUED FOR WORK WITHIN THE STATE HIGHWAY LAYOUT (S.H.L.O.) ONLY. AUTHORIZATION TO PERFORM ASSOCIATED WORK OUTSIDE OF S.H.L.O. MUST BE GRANTED BY IMPACTED PROPERTY OWNERS.

PLEASE BE ADVISED THAT IN THE EVENT THAT ANY OF THE DRAINAGE STRUCTURES/PIPES ARE IMPACTED BY THIS WORK THE TOWN WILL BE RESPONSIBLE TO PERFORM THE NECESSARY REPAIRS.

Prior to any work being done within the State Highway Layout, the Grantee(s) must upload/submit a Work Request in State Highway Access Permit System (SHAPS) to obtain approval for the proposed work schedule. Said form to be completed/uploaded can be found under the Forms and Sample Submission Documents tab and is entitled "Work Request Form D1 - D5". One (1) of these forms must be uploaded by the close of business every Thursday for the entire duration of the project in order to request approval for the following week's work schedule.

The Grantee(s) must adhere to 520 CMR 14.00: Excavation and Trench Safety as promulgated by the Department of Public Safety in conjunction with the Division of Occupational Safety pursuant to authority granted by M.G.L. c. 82a § 1. If not already approved, a Trench Permit Rider must be completed and uploaded to SHAPS before any trench work is performed under this Permit.

The Grantee(s) must strictly adhere to the Order of Conditions issued by the Orleans Conservation Commission (D.E.P. #SE 54-2481) which is considered an integral part of this Permit.

The Grantee(s) shall be responsible for all litter and debris generated from their property during the work as described herein and/or from all prospective residents, visitors or patrons of all existing or proposed facilities mentioned herein. This responsibility shall remain in effect for the entirety of all current or future owners of said property. The Grantee(s) shall perform routine inspections and upkeep within the State Highway Layout. If conditions warrant an individual to enter in or within the proximity of a travelled way, the Grantee(s) shall assume all liability and responsibility for the removal of all litter and debris or the hiring of an appropriate party to perform such duties. Significant work within the travelled way may require a police detail. In consideration to all abutters, the Grantee(s) must take notice to the drifting of debris and the removal thereof. If it is found that this requirement is not being fulfilled in a satisfactory manner, MassDOT, Highway Division may decide to clean the area at the Grantee's expense.

CONTROLLED DENSITY FILL (CDF) WAIVER

At the written request of the Grantee(s) and approval from MassDOT, Highway Division, CDF is NOT required on this project for trenches greater than 48" in depth. The Grantee(s) shall perform the work for conventional backfill methods as follows:

1. All methods used to determine and verify the proper compaction of backfill shall be in accordance with AASHTO Standard Specifications of Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth) (Designation T238-86 Method B - Direct Transmission shall be used to determine in-place density) and Moisture Content of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth) (Designation T239-91). Backfill material shall be in accordance with MassDOT, Highway Division Standard Specifications, Section 150.64, Subsection C.

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All methods and work shall be performed by a technician on location certified in "soils" by the New England Transportation Technician Certification Program (NETTCP). All data and results shall be submitted to the appropriate District Highway Director for its review and acceptance.

Soil compaction needs to be performed every 6 inches. Nuclear Gauge Density Testing shall be performed every 1' (foot) of depth and at least twice a week. Proctor/Sieve Analysis testing shall be performed once a week per source of material.

2. A **Performance Bond** in the (approximate) amount of **$3,000,000.00** is required by the Grantee(s) to warranty the work described in this waiver. The Performance Bond must be submitted before any work commences on State Property. The life of the Performance Bond shall continue for three (3) additional years from the date MassDOT, Highway Division signs off on the permit.

The Performance Bond shall be in a form satisfactory to MassDOT, Highway Division, furnished by a surety company incorporated pursuant to M.G.L. chapter 175, section 105 or authorized to do business in the Commonwealth under M.G.L. Chapter 175, section 106 and satisfactory to the awarding authority. The name of the agency or agent writing these bonds shall be identified within the bond.

3. The Completion of Work Form shall be electronically uploaded, via the State Highway Access Permit System (SHAPS), as soon as possible after the completion of the physical work to begin the sign-off process. MassDOT, Highway Division, will hold the Permit on file for a period of not less than three (3) years.

4. The Grantee(s) shall assume full responsibility for the structural integrity of any trench described in this Permit. This responsibility shall remain in place for a period of three (3) years after the completion of work which time starts with MassDOT, Highway Division, receiving the Completion of Work Form.

The Grantee(s) shall immediately respond to trench maintenance requests by the District Highway Director. The Grantee(s) must respond within two (2) working days for non-emergency situations. Non-response within the specified time will result in the required maintenance work being done by MassDOT, Highway Division, with all expenses charged to the Grantee(s).

5. Supplying, positioning, adjusting, and re-positioning of all required signs and traffic warning devices shall be the responsibility of the Grantee(s). All signs and devices shall be in accordance with the current Manual on Uniform Traffic Control Devices. The number and location of all signs and devices shall be deemed necessary by the District Highway Director for the safe and efficient performance of the work and safety of the travelling public.

Care must be exercised so as not to disturb any existing State Highway Drainage or Traffic Duct/wiring Systems or any underground structures that exist. If said system is disturbed, it shall be restored immediately to its original condition. All expenses for restoring conditions shall be the responsibility of the Grantee(s).

6. Uniformed Police Officers or Certified Flaggers shall be provided and compensated by the Grantee(s) and shall be in attendance at all times until completion of the physical work.

"WORK WITHIN THE HARDENED SURFACE WITH CDF WAIVER APPROVED"

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The pavement shall be saw-cut in neat, true lines along the length of the trench. The trench shall then be excavated, the utility installed, and backfilled. The backfill material shall consist of gravel or other suitable material conforming to MassDOT Specifications throughout, to a compacted depth of three inches below the existing surface.

The material shall be selected from excavation free from large lumps, clods, or rock placed between the pipe and the walls of the trench in layers not exceeding 6" (inches) in depth and thoroughly compacted. Each layer, if dry, shall be moistened and then compacted by rolling or by tamping with mechanical rammers. Special care shall be taken to thoroughly compact the fill under the haunches of the pipe or conduit. This method of filling and compacting shall be continued until the material is level with the top of the pipe or conduit. The remainder of the filling shall consist of suitable material placed in successive layers not more than 6" (inches) in depth. The top layer shall be thoroughly compacted to within 3" (inches) of the existing surface.

The trench will then be patched temporarily with a minimum of 3" (inches) of Surface Course placed in one layer to the finished grade of the roadway surface. Be advised that a temporary patch with a minimum of 4" (inches) of Surface Course is required on high traffic volume roadways.

In the cases where the trench needs to include the repair of the entire travel lane/paved shoulder/curb-to-curb, the Grantee may patch the temporary trench with a minimum of 7" (inches) of Hot Mix Asphalt pavement or match existing thickness of this for the roadway, whichever is larger. Pavement composition must meet MassDOT's latest standards. Then after the 90-day settlement period (SOP HMD-75-03-1-000), the Grantee will have to mill 2" (inches) of the existing pavement and overlay the travel lane/paved shoulder/curb-to-curb with two 2" (inches) of Surface Course.

If required, steel plates may be utilized for the safety of overnight motorists. However, steel plates create a slippery surface and should only be used when necessary. The plates may need to be recessed to the finished grade of the roadway as directed by the Engineer. No plates may be left over the weekend. Therefore, the Grantee(s) shall schedule the work accordingly.

Temporary patches shall remain in place for ninety (90) days before being replaced with permanent patch or until in the Engineer's judgment that final compaction and settlement of the trench area has taken place.

The Grantee(s) must then excavate the temporary patching and material to a depth of 7" (inches) below the existing surface and replace with the permanent patch which shall consist of 3" (inches) of Intermediate or Base Course, 2" (inches) of Intermediate Course, and 2" (inches) of Surface Course.

All abutting edges of the existing pavement shall be coated with hot poured joint sealer immediately prior to the placement of the permanent patch.

The District Office must be notified two days prior to starting this work, so that an inspector may be assigned. This mix must be machine laid.

All traffic safety lines if disturbed shall be replaced in kind.

All trenches shall be maintained by the Grantee(s) from inception of this project at all times until the resurfacing of this particular portion of highway by MassDOT, Highway Division.

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If it becomes necessary, MassDOT, Highway Division shall assign an inspector on any project and the inspector will be paid for under a reimbursable account by the Grantee(s).

The Grantee(s) shall be responsible for the maintenance and repair of this portion of the roadway and shall perform routine inspections for deficiencies such as settling, heaving, cracks, etc. This responsibility shall remain in effect until the resurfacing of this particular portion of highway is performed by MassDOT, Highway Division.

THE BACKFILLING METHOD FOR WORK WITHIN THE SHOULDER AREA WILL BE AS FOLLOWS:

Backfill for conduit or pipe shall be selected from excavation free from large lumps, clods or rock placed between the pipe and the walls of the trench in layers not exceeding 6" (inches) in depth and thoroughly compacted. Each layer, if dry, shall be moistened and then compacted by rolling or by tamping with mechanical rammers. Special care should be taken to thoroughly compact the fill under the haunches of the pipe or conduit. This method of filling and compacting shall be continued until the material is level with the top of the pipe or conduit. The remainder of the filling shall consist of suitable material placed in successive layers not more than 6-inch in depth. Each layer shall be thoroughly compacted as specified above.

If the work is to be performed within the soft shoulder, the excavation might be performed within the immediate area along the edge of road and may diminish the integrity of the hardened surface. Therefore, if the excavation directly abuts or tapers under the hardened surface of the roadway, the opening must be backfilled with Controlled Density Fill (CDF) to prevent undermining and preserve the roadway.

The Grantee(s) shall be responsible for the shoulder and roadway areas affected by the proposed work to be performed as described herein and shall routinely inspect said areas for deficiencies such as settling, heaving, cracks etc. This responsibility shall remain until work is performed at the subject location by MassDOT, Highway Division.

SIDEWALK RECONSTRUCTION

The sidewalk shall match the existing conditions and shall be reconstructed with 4" dense graded crushed stone with a 3" hot mix asphalt top course laid in 2 lifts of 1.75" and 1.25", respectively, or 4" of cement concrete. If the cement concrete sidewalk crosses a driveway, the driveway apron shall be constructed with 6" cement concrete.

The reconstructed sidewalk must be compacted and graded in such a manner that no ponding of water occurs within the Highway Layout. If such ponding results, the Grantee(s) shall be responsible for its correction.

Sidewalks and concrete wheelchair ramps shall be in conformance with the Architectural Access Board Regulations within all sidewalk areas located at drives or roadway intersections that may be included in this project.

The Grantee(s) shall be responsible for the maintenance and repair of the portion of the proposed sidewalk located within the State Highway Layout and shall routinely inspect the sidewalk for deficiencies such as settling, heaving, cracks etc. This responsibility shall remain in effect until MassDOT, Highway Division, or the Town reconstructs the sidewalk.

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Upon completion of the work, the Grantee or Agent must upload into SHAPS, a letter from the local building inspector or governing authority, indicating the installed ramps and sidewalks are in conformance with AAB and ADA regulations.

UTILITY WORK IN DRIVE

Whereas the proposed work is to be performed within the apron of an existing drive, the Grantee(s) shall restore the drive with an eight-inch gravel base that has been machine compacted then paved with 4" (inches) of hot mix asphalt laid in two (2) courses consisting of a 2-1/2" (inch) intermediate course and a 1-1/2" (inch) surface course. Any hot mix asphalt berm or granite edging that exists in the driveway area must be sawcut and removed. The new pavement must butt into and not overlap the edge of the hardened surface of the roadway.

All abutting edges of the existing pavement shall be coated with hot poured joint sealer immediately prior to the placement of the permanent bituminous concrete.

The Grantee(s) shall be responsible for this portion of the drive and shall routinely inspect it for deficiencies such as settling, heaving, cracks etc. Such deficiencies shall be corrected at the cost of the Grantee(s) and to the satisfaction of the Engineer.

PAVEMENT MILLING AND OVERLAY

This work will be performed as indicated on the approved plans.

No milling shall take place sooner than seventy-two (72) hours prior to the scheduled final paving operations. The Grantee/Resident Engineer shall ensure that the Permits Office is notified of this scheduled work at least five (5) days prior to the commencement of any milling.

All raised structures located within the roadway must be ramped with hot mix asphalt immediately following milling operations.

The Grantee/Resident Engineer/Contractor shall make every effort to protect the structural integrity of all edging and structures and prevent all cold planning material from entering the State Highway's drainage structures and inspect all structures and grates for damage and clogging.

All proposed work must be transitioned properly to match the existing roadway conditions.

All proposed pavement markings must match existing conditions.

If existing pavement markings are so disturbed during construction or altered according to the Traffic Management Plan, the Grantee(s) shall restore said markings in conformance to MassDOT, Highway Division Standards and as per the final Traffic Markings Plan.

Before scheduling this work, the Grantee must provide the following information to the Permits Section:

I) Schedule of paving work with proposed work hours for review by the District.

II) The Town, Fire and Police Department must be notified about this work.

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III) Information of the Qualified Contractor who will be performing the paving, and the asphalt plant that will be providing the mix.

IV) Specifications of the Superpave Mix and quantification (Tons) that will be used for the project.

V) Traffic Management Plan to be used during the milling/paving work.

VI) Advance notification should be provided to residents and businesses that may be affected by the work.

TIME RESTRICTIONS AND NOTIFICATIONS

DUE TO HEAVY SUMMER TRAFFIC, NO WORK SHALL BE PERFORMED ON THIS PROJECT BETWEEN MEMORIAL DAY WEEKEND AND LABOR DAY WEEKEND WITHOUT PRIOR APPROVAL FROM THE DISTRICT HIGHWAY DIRECTOR.

Special attention shall be given when performing work that will impact MassDOT, Highway Division, snow and ice operations.

No work shall be performed on the hardened surface of the roadway between November 15th and April 1st of any year without prior written approval from the District Highway Director.

No pavement shall be laid between November 15th and April 1st of any year without prior written approval from the District Highway Director.

No work shall be performed on this project on Saturdays, Sundays, and Holidays, or on the Friday after a Thursday Holiday. Work is also restricted on the day before and the day after a long Holiday weekend without prior written approval by the District Highway Director.

No equipment, trucks, etc., shall occupy any part of the travelled way except between the hours of **9:00 a.m. and 3:00 p.m., Monday - Friday**. In no case will operations exceed the specified hours. This includes the placement of traffic control devices, equipment, or anything that restricts the flow of traffic through the construction zone. Any change in work hours will require prior written approval by the District Highway Director. The 12-minute rule will remain in effect for the duration of the permit.

All other work off the pavement on this project is restricted to a normal 8-hour day, Monday - Friday, with the prime Contractor and all subcontractors working on the same shift. Any change in work hours will require prior written approval by the District Highway Director.

GENERAL TRAFFIC MANAGEMENT AND SAFETY REQUIREMENTS

If required by MassDOT, Highway Division District 5, variable message boards (VMBs) shall be utilized as part of the approved traffic management plan under this Permit which must be properly secured with regards to hacking and unauthorized tampering prevention. The Grantee(s) shall adhere to all appropriate security specifications and take all necessary precautions to mitigate the risk of the boards being hacked. All VMBs shall be stored in a secured area and shall have a lockable, weatherproof enclosure for the operator interface, removable local keyboards which shall be

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removed whenever possible, and a password protected controller with local administrative passwords changed on a regular basis.

When any portion of the roadway will be blocked with equipment to facilitate the proposed work, the Grantee(s) will be required to adhere to the attached Traffic Management Plan (TMP) or submit a proposed TMP to MassDOT, Highway Division, to be reviewed and approved by the District Traffic Maintenance Engineer prior to working within or impacting the roadway. The plan must include information relating to proper signing, traffic control device placement and police details.

It is imperative to maintain two-way traffic at all times and these operations are managed so that motorists travel "delay" is minimized. At any time during the operation when a traffic delay of over twelve (12) minutes occurs and the situation is worsening, the Resident Engineer, Contractor, or Police Detail will begin to suspend operations. Continuously increasing "delays" of over twelve (12) minutes are not to be permitted.

If traffic must be "stopped", the duration shall not be more than five (5) minutes.
Uniformed State/Local Police Officer(s) and their official vehicle(s) may be necessary to provide protection for those installing and removing all temporary traffic warning signs and devices and to perform all traffic management as required.

The Grantee(s) will monitor the flow of traffic during peak traffic volumes and if necessary, shall suspend all operations. Work will resume at the discretion of the Police detail officer and/or to the satisfaction of the supervising MassDOT, Highway Division, Engineer.

In the event of inclement weather or dense fog, which lessens the visibility of advance warning signs, vehicles and workers, the Grantee(s) will suspend all operations so as not to interfere with the safety of the motoring public and the operations of work. In the event of snow or icing conditions, all vehicles and equipment must be removed from the roadway and/or shoulder area so as not to interfere with Snow and Ice Operations.

The Grantee(s) shall provide safe and ready means of access and egress to all public and private roads and drives 24 hours per day. Every effort must be made as not to interfere with or inconvenience all abutters throughout the duration of this project.

Signs and traffic control devices are required for advance notice of the work and within the work area.

The Grantee(s) or Applicant will supply all required signs and traffic warning devices and shall be in accordance with the Massachusetts Manual on Uniform Traffic Control Devices. The number and location of all signs and devices shall be deemed necessary by the Engineer for the safe and efficient performance of the work and the safety of the travelling public.

All warning devices shall be subject to removal, replacement, and/or repositioning by the applicant as often as deemed necessary by the Engineer.

Cones or non-reflectorized warning devices shall not be left in operating position on the highway when the daytime operations have ceased. If it becomes necessary for MassDOT, Highway Division, to remove the construction warning devices or their appurtenances from the project due to negligence by the applicant, all costs for this work will be charged to the Grantee(s).

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All vehicles, except passenger's cars, which are assigned to the permitted project and which operate on the site at speeds of 25 MPH or less, shall have an official SLOW-MOVING VEHICLE emblem displayed. All vehicles and equipment on this project must be equipped with back-up alarms.

All personnel who are working on the travelled way or breakdown lanes shall wear approved safety vests and hard hats.

GENERAL CONDITIONS AND APPROVED PROCEDURES

The Grantee(s) must contact the "Dig Safe" Center at 811 to obtain a "Dig Safe" number prior to starting the proposed excavation for the purpose of identifying the location of underground utilities.

IF THE PROPOSED WORK FALLS WITHIN THE AREA OF A SIGNALIZED INTERSECTION, the Grantee(s) must contact the District Traffic Maintenance Engineer at (508) 884-4208 at least two (2) weeks prior to the commencement of said work to locate the existing traffic signal conduit/detectors and to coordinate this work so as not to disturb the traffic signals. The Grantee(s) will be responsible to repair/replace all damaged items and will be billed for any cost incurred to restore normal operation to MassDOT, Highway Division, signal equipment to the satisfaction of the Engineer.

Unless otherwise stated, no hardened surface of the State Highway may be disturbed.

When an opening in the roadway is required and permitted herein, the opening must be as small as possible to perform the proposed work.

If the integrity of any existing sidewalks, catch basins, manholes or any other underground structures or equipment is compromised, the Grantee(s) will reconstruct and/or replace all items according to MassDOT, Highway Division, Standards at the cost of the Grantee(s) and to the satisfaction of the Engineer.

The Grantee(s) must not disturb or remove any MassDOT, Highway Division, bound(s) (MHB) associated with this project. If so disturbed or missing, the bound(s) must be reset/replaced by a Registered Land Surveyor. All procedures and materials must be in compliance with Massachusetts Design and Construction Standards. A copy of the paid bill must be submitted to this office upon completion of said work.

All traffic safety lines if disturbed shall be replaced in kind.

All disturbed areas within the State Highway Layout must be graded, loamed, and seeded to the Engineer's satisfaction.

All debris and litter remaining from the proposed construction shall be removed by the Grantee(s) and the area left clean daily.

DRAINAGE AND UTILITY CASTINGS

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"The use of risers to adjust drainage and utility structures will not be allowed. All adjustment work done to existing or new drainage structures shall conform to Section 220 of MassDOT, Highway Division, Standard Specifications and according to Plates 201.3.0 and 202.9.0 of MassDOT, Highway Division, Construction Standards."

ENVIRONMENTAL LIABILITY AND COMPLIANCE

The Grantee(s) assumes all risk associated with any environmental condition within the subject property and shall be solely responsible for all costs associated with evaluating, assessing, and remediating, in accordance with all applicable laws, any environmental contamination (1) discovered during Grantee's work or activities under this Permit to the extent such evaluation, assessment or remediation is required for Grantee's work, or (2) resulting from the Grantee's work or activities under this Permit. The Grantee(s) shall notify MassDOT, Highway Division, of any such assessment and remediation activities.

The Grantee(s) is hereby held solely responsible for obtaining and maintaining any and all environmental compliance permits required by local, state, and federal laws and regulations when regular or emergency work is proposed within, or in close proximity to, any wetland area. These environmental compliance requirements include, but are not limited to, a Negative Determination of Applicability or Order of Conditions from the local Conservation Commission, a Water Quality Certificate from the Department of Environmental Protection, and a Programmatic General Permit from the U.S. Army Corps of Engineers. The Grantee(s) shall forward to MassDOT, Highway Division, a copy of each such environmental compliance permit.

CLOSING CONDITIONS

All of said work shall comply with the terms and conditions herein and must be done as directed by and to the satisfaction of the engineer.

All work done under this contract shall be in conformance with the 2020 Edition of the MassDOT Highway Division Standard Specifications for Highways and Bridges. All construction shall conform to the October 2017 edition of the Massachusetts Department of Transportation, Highway Division "Construction Standard Details (English Edition)"; the latest Manual on Uniform Traffic Control Devices with Massachusetts Amendments; the latest edition to the following: the 1996 Construction and Traffic Standard Details (as related to Traffic Standard details only); the 1990 Standard Drawings for Traffic Signs and Supports; the 1968 Standard Drawings for Traffic Signals and Highway Lighting; the latest edition of American Standard for Nursery Stock; the Plans and these Special Provisions.

The Grantee(s) shall indemnify and save harmless the Commonwealth and MassDOT, Highway Division, against all suits, claims or liability of every name and nature arising at the time out of or in consequence of the acts of the Grantee(s) in the performance of the work covered by this Permit and/or failure to comply with the terms and conditions of this Permit whether by themselves or their employees or subcontractors.

It is noted that the Grantee(s) will be responsible for future corrective actions resulting from defective work under the subject permit. Any damage to the roadway and/or shoulder as a result of the permitted work is the Grantee's responsibility and shall be repaired at his/her expense.

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The Completion of Work Form and supporting photos shall be electronically uploaded, along with local AAB approval (if required), via the State Highway Access Permit System (SHAPS), as soon as possible after the completion of the physical work to begin the sign-off process.

MassDOT, Highway Division, will hold the Permit on file for a period of not less than three (3) years. If the Completion of Work Form is not uploaded, the liability assumed under this Permit will continue.

A copy of this Permit must be on the job site at all times for inspection. Failure to have this Permit available at the site will result in suspension of the rights granted by the Permit.

"FOLLOWING CONDITIONS APPLY TO PERMITS"
Conditions Relating Particularly to Permits for the Laying of Pipes, Conduits, etc.

After any pipes, conduits, drains or other underground structures are laid, or any excavation is made in the roadway, the trenches or openings shall be properly backfilled with suitable material, the back-filling shall be thoroughly tamped, and the surface of the road over said structures shall be left even with the adjoining ground. If the work is done in cold weather no frozen material shall be used for backfilling.

Wherever the hardened surface of the roadway, gutters, or any part of the surface of the highway is disturbed it shall be replaced in as good condition as before it was disturbed, and if new materials are required, they shall correspond with those already in place on the road.

Where service pipes are to cross the highway, the connections shall be made without disturbing the hardened surface of the roadway, by driving the pipes under the roadway, or the service pipes shall be carried under and across the road in a larger pipe, unless otherwise ordered by the Director.

The Grantee shall maintain the surface of the roadway over said structures as long as MassDOT may deem necessary, until all signs of the trenches shall have been eliminated.

CONDITIONS RELATING PARTICULARLY TO PERMITS FOR THE ERECTION OF POLES, WORKS AND OVERHEAD STRUCTURES, AND THE CUTTING AND TRIMMING OF TREES

In the erection of pole lines, unless otherwise herein provided, no trees located within the limits of the State Highway shall be cut or trimmed. No guy wires shall be attached to trees without a special Permit from MassDOT, and in no event shall they be so attached as to girdle the trees or in any way interfere with their growth. The wires shall be so protected at all time and places that they shall not interfere with or injure the trees either inside or outside the location of the highway.

Where the cutting or trimming of trees is authorized by this Permit, only such cutting, and trimming shall be done as may be designated by the Director.

In the construction or reconstruction of pole lines no guy wires shall be erected nearer to the surface of the ground than 6' (feet); provided, however, that the owners of such lines may maintain such guy wires at a lower elevation than 6' (feet) from the ground until such time as MassDOT shall notify them to remove said wires or to the elevation first stated.

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In order to protect the trees through which any wires may pass, said wires shall be insulated and such other tree guards used as may be directed by the Director. Where high tension wires are erected under this Permit, they shall be so located that, under conditions of maximum severity as regards a coating of ice or snow, there shall be a space of at least 8' (feet) between such high-tension wires and other wires.

The Grantee shall, within sixty (60) days from the date of completion of the work, file in the office of MassDOT a plan showing the location of each pole erected in accordance with the Permit, said plan to be of such size and in such form as MassDOT may direct.

GENERAL AND ADDITIONAL CONDITIONS

Whenever the word "MassDOT" is used herein it shall mean the Massachusetts Department of Transportation of the Commonwealth of Massachusetts.

Whenever the word "Director" is used herein it shall mean the District Highway Director or other authorized representative of MassDOT.

Whenever the word "Grantee" is used herein it shall mean the person or persons, corporation or municipality to whom this Permit is granted, or their legal representatives.

During the progress of the work all structures underground and above ground shall be properly protected from damage or injury; such barriers shall be erected and maintained as may be necessary for the protection of the traveling public; the same shall be properly lighted at night; and the Grantee shall be responsible for the damages to persons or property due to or resulting from any work done under this Permit.

Except as herein authorized, no excavation shall be made, or obstacle placed within the limits of the State highways in such a manner as to interfere unnecessarily with the travel over said road.

If any grading of sidewalk work done under this Permit interferes with the drainage of the State highway in any way, such catch basins and outlets shall be constructed as may be necessary, in the opinion of the Director, to take proper care of such drainage.

Wherever the hardened surface of the roadway is disturbed and the Director may consider it necessary or advisable to do so, said surface will be restored by the employees of MassDOT, at such time as MassDOT may direct, and the expense thereof shall be borne by the Grantee, who shall purchase and deliver on the road the materials necessary for said work if and when directed by the Director. All payments to the supplier and to laborers, inspectors, etc., employed by MassDOT for or on account of the work herein contemplated shall be made by said Grantee forthwith on receipt of written orders, pay rolls, or vouchers approved by MassDOT.

IF THE GRANTEE DOES ANY WORK CONTRARY TO THE ORDERS OF THE DIRECTOR, AND, AFTER DUE NOTICE, FAILS TO CORRECT SUCH WORK OR TO REMOVE STRUCTURES OR MATERIALS ORDERED TO BE REMOVED, OR FAILS TO COMPLETE WITHIN THE SPECIFIED TIME THE WORK AUTHORIZED BY THIS

PERMIT, MASSDOT MAY, WITH OR WITHOUT NOTICE, CORRECT OR COMPLETE SUCH WORK IN WHOLE OR IN PART, OR REMOVE SUCH STRUCTURES OR MATERIALS, AND THE GRANTEE SHALL REIMBURSE MASSDOT FOR ANY EXPENSE INCURRED IN CORRECTING AND/OR COMPLETING THE WORK OR REMOVING THE STRUCTURES OR MATERIALS.

ALL OF THE WORK HEREIN CONTEMPLATED SHALL BE DONE UNDER THE SUPERVISION AND TO THE SATISFACTION OF THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, AND THE ENTIRE EXPENSE THEREOF SHALL BE BORNE BY THE GRANTEE.

On the completion of the work herein contemplated all rubbish and debris shall be removed and the roadway and roadsides shall be left neat and presentable and satisfactory to the Director.

MassDOT hereby reserves the right to order the change of location or the removal of any structure or structures authorized by this Permit at any time, said change or removal to be made by and at the expense of the Grantee or its / their successors or assigns.

This Permit may be modified or revoked at any time by MassDOT without rendering said MassDOT or the Commonwealth of Massachusetts liable in any way.

The Grantee shall pay the salary, subsistence, and travel expenses of any inspector appointed by MassDOT to supervise the work herein contemplated.

All of the above conditions shall be applicable to the work herein authorized, unless the same are inconsistent with the conditions on the face of the Permit, in which case the conditions written or printed on the face of the Permit shall apply.

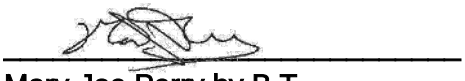
The acceptance of this Permit or the doing of any work thereunder shall constitute an agreement by the Grantee to comply with all of the conditions and restrictions printed or written herein.

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Charles D. Baker. Governor
Karyn E. Polito, Lieutenant Governor
Stephanie Pollack, Secretary & CEO
Jonathan L. Gulliver, Highway Administrator

massDOT
Massachusetts Department of Transportation
Highway Division

Approved Signature



Mary-Joe Perry by B.T.
District Highway Director

Date of Issue: March 30, 2020

Permit Expiration: Wednesday, March 31, 2021

District 5, 1000 County Street Taunton, MA 02780
Tel: (508) 824-6633, FAX: (508) 880-6102
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Easements

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SPECIAL CONDITIONS - MASSDEP POLICY MEMORANDA

Policy Memorandum No. CG-1	Easements and Rights-of-Way
Policy Memorandum No. CG-2	Permits
Policy Memorandum No. CG-3	Field Controls
Policy Memorandum No. CG-4	Record Drawings
Policy Memorandum No. CG-5	Plan Scale
Policy Memorandum No. CG-6	Borings Logs
Policy Memorandum No. CG-7	Breakdown of Bid Items
Policy Memorandum No. CG-8	Pavement
Policy Memorandum No. CG-9	Pipe Testing
Policy Memorandum No. CG-10	Change Orders
Policy Memorandum No. CG-11	Utility Relocation
Policy Memorandum No. CG-12	Refundable Deposits for Plans and Specifications
Policy Memorandum No. CG-13	Bid Opening Procedures
Policy Memorandum No. CG-14	Payment for Rock Excavation
Policy Memorandum No. CG-15	Traffic Police
Policy Memorandum No. CG-16	Documentation Required to Substantiate Contract Quantities
Policy 88-02	Policy for Review of Sewer Line/Water Supply Protection

Exceptions:

A. Policy Memorandum No. CG-9 Pipe Testing.

1. Under this Contract only seventy-five (75) percent of the price bid per linear foot of pipeline shall be paid for upon its installation, the balance shall be withheld until such time as pipeline has been successfully tested and accepted by the Owner and the site(s) has been fully restored. This percentage is exclusive of normal Contract retainage.

B. Policy Memorandum No. CG-10 Change Orders

1. Paragraph B., item (5.), delete the number 20% and insert the number 15%.
2. Paragraph B., item (6.), delete the number 7-1/2% and insert the number 5%.

C. Policy Memorandum No. CG-14 Payment for Rock Excavation

1. Under this Contract, Rock and/or Boulder Excavation shall be paid as defined in SECTION 01025, MEASUREMENT AND PAYMENT.

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
ONE WINTER STREET, BOSTON, MA 02108 617-292-5500

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF RESOURCE PROTECTION

DIVISION OF MUNICIPAL SERVICES POLICIES

The Division of Municipal Services (DMS) has established the following policies for all Division financially-assisted projects.

POLICY MEMORANDUM NO. CG-1 EASEMENTS AND RIGHTS OF WAY

Prior to the approval of financial assistance for construction, the owner shall obtain and shall thereafter retain, a fee simple or such estate or interest in the site of construction and rights of access as will assure undisturbed use and possession for the purpose of construction and operation for the estimated life of the project. The Division may refuse to approve financial assistance until it has received from the owner sufficient assurances that such interests have been obtained. Unless the Division otherwise notifies the owner, the certificate (under pains and penalties of perjury) of the owner's legal representative shall constitute such sufficient assurance.

Additional cost which result from interruptions of construction or extensions of contract time caused by the owner's failure to obtain the necessary interests in land shall be ineligible for financial assistance, and all such additional costs shall be borne by the owner.

POLICY MEMORANDUM NO. CG-2 PERMITS

The owner shall be responsible for identifying and obtaining all federal, state, local and railroad permits required by the nature and location of construction, including but not limited to building construction permits and permits for street and highway cuts and openings, and all such permits shall be listed in a separate permits section of the contract documents. To the extent possible, such permits shall be obtained by the owner prior to the solicitation of bids for construction, and copies of all permits so obtained shall be included in the said permits section. The status of the application for each permit, including the permit conditions, and costs, not obtained prior to the solicitation of bids shall also be indicated in the contract documents permits section. The Division may refuse to approve financial assistance for construction unless and until it has received from the owner sufficient assurances that all necessary permits have been or will be obtained prior to the commencement of construction.

The contractor shall be responsible for obtaining all permits required of his equipment, work force, or particular operations (such as blasting) in the performance of the contract and not otherwise specified in the two preceding paragraphs as to be obtained by the owner. These permit fees shall be paid by the contractor.

The owner shall be responsible for the payment of all other permit fees required by the construction.

The following permits shall not be eligible for financial participation by the Department of Environmental Protection (DEP).

- Permits and insurance for construction in railroads' rights of way;
- Building permits;
- Permits for opening public streets and other public or municipal rights of way;
- Permits for the use of explosives;
- Permits for the disposal of waste materials; and
- Permits and fees for connecting to municipal utilities.

Permits required by extraordinary circumstances and not specifically excluded from eligibility above may be eligible for DEP participation. For such permits to be so eligible, the owner or his representative must notify the DEP project engineer in advance of obtaining such permit and receive from the engineer specific agreement that such permit will be eligible for DEP participation. Eligibility for such participation will not be made retroactively.

Additional costs which result from interruptions of construction or extensions of contract time resulting from the owner's or the contractor's failure to obtain the necessary permits may be ineligible for participation.

POLICY MEMORANDUM NO. CG-3 FIELD CONTROLS

The Owner shall be responsible for indicating on the contract drawings all easement limits and all property and other control lines for locating the principal component parts of the work together with those elevations and bench marks used in the design of the work, all hereinafter referred to as "field controls". Where easement and property limits have not previously been established in the field, the owner shall be responsible for establishment of such limits. From the information provided by the Owner, unless otherwise specified, the Contractor shall develop and make all layouts required for construction, such as slope stakes, batter boards, stakes for pipe locations and other working points, lines, elevations and cut sheets.

Whenever he has reason to believe that an error exists or whenever he is otherwise unable to locate the field controls, the contractor shall promptly notify the owner and the owner's engineer of such error with appropriate documentation.

POLICY MEMORANDUM NO. CG-4 RECORD DRAWINGS

The Owner shall be responsible for the preparation of all record drawings required by this contract. This responsibility may be delegated to the Owner's representative. The responsibility for preparation of record drawings shall not be delegated or transferred to the contractor. They may use the contractor's and sub-contractor's certified AS BUILT drawings along with their own marked up set in the preparation of the Record Drawings.

Division approved contract drawings shall be revised upon completion of the contract to reflect any changes made and/or final quantities, as appropriate.

POLICY MEMORANDUM NO. CG-5 PLAN SCALE

Unless otherwise approved in advance by the Division, the horizontal scale for construction plans for non-structural facilities shall be 1" = 40'. A larger horizontal scale shall be used where appropriate to show sufficient detail to construct the project. The vertical scale for construction plans for non-structural facilities shall be 1" = 4'. Based on the best information available at the time of their preparation, the location of underground utilities and support structures for overhead utilities shall be shown on the plans.

Unless otherwise exempted in advance by the Division, construction plans shall be updated whenever the date of the advertisement for bids for the construction of such facilities is more than one year after the date of approval by the Division or EPA; and in the case of approval by both such agencies, the later approval date shall be used in determining the need for update.

The consulting engineer shall receive adequate compensation for updating plans and specifications, and such additional cost shall be eligible for assistance to the extent not otherwise prohibited by USEPA and Division regulations and program guidance.

All revision, or review without need for revision, shall be noted and dated on the plans prior to advertisement of the project for bid.

POLICY MEMORANDUM NO. CG-6 BORINGS LOGS

All soil borings shall be taken as close as practicable to the construction line, and the location of all such borings shall be clearly indicated on the contract drawings. The plan view shall show the location and boring number of each boring. The profile view shall show the location, elevation, and depth of each soil boring, the location of each change in soil stratum, the groundwater level, and the average of blow counts at each five foot interval. As a minimum, boring logs to be submitted with the plans and specifications shall show the name of the company taking the borings, the soil classification, the number of blows per foot of penetration, the groundwater elevation, and the date on which the borings were taken.

As part of the submission of plans and specification for approval, the owner's representative shall include written justification for the lesser frequency and depth of borings where their interval is more than approximately 300' or their depth is less than 50% below depth of pipe invert.

POLICY MEMORANDUM NO. CG-7 BREAKDOWN OF BID ITEMS

The following items shall, where applicable, be listed separately in the bid documents.

1. Mobilization

2. Pavement

a. Municipal
i. temporary
ii. permanent

b. State
i. temporary
ii. permanent

3. Concrete cradle or encasement (to be identified where applicable)

4. Rock-Excavation

5. Wood or steel sheeting left in place

6. Excavation of unsuitable materials below grade

7. Select and/or borrow material

8. Dewatering

9. Special Dewatering (coffer dam)

Mobilization costs are the costs of initiating the contract, exclusive of the cost of materials. Payment for mobilization shall be a lump sum at the price bid for this item in the proposal and shall be payable when the contractor is operational on the site. For purposes of this policy, "operational" shall mean the substantial commencement of work on site.

The lump sum price bid for mobilization shall not exceed five per centum (5%) of the total amount of the bid.

POLICY MEMORANDUM NO. CG-8 PAVEMENT

All roads and trenches therein shall be refilled and repaved in accordance with specifications provided by the owner in the contract documents. Please note that this policy may be excludable on Federally assisted projects where bid alternative items may be required (i.e. trench width vs. full width pavement). You are advised to seek project specific clarification.

Loan eligibility shall be limited to the following:

A. Where the depth of the pipe invert is 0 to 8', the maximum pavement widths which shall be eligible for financial assistance are as follows:

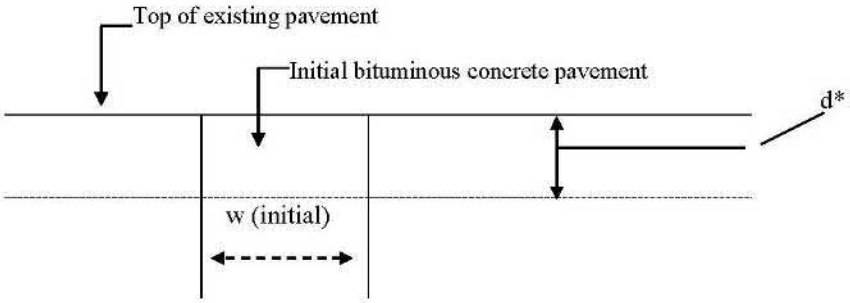
Nominal Pipe Diameter	Maximum Eligible Widths	
	Initial Pavement	Permanent Trench
0-24"	6'-6"	8'-6"

Where the nominal pipe diameter is greater than 24" the maximum eligible width for Initial re-paving shall be the nominal diameter of the pipe plus four (4) feet, and for permanent trench re-paving the maximum eligible width shall be the nominal pipe diameter plus six (6) feet.

B. For each additional four (4) feet (or fraction thereof) of pipe invert depth, add three feet to the eligible width limits stated in paragraph A.

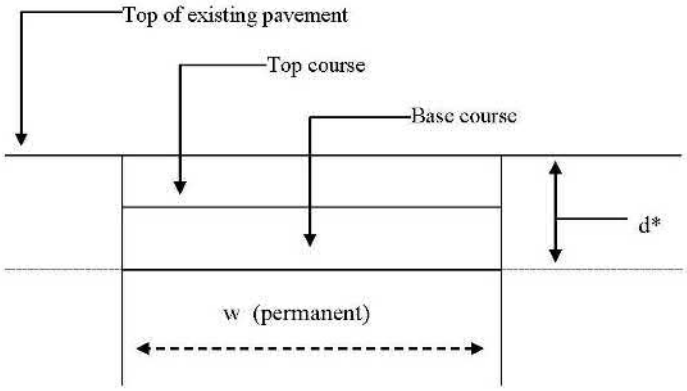
At the design phase of a project the owner has the option to elect either Initial Pavement with Option I (Permanent Trench replacement) or Initial with Option II (curb to curb over initial)

Initial Pavement



d*= depth of existing pavement to a maximum of 3 inches (see general notes #3)
w = maximum eligible Initial pavement width as described in paragraphs "A" & "B" on page DEP-DMS-CG's-P4.

OPTION I Permanent Trench Pavement

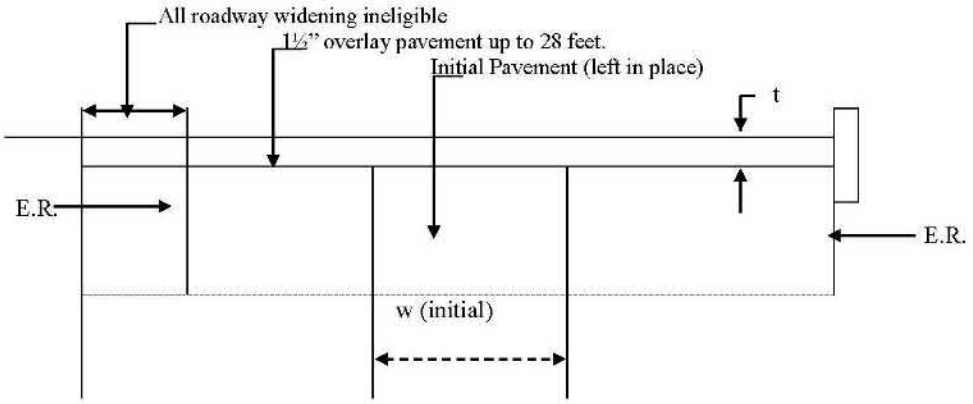


d*= depth of existing pavement trench to a maximum of 3 inches (see general notes #3)
w = maximum eligible permanent pavement width as described in paragraphs "A" & "B". equals initial width plus 2 feet and includes:

- Cutting edges for the permanent trench
- Removal of initial patch plus two feet of existing pavement
- Fine grading/compacting gravel
- Placement of Permanent Trench pavement in two courses.

POLICY

OPTION II Curb to Curb Pavement (overlay pavement for roadways up to 28 feet)



E.R.= edge of existing paved roadway
t = one and one half inch (1½") overlay of bituminous concrete pavement

GENERAL NOTES:

1. Repavement of settled areas and crown restoration within the trench limits shall be the responsibility of the contractor.
2. Leveling outside the trench limits shall be the responsibility of the owner.
3. Sewer trench re-fill and pavement re-paving on public ways under the jurisdiction of the Massachusetts Department of Public Works, the Metropolitan District Commission, or other such agency shall be in accordance with permit(s) issued therefor by that Department or Commission, as the case may be.
4. The Division will consider requests for increase in the participating pay limits defined in paragraphs A and B, when such increases are, in the Division's opinion, reasonable. Such requests should be documented in writing and submitted to the Division in a timely manner.
5. Projects which deviate from the above options are required to seek Division review and approval.

MEMORANDUM NO. CG-9 **PIPE TESTING**

Monthly payment estimates shall be prepared in accordance with contract documents. All pipe shall be tested in accordance with the contract documents and sound engineering practice. If, after 60 days following submission of a monthly payment estimate for pipe items, the pipe for which payment is requested has not been successfully tested, the owner may withhold up to 10% of the amount requested for such pipe items until the pipe has been so tested. However, in the case of a major (pipe diameter 24 inches or greater) interceptor pipe installation, sums retained by the owner pursuant to this policy memorandum shall not exceed two per centum (2%) of the costs of such pipe items.

POLICY MEMORANDUM NO. CG-10 **CHANGE ORDERS**

Executed change orders submitted to the Division for review and processing for financial assistance must be prepared on the attached Change Order Forms (CG-10, Attachment 1, pages A-1 & A-2) with a duplicate copy, calculation sheet(s) (CG-10, Attachment 2), and all other supporting documentation necessary for evaluation. Failure to comply with these instructions will result in delays in processing the change order and/or limited financial assistance.

M.G.L. c.44, s.31C requires that the auditor, accountant, or other municipal officer having similar duties must certify that adequate funding in an amount sufficient to cover the total cost of the change order has been made. Change orders will not be processed or approved until this certification is made on the face of the Change Order Form (CG-10 Attachment 1).

Payment of Change Orders:

Payment of all change orders shall be in accordance with the relevant provisions of Massachusetts General laws, Chapter 30, Section 39G for non-building construction and Section 39K for building construction.

Payment of change orders shall be made in accordance with one of the following three methods:

A. Existing unit prices as set forth in the contract; or

B. Agreed upon lump sum or unit prices; or

C. Time and materials

A. Payment for work for which there is a unit price in the contract:

Where the contract contains a unit price for work and the Engineer orders a change for work of the same kind as other work contained in the contract and is performed under similar physical conditions, the contractor may accept full and final payment at the contract unit price(s) for the acceptable quantities.

B. Payment for work or materials for which no price is contained in the contract:

If the Engineer directs, the contractor shall submit promptly in writing to the Engineer and offer to do the required work on a lump sum or unit price basis, as specified by the Engineer. The stated price, either lump sum or unit price, shall be divided so as to show that it is the sum of:

(1) The estimated cost of labor, plus

(2) Direct Labor Cost, plus

(3) Material and Freight Costs, plus

(4) Equipment Costs, plus

(5) An amount not to exceed 20% of the sum of items (1) through (4) for overhead and profit, plus (if applicable),

(6) In the case of work done by a subcontractor and amount not to exceed 7 ½ %, for the general contractor of the sum of items (1) through (4) for his overhead and profit, less, if applicable,

(7) Credits for work deleted from the contract.

C. Payment for work on a time and materials basis:

Unless an agreed lump sum and/or unit price is obtained from above and is so stated in the change price, the contractor shall accept as full payment for which no other agreement is contained in contract, and amount equal to:

(1) The estimated cost of Labor, plus

(2) Direct Labor Cost, plus

(3) Material and Freight Costs, plus

(4) Equipment Costs, plus

(5) An amount not to exceed 20% of the sum of items (1) through (4) for overhead and profit, plus (if applicable),

(6) In the case of work done by a subcontractor and amount not to exceed 7 ½ %, for the general contractor of the sum of items (1) through (4) for his overhead and profit, less, if applicable,

(7) Credits for work deleted from the contract.

Explanation of items (1) through (7) as outlined in "B" and "C":

(1) Labor – Only those workers employed on the project who are doing the extra work, including the foreman in charge, are allowable. General foremen, superintendents, or other supervisory personnel are considered to be included in the overhead markup as provided in items (5) and/or (6). Hourly labor rates in excess of those as listed in the contract wage rates (Federal or State, whichever applies require documentation. As a minimum, an explanation and the appropriate copy of the certified payroll are required.

(2) Direct Labor Costs - These costs are limited to those which are required in the contract document. Coverage in excess of the contract provisions, secured by the contractor/subcontractor(s) at his option, are ineligible for financial assistance. The following list of typical direct labor charges is provided for your assistance and is in no way intended to be complete or all encompassing:

- Workman's Compensation
- Federal/State: Social Security Tax and Unemployment Tax;
- Health, Welfare and Pension Benefits; (this cost is included in the wage rates appearing in the Mass. Wage Rates of the contract specifications)
- Liability Insurance: Bodily Injury; Excess Umbrella; Property damage; Public Liability
- Blasters Insurance
- Builders Risk Insurance
- Experience Modification Insurance
- Surcharges

If applied to any required direct labor costs.

Following award and prior to execution of a construction contract, the contractor and filed sub-bidders (where applicable) shall submit for review by the owner, documentation to establish the Direct Labor Cost percentage(s) (Direct Labor markup percentage(s)).

The documented direct labor markup for this contract may be adjusted on an annual basis as measured from the date the contract is executed. The contract agreement will provide for the establishment of the Direct Labor Cost percentage.

(3) Material and Freight – Only those materials required as a result of the change order and reasonable freight charges for delivery of same are allowable.

(4) Equipment – Only the equipment required as a result of the change order is allowable. Equipment rental rates shall be governed by the current Nielson/Dataquest Rental Rate bluebook for Construction Equipment (the "Bluebook"). In determining the rental rate the following shall apply:

(a) For equipment already on the project – the monthly prorated rental rate by the hourly use shall be applicable;

(b) For equipment not on the project the daily rate, the weekly rate, or monthly rate will prevail, whichever will prove to be most cost effective. Small tools and manual equipment are examples of costs not allowable under this item. These costs are considered to be included in the overhead markup as provided in items (5) and/or (6)

(1 month (normal use) = 176 hours)

(5) & (6) Overhead and Profit – All other costs not previously mentioned are considered to be included in this item, be it for the general contractor or subcontractor(s).

(7) Credits – Work deleted, material and equipment removed from the contractor, stored and/or returned shall be credited to the cost of the change order, less costs.

The Contractor shall furnish itemized statements of the cost of the work ordered and shall give the Engineer access to all accounts, bills and vouchers relating thereto; and unless the Contractor shall furnish such itemized statements, and access to all accounts, bills and vouchers, he shall not be entitled to payment for any items of extra work for which such information is sought by the Engineer. Deviations from any of the above will be reviewed for financial assistance on a case-by-case basis.

The change order will be prepared in such manner as to clearly separate Eligible and Ineligible Costs.

Attachment 1 Page A-1

CHANGE ORDER FORM

SRF Number _____

Public Entity _____

Contract Number _____

Change Order Number _____

Contract Amount (As Bid) $ _____

Net Change in Contract Price (this change order) $ _____

Total Adjusted Contract Price (including this and all other change orders) $ _____

This change order extends the time to complete the work by _____ calendar days.

The extended completion date is _____

This change order checked by _____ _____
(Chief) Resident Engineer Date

This change order is requested by: _____

This change order is recommended by: _____

_____ _____ _____
Consultant Engineer P.E. Number Date

The undersigned agree to the terms of the change order.

_____ _____
Contractor Date

_____ _____
Owner Date

Certification of Appropriation under M.G.L. c.44, §31C: Adequate funding in an amount sufficient to cover the total cost of this change order is available.

By: _____ _____
Certification Officer (Auditor, accountant, treasurer) Date

0Do not write below: this space reserved for STATE AGENCY APPROVAL

1DEP/DMS

Attachment 1 Page A-2

CHANGE ORDER FORM (Continued)

2Public Entity _____

SRF No: _____ Contract No. _____ Change Order No. _____

3Contract Title: _____

4Owner's Name: _____

5Owner's Address: _____

6Contractor's Name: _____

7Contractor's Address: _____

Description of Change

Reason for Change

Attachment 2 - Page B-1

CALCULATION SHEET

(1)	Labor			
	Foreman	10 hrs @ $10.00/hr.	$ 100.00	
	Engineer	10 hrs @ 8.50/hr	85.00	
	Operator	10 hrs @ 9.50/hr	95.00	
	Laborers	24 hrs @ 7.00/hr	168.00	$448.00
(2)	Direct Labor Cost (use the agreed upon Direct Labor Cost)			
	* (30)% of $448			
	* (Used for example purposes only)			134.00
(3)	Materials & Freight			
	150 l.f. of 12" pipe @ $2.00/l.f.		$ 300.00	
	15 v.f. precast SMH		1,700.00	
	Freight (slip # _____ Enclosed)		25.00	2,025.00
(4)	Equipment			
	1 Backhoe 10 hrs @ $80.00/hr		$ 800.00	
	1 Truck-crane 10 hrs @ $100.00/hr		1,000.00	
				1,800.00
	Total (Items 1 through 4)			4,407.00
(5)	20% markup for Overhead, Profit			
	20% of $4,407			881.00
(6)	5% markup for general contractor (if subcontractor is involved)			
	5% of $4,407			220.00
(7)	Credits (deductibles)			-323.00
			Total Cost $	4,965.00

Reminder: Provide support documentation as necessary i.e. vouchers, correspondence, Calculation, photographs, reports……

POLICY MEMORANDUM NO. CG-11 UTILITY RELOCATION

The construction of treatment facilities, sewers, pumping stations, force mains and appurtenant work can cause the relocation of utilities. Costly relocation can sometimes be minimized by early communication and cooperation of the representatives of the municipality (owner) and the utilities.

Every possible effort should be made by the owner and each utility to establish the location of existing utilities in the vicinity of the proposed construction. The owner or its consulting engineer should make every reasonable effort to design the proposed construction so that relocation of existing utilities is minimized whenever possible. If the proposed construction is in an area of many existing utilities or in an otherwise critical area, the utilities are encouraged to mark the location of their existing utilities at the site during the design phase of the project.

During the design phase of the project, the municipality should provide timely notice to all utilities known or thought to have facilities in or proximate to the site of such future construction.

POLICY MEMORANDUM NO. CG-12 REFUNDABLE DEPOSITS FOR PLANS AND SPECIFICATIONS

For each set of project plans and specifications provided, the owner may require a deposit in form of cash or other appropriate security, in an amount sufficient to cover the costs of production of such plans and specifications.

Upon return of the plans and specifications to the owner within a reasonable time and in good condition, such deposit shall be refunded.

Actual mailing costs, if any, shall be borne by the party requesting such plans and specifications.

POLICY MEMORANDUM NO. CG-13 BID OPENING PROCEDURES

As a minimum, bid documents shall be reviewed/inspected for conformance to the following bid opening procedure in the order presented below. Failure to comply with any of these steps shall render the bid non-responsive and upon determination of such non-responsiveness, such bid shall be rejected immediately, set aside, and shall receive no further consideration.

Bid Opening Procedure

Step #1. Timeliness – The bid must be filed at the place and within the time specified therefore in the invitation to bid, and no bid shall be accepted after such time. The time at which a bid is filed should be time/date stamped or otherwise prominently noted on the bid;

Step #2. Bid Security – Properly executed bid security, in the amount and terms specified in the invitation to bid (equal to 5% of Base Bid or Highest Possible Amount considering all alternatives) shall be placed in a seal envelope and attached to the outside of the envelope containing the bid at the time of its submission;

A. Bid Bond

The Bid bond must be dated On or Before the Bid Date;
Issued by a Bonding Company Licensed in Massachusetts;
Accompanied by a Current Power of Attorney;
Signed by Surety;

B. Check

The Check must be a Certified, Cashiers or Bank Treasurer's;
Dated On or Before the Bid Date;

Step #3. Bid Signature – The bid and all accompanying documents so required shall be signed by the bidder or its authorized representative before submission;

Step #4. Addenda – All addenda shall be sent certified mail, return receipt requested, by the owner to all individuals and organizations which have received plans and specifications and shall be mailed not later than five days prior to the date established for submission of bids. All bidders shall include with their bids written acknowledgement of receipt of all addenda, which acknowledgement may be on a form provided therefore by the owner.

Alternates – Any Alternates shall be acknowledged.

Step #5. Written Dollar Amounts – The total dollar amount of each bid shall be read, and the three lowest bids shall be selected for further consideration. The remaining bids shall then be set aside. The three apparent low bids shall be read to determine whether the unit price for each line item of each bid has been written therein in words. If it has not, such bid shall be rejected and shall receive no further consideration. Bid amounts shall be consistent (words vs. numbers) and if words and numbers differ, the words govern**.** This procedure shall then be repeated with the next apparent low bid until three are acceptable which have all the unit prices written in words, at which time the lowest bid shall be announced as the apparent low bidder, and the bid opening procedure shall be closed.

The Division recommends that this policy memorandum be included in all contract specifications and that the owner's evaluator(s) use the attached form (CG-13 Attachment #1) for bid opening procedures.

The Contractor's Bid Opening Checklist also attached hereto, is for use by each contractor to assure that his bid conforms with this policy memorandum. It is recommended that the checklist (CG-13 Attachment #2) be included in information for bidders, or at the end of the bid proposal, or in some other prominent part of the bid specifications

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FORM FOR BID OPENING PROCEDURES
(to be completed by the owner's evaluator(s))

CONTRACT NO.: _____ DATE: _____

CONTRACT NAME: _____ BID OPENING TIME: _____

All non-responsive bids shall be rejected forthwith by the awarding authority upon determination of such bids' non-responsiveness at the time bids are opened and read. Failure to comply with any one of the requirements shall render the bid non-responsive, and upon determination of such non-responsiveness such bid shall be rejected and receive no further consideration.

A = Acceptable *N-R = Non-Responsive (explain reasons on supplemental sheet & attach)*

	BIDDER	1. TIMELINESS	2. BID SECURITY	3. SIGNATURE	4. ADDENDA ALTERNATIVES	5. WRITTEN DOLLAR AMOUNTS	COMPLIANCE (CIRCLE ONE)	
1							YES	NO
2							YES	NO
3							YES	NO
4							YES	NO
5							YES	NO
6							YES	NO
7							YES	NO
8							YES	NO
9							YES	NO
10							YES	NO
11							YES	NO
12							YES	NO

DEP/DMS

Evaluator(s) _____

_____

_____

CG-13 Attachment #1

BID OPENING PROCEDURES
CONTRACTORS CHECKLIST

CONTRACT NO.: _____ BIDDER: _____ DATE: _____

All non-responsive bids shall be rejected forthwith by the awarding authority upon determination of such bids' non-responsiveness at the time bids are opened and read. Failure to comply with one or more of the following requirements shall render the bid non-responsive, and upon determination of such non-responsiveness such bid shall be rejected and receive no further consideration.

ITEM	REQUIREMENTS	COMPLIANCE (CIRCLE 1)		REASONS FOR REJECTION
1. Timeliness	Bid filed w/in time specified	Yes	No; Rejected	
2. Bid Security	Appropriate and properly Executed security w/bid.	Yes	No; Rejected	
3. Signature	Bid signed by authorized Representative	Yes	No; Rejected	
4. Addenda	8All addenda acknowledge Any alternative	Yes	No; Rejected	
5. Dollar Amount	Dollar amount in words Specified for each line item in bid	Yes	No; Rejected	

DEP/DMS Attachment #2

POLICY MEMORANDUM NO. CG-14 PAYMENT FOR ROCK EXCAVATION

There shall be in the contract documents a separate pay item for rock excavation. For such purposes, "rock" shall mean igneous, sedimentary, metamorphic, and conglomerate rock, which for excavation must be drilled, blasted, broken, or ripped by power tools. Boulders and concrete structures one cubic yard or greater, however removed, are included within this definition of rock for payment purposes. At the option of the owner or his representative a separate pay item for boulders, concrete structures, or concrete road base may be used.

Depth From Ground Surface To Invert Pipe	Pay Width (Nominal Pipe Diameter)	
	0-24"	Over 24"
* 0 – 12'	5'0"	D+3'0"
* Over 12' – 20'	7'0"	D+5'

Engineer's plans and specifications shall establish pay limits below pipe and structures.

- See CG-14 Attachment #1 (typical cross section)

Payment width for depths over twenty feet (20') shall be determined on a case-by-case basis consistent with the foregoing chart.

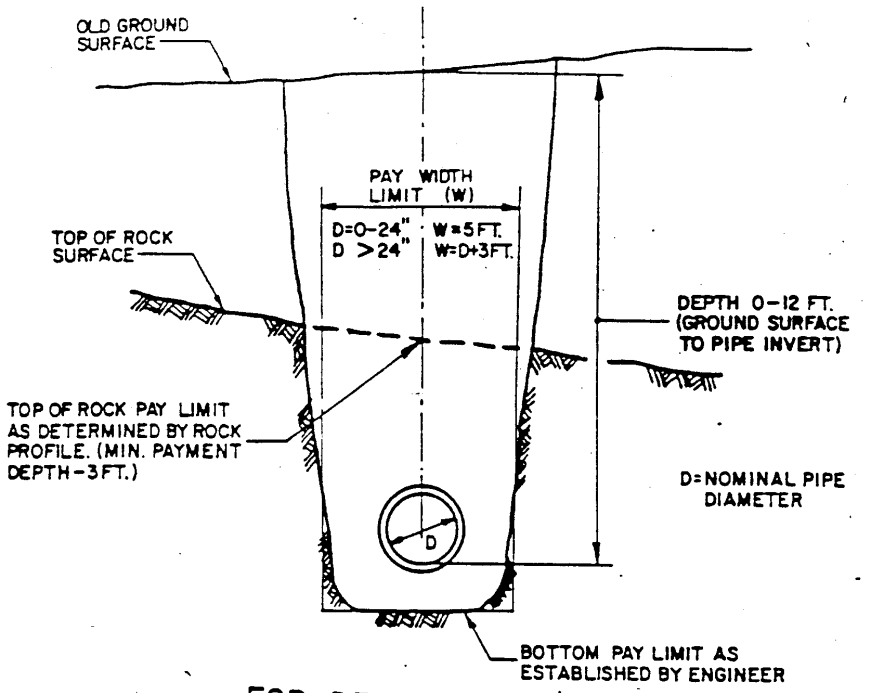
The pay limit for rock removal outside proposed manholes shall commence one foot (1') outside the widest dimension of the structure of shall be the maximum connecting trench width, whichever is greater.

Payment depth for rock which is encountered in a trench shall be no less than three feet (3') when removal can be accomplished only by drilling and blasting or by use of jack (air or hydraulic) hammers.

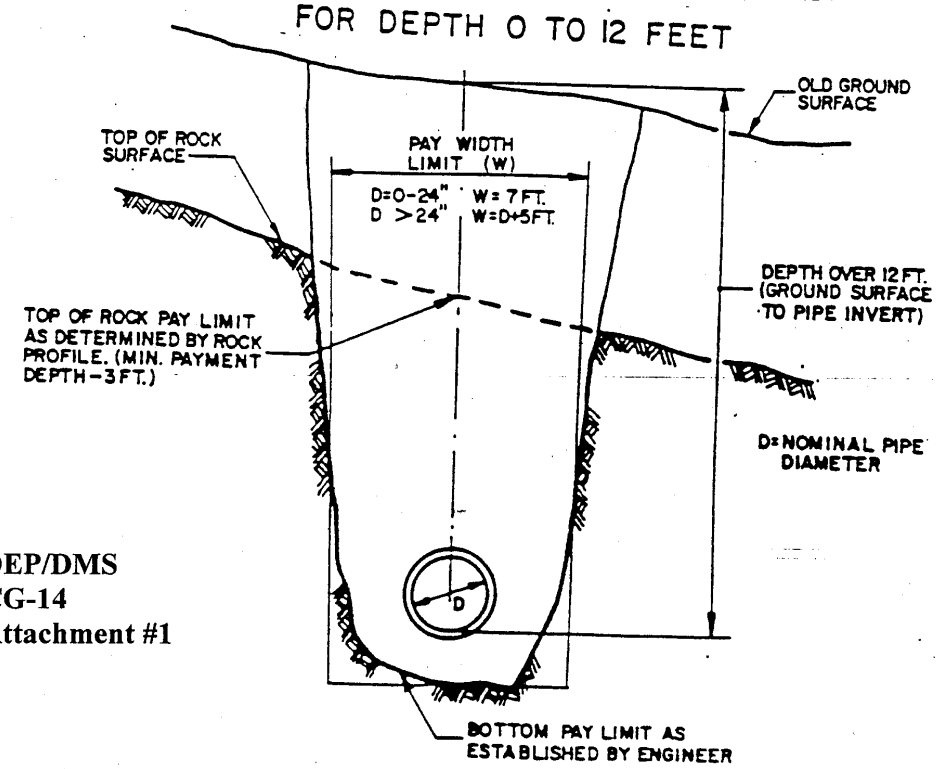
Payment for rock removed, using the same or equal equipment as utilized for normal trench excavation, shall be limited to the actual depth removed within the limits established by the contract documents.

Boulders encountered within the pay limits of excavation, whose volume is one cubic yard or greater, part of which extends outside said limits shall be paid in accordance with the actual volume excavated.

CG-14 ROCK EXCAVATION



FOR DEPTH 0 TO 12 FEET



FOR DEPTH OVER 12 FEET AND UP TO 20 FEET

DEP/DMS
CG-14
Attachment #1

POLICY MEMORANDUM NO. CG-15 TRAFFIC POLICE

The reasonable costs for police details required for traffic control on a construction project which receives financial assistance shall be considered as an eligible administrative cost. A police detail item shall not be included as a bid item in the contract documents.

"Police" as used in this memorandum includes local, county, capital, state, regular and auxiliary police.

Owner's Responsibility

It shall be the owner's responsibility to submit in writing the hourly rate of pay to be established for detailed traffic police and each change in rate during the course of the project. It is the owner's responsibility to arrange, document and pay for such police details. The owner or its representative shall meet with the police chief or other officer in charge of police detail duty to review contract needs. The owner shall maintain a daily record of the following:

a. Officer's name
b. Hours worked
c. Location of assignment
d. Hourly rate

POLICY MEMORANDUM NO. CG-16 DOCUMENTATION REQUIRED TO SUBSTANTIATE CONTRACT QUANTITIES

Unit	Documentation required
Acres (A)	Location, station, offset and calculations. Location = Street right-of-way, etc. Station = Point on Baseline; Offset = Distance left or right of Baseline
Cubic Yard (C.Y.)	Location, stations, widths, depths, calculations and Cross sections as necessary
Each (Ea.)	Location, station, and offset
Gallon (Gal.)	Location, stations, calculations (if appropriate) and delivery slips.
Hour (Hr.)	Hours and location.
Linear Feet (L.F.)	Location, stations, and offsets.
Month (Mo.)	Location, period of time and calculations if applicable.
1000 Foot Board Measure (MFBM)	Location, stations, offset, elevations, grade, and calculations. Attach invoices where applicable.
Pound (Lb.)	Locations, stations, and calculations (if applicable). Attach Delivery weight slips.

Square Feet (S.F.)	Locations, stations and calculations
Square Yard (S.Y.)	Locations, stations and calculations
Ton	Locations, stations and calculations (if applicable). Attach Delivery weight slips.
Vertical Feet (V.F.)	Locations, stations, elevations, and offsets.

Notes:

1. All of the above, that apply must be submitted with a final payment request or change order as applicable.
2. Where in place measurement is not possible or practical, delivery slips may be used to substantiate quantities.
3. Change orders – See CG-10 in which some of the above may be applicable in justifying materials, equipment and labor.
4. When necessary, itemized quantities must be separated into eligible and non-eligible units with separate calculations to justify eligible costs.
5. Overruns and underruns of any specific item shall be explained with an appropriate sentence or paragraph.
6. On all quantities, units of payment shall be maintained at the project site and shall be updated daily so that upon field inspection by the C.O.E., EPA or DMS, the quantities paid to date can be substantiated.
7. In the case of unforeseen conditions, photos should be submitted with the applicable item in addition to the recommended documentation.
8. Documentation of units of payment shall be clearly legible and cross referenced to the applicable sheets of the record drawings.
9. For record drawings policy, please see CG-4.

DMS Policies 1 through 16 Approved By: Division of Municipal Services

DWS POLICY 88-02
DEPARTMENT OF ENVIRONMENTAL PROTECTION
POLICY FOR REVIEW OF SEWER LINE/WATER SUPPLY PROTECTION

The Department of Environmental Protection seeks to protect existing and potential water supplies from the potentially negative effects of leaking sewer lines through the adoption of a Department policy on this subject.

The following restrictions will apply to new sewer construction statewide:

Gravel Packed Wells

~ Within the 400 foot radius protective distance around gravel packed wells, all sewer lines and appurtenances are prohibited, unless they are necessary to eliminate existing and/or potential sources of pollution to the well.

Tubular Wells

~ Within the 250 foot radius protective distance around tubular wells, all sewer lines and appurtenances are prohibited, unless they are necessary to eliminate existing and/or potential sources of pollution to the well.

Gravel Packed and Tubular Wells

~ Within a minimum radius of 2,640 feet or unless otherwise documented by an appropriate study specifically defining the area of influence and approved by the Division of Water Supply, all sewer lines and appurtenances will be designed and constructed for maximum water tightness.

- Force Mains or Pressure Sewers: shall be tested at 150% above maximum operating pressure or 150 p.s.i. whichever is greater. Testing shall conform to the requirements of the American Water works Association (AWWA) standard c 600.

- Gravity Sewers: shall be tested by approved methods which will achieve test results for infiltration or exfiltration of less than 100 gallons/inch diameter/mile/24 hours.

- Manholes: shall be installed with watertight covers with locking or bolted and gasketed assembles. Testing for infiltration/exfiltration shall conform to the same standards as the maximum allowed for pipes in the manhole as required for gravity sewers, indicated above.

- Satisfactory test results for Force Mains, Manholes and Gravity Sewers shall be performed prior to the expiration of the contractor's one year guarantee period.

- All pumping stations within this zone shall have standby power high water alarms telemetered to an appropriated location that is manned at all times. An emergency contingency plan must be developed by the owner and approved by the BRP.

- A minimum of Class B bedding as defined by WPCF-MOP9 must be used for all piping.

- Service connections (laterals and house connections) shall be rigidly inspected by the appropriate municipal official. Certified inspection reports shall be submitted to the BRP.

Bedrock Wells

The above requirements are the same for bedrock wells, with the Department reserving the right to require more stringent controls on a case-by-case basis.

Surface Water Supplies

~ Within 100 feet of all surface water supplies and tributaries all sewer lines and appurtenances are prohibited except as required to cross tributaries or to eliminate existing or potential pollution to the water supply. In the latter case, watertight construction methods shall be use.

~ Tributary stream crossings shall employ watertight construction methods of sewer lines and manholes. Watertight construction must extend 100 feet to either side of the stream.

~ Within 1,000 feet of surface water supplies and tributaries, all pumping stations shall have standby power and high-water alarms telemetered to an appropriate location that is manned at all times. An emergency contingency plan must be developed by the owner of the wastewater treatment facility and submitted to the BRP for approval.

~ Beyond 1,000 feet and within the watershed of surface water supplies the Department may in specific circumstances after review, require additional controls.

Potential Public Water Supplies

The above requirements also apply to potential public water supplies.

Baseline Date Requirements

Two (2) copies of an appropriately scaled map(s) shall be submitted to the Department which details the proposed sewers and/or appurtenances and also includes the following:

(1) the location of all nearby existing or potential surface water supplies, tributaries thereto, and watershed boundaries;

(2) the location of existing and potential public and municipal potable groundwater supply wells.

The Department reserves the right to impose more restrictive measures than those contained in this policy as deemed appropriate.

Definitions

○ Appurtenances – all attachments to sewer lines necessary for the transport and operation and maintenance of sewer lines, including manholes, pumping station, siphons, etc.

○ Area of influence – that area of an aquifer which contributes water to a well under the most severe recharge and pumping condition that can be realistically anticipated (i.e. pumping at the safe yield of the well for 180 days without any natural recharge occurring). It is bounded by the groundwater divides which result from pumping the well and by the contact of the edge of the aquifer with less permeable materials such as till and bedrock. At some locations, streams and lakes may form recharge boundaries.

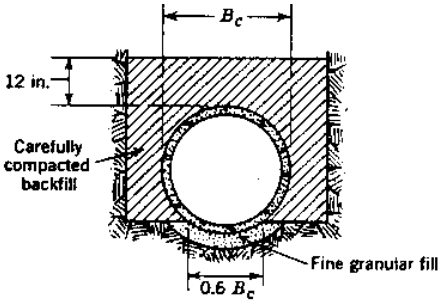
○ Potential public water supply – areas designated by communities for water supply purposes where land has been set aside and Department approved pump tests conducted and surface water supplies as defined below.

○ Surface Water Supply – Waters classified as Class A by the DWPC.

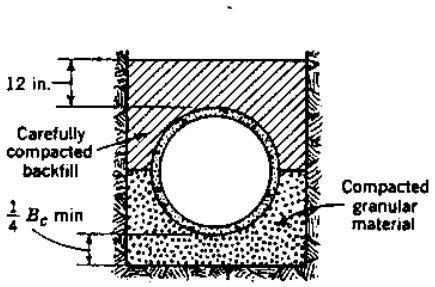
○ Public Water Supply Systems – as defined in 310 CMR 22.02 (DEP Drinking Water Regulations).

○ Class B Bedding – as defined in WPCF Manual of Practice No. 9.

APPROVED: (Signature on File)



Shaped bottom with tamped backfill, load factor 1.9



Compacted granular bedding, load factor 1.9

Class B---First-Class Bedding – Class B bedding may be achieved by either of two construction methods:

a. Shaped Bottom with Tamped Backfill. The bottom of the trench excavation shall be shaped to conform to a cylindrical surface with a radius at least 2 in. (5 cm) greater than the radius to the outside of the pipe and with a width sufficient to allow six-tenths of the width of the pipe barrel to be bedded in fine granular fill placed in the shaped excavation. Carefully compacted backfill shall be placed at the sides of the pipe to a thickness of at least 12 in. (30 cm) above the top of the pipe. Shaped trench bottoms are difficult to achieve under current construction conditions.

b. Compacted Granular Bedding with Tamped Backfill. The pipe shall be bedded in compacted granular material placed on a flat trench bottom. The granular bedding shall have a minimum thickness of one-fourth the outside pipe diameter and shall extend halfway up the pipe barrel at the sides. The remainder of the side fills and a minimum depth of 12 in. (30 cm) over the top of the pipe shall be filled with carefully compacted material.

END OF DOCUMENT

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SECTION 00902

PROJECT SIGN

PART 1 - GENERAL

1.01 - SCOPE

A. The work of this section includes furnishing all labor, equipment, tools and materials, and performing all operations in connection with furnishing, erecting, maintaining and removal / legal disposal of the Project Sign as specified herein.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. The Contractor shall include the cost for two signs as specified herein.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Drawing showing layout Project Sign.
2. Scope of supply of all materials and hardware.

1.05 - PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed to not degrade the quality of the Project Sign.

1.06 - DESIGN CRITERIA

A. The Contractor shall erect a sign at the project site identifying the project information as specified herein.

B. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

PART 2 - PRODUCTS

2.01 - SUBMITTAL PROCEDURES

A. Panel

1. Material: APA rated A-B grade – Exterior
2. Dimensions: 4-feet x 8-feet x ¾-inch

B. Posts

1. Material: Pressure Treated
2. Dimensions: 4-inch x 4-inch x 12-feet

C. Hardware shall be 5/16-inch Type 304 stainless steel nuts, washers and bolts

D. Finish

1. Front side (background) shall consist of at least three coats of white outdoor enamel paint.
2. Rear side shall be painted with one coat of white outdoor enamel paint.
3. Lettering shall be 4-inch high and either Helvetica or Arial Font and shall be painted with two coats of black outdoor enamel paint.

PART 3 - EXECUTION

3.01 - VERIFICATION OF CONDITIONS

A. Before the start of the work of this Section, verify that the project is ready for this work.

B. Verify that field measurements are as shown on approved shop drawings.

C. Notify subcontractors involved or affected by this work and coordinate the work with them.

3.02 – INSTALLATION, MAINTENANCE AND REMOVAL

A. Installation

1. The sign shall be erected within 14 days after shop drawing approval and prior to the start of any construction.
2. The Project Sign shall be installed at a location identified in the field with the Engineer.
3. The Project Sign shall be installed level with the top of the sign 8 feet above natural ground and installed vertically to a minimum depth of 3-feet below natural ground.
4. Install with four nuts and bolts per post with one washer front and back.

B. Maintenance

1. The Contractor shall maintain the Project Sign throughout the direction of construction.
2. The Contractor shall repair, repaint, and/or replace the Project Sign as required to ensure that the sign

C. Removal

1. The sign shall be removed and legally dispose of within 14 days of substantial completion.
2. The location shall be restored in accordance with SECTION 02485, LOAMING AND SEEDING.

3.03 – CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF TEXT

See Attached Figure

Downtown Area Collection System and Pumping Stations
Contract No. 2019-02 and SRF No 4486

Owner
Town of Orleans, MA

Owners Project Manager
Tighe & Bond
Worcester, MA

Engineer
AECOM Technical Services, Inc.
Pocasset, MA

Contractor
Name TBD
Address TBD

This Project is Funded and Administered by the US Environmental Protection Agency and the Massachusetts Department of Environmental Protection

Project Cost
$ TBD

DOCUMENT 00945

CERTIFICATE OF SUBSTANTIAL COMPLETION

Project Name:	Downtown Area Collection System and Pumping Stations Contract No. 2019-02 and SRF No. 4486
Agreement Date:	
Owner:	Town of Orleans, MA, 139 Main Street, Orleans, MA 02653
Completion Date:	
Contractor:	
Contract For:	

This Certificate of Substantial Completion applies to all Work under the Contract Documents or to the following specified parts thereof:

To: _____

From: _____

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and that Work is hereby declared to be substantially complete in accordance with the Contract Documents on

Date of Substantial Completion: _____

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of Contractor to complete all the Work in accordance with the Contract Documents. The items in the tentative list shall be completed or corrected by Contractor within 30 calendar days of the above date of Substantial Completion.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance and warranties shall be as follows:

Owner:

1. _____
2. _____
3. _____
4. _____
5. _____

Contractor:

1. _____
2. _____
3. _____
4. _____
5. _____

The following documents are attached to and made a part of this Certificate:

1. _____
2. _____
3. _____
4. _____
5. _____

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

Executed by Engineer on:

	AECOM Technical Services, Inc.
Date	Consultant Engineer
	Signature
	Thomas Parece, P.E.
	Name
	Associate Vice President
	Title

Contractor accepts this Certificate of Substantial Completion on:

Date	Contractor
	Signature of Contractor
	Name
	Title

Owner accepts this Certificate of Substantial Completion on:

	Town of Orleans, MA
Date	Owner
	Signature of Owner
	John Kelly
	Name
	Town Administrator
	Title

END OF DOCUMENT

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DOCUMENT 00950

WAIVER OF LIENS

Project Name:	Downtown Area Collection System and Pumping Stations Contract No. 2019-02 and SRF No. 4486
Agreement Date:	
Owner:	Town of Orleans, MA, 139 Main Street, Orleans, MA 02653
Completion Date:	

The undersigned Contractor hereby swears under penalty of perjury that (1) all previous progress payments received from the Owner on account of Work performed under the Contract referred to above have been applied by the undersigned to discharge, in full, all obligations of the undersigned incurred in connection with Work covered by prior Estimates for Partial Payment under said Contract, being Estimates Number 1 through 6 inclusive; and (2) all labor, materials and equipment incorporated in said Project or otherwise listed in or covered by these Estimates for Partial Payment are free and clear of all liens claims, security interests and encumbrances, except those listed below by obligee, nature and amount of obligation and covered by appropriate Bond or Bonds, as listed beside each obligation and attached to and made a part of this certification.

Obligation	Bond

Date

Contractor

Signature of Officer of the Contractor

Name of Officer of the Contractor

Title

State of: County of:

Subscribed and sworn to before me this day of

personally appeared known to me, who being duly sworn, did depose and save that he is the (Officer) of the Contractor above mentioned; that he executed the above statement on behalf of said Contractor and that all of the statements contained therein are true, correct and complete.

Notary Public

My Commission Expires:

END OF DOCUMENT

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DOCUMENT 00960

CERTIFICATE OF FINAL PAYMENT AND COMPLETION OF WORK

Project Name:	Downtown Area Collection System and Pumping Stations Contract No. 2019-02 and SRF No. 4486
Agreement Date:	
Owner:	Town of Orleans, MA, 139 Main Street, Orleans, MA 02653
Completion Date:	

FINAL CERTIFICATION OF CONTRACTOR

_____(Contractor), _____ (address) agrees to accept $_____ as full and final payment for all work completed under this Contract dated _____ with the Town of Orleans, MA for Contract No. 2019-02, Downtown Area Collection System and Pumping Stations.

I certify that all construction has been carried out in substantial compliance with the Contract Documents, and that all labor, equipment, materials and Subcontractors have been or will be paid in accordance with the requirements of the General Laws of the Commonwealth of Massachusetts.

Date	Contractor
	Signature of Officer of the Contractor
	Name of Officer of the Contractor
	Title

END OF DOCUMENT

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DOCUMENT 00965

TRANSFER OF TITLE

Project Name: Downtown Area Collection System and Pumping Stations
Contract No. 2019-02 and SRF No. 4486

Agreement Date: _____

Owner: Town of Orleans, MA, 139 Main Street, Orleans, MA 02653

_____, (Contractor), a corporation, or a partnership, or an individual, having a principal place of business in _____ hereby transfers and conveys to the Town of Orleans, MA (Owner), title to the following material(s) delivered and stored at the designated storage area(s) at _____ upon the receipt of $ _____, which amount is to be included in the Application and Certification For Payment No. _____

Therefore, upon the receipt of the sum of $ _____ * paid by the Owner, the Contractor waives all of its statutory lien rights regarding the following material. The storage, transportation, protection and ultimate installation of this material remain the responsibilities of the Contractor.

* Amount subject to reduction by applying applicable retainage percentage according to the terms of the Contract between the Owner and Contractor.

Title to the following material is being transferred by this document:

1. _____
2. _____
3. _____
4. _____
5. _____

In witness whereof, the Contractor has caused this instrument to be executed by its duly authorized representative.

Date	Contractor
	Signature of Officer of the Contractor
	Name of Officer of the Contractor
	Title

State of: County of:

Subscribed and sworn to before me this day of

personally appeared known to me, who being duly sworn, did depose and save that he is the (Officer) of the Contractor above mentioned; that he executed the above statement on behalf of said Contractor and that all of the statements contained therein are true, correct and complete.

Notary Public

My Commission Expires:

END OF DOCUMENT

SECTION 01020

ALLOWANCES

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1.02 - MEASUREMENT AND PAYMENT 1
1.03 - DEFINITIONS 1
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PART 1 - GENERAL

1.01 - SCOPE

A. Include all costs related to the scheduled allowances in the applicable bid item of DOCUMENT 00300, BID FORM. Allowance amounts listed herein have been estimated. Actual paid invoice amounts shall be used for reimbursement purposes.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. Include in the Contract Price, scheduled allowances included under the applicable Bid Item of DOCUMENT 00300, BID FORM specified in the respective specification sections and listed below:

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS – Not Used

1.05 - ALLOWANCES FOR PRODUCTS

A. The amount of each allowance unless otherwise specified in SECTION 01025, MEASUREMENT AND PAYMENT:
   1. The cost of the product for service.
   2. Applicable taxes.

B. In addition to the amount of each allowance, include, except as specified herein, in the Contract Sum the Contractor's costs for:
   1. Handling at the site, including unloading, uncrating, and storage.
   2. Protection from the elements and from damage.
   3. Labor for installation and finishing, except where labor is specified to be a part of the Allowance.
   4. Other expenses required to complete the installation.
   5. Contractor's and Subcontractor's overhead and profit.

C. The scheduled allowances are as follows:

SCHEDULED ALLOWANCES - SRF ELIGIBLE BID ITEMS - BASE BID

Item Number	Description	Amount	Bid Item
1	Traffic Markings	$25,000	15.L.
2	Removal and Relaying and/or Replacement of Existing Gas Mains and Services	$50,000	16.C.
3	Removal and Relaying and/or Replacement of Existing Miscellaneous Utilities	$50,000	16.D.
4	MassDOT Inspections	$10,000	22.B.
5	Electric Company Connection/Service Fee	$100,000	23.D.
6	Telephone Company Connection/Service Fee	$20,000	23.E.
7	Planting Operations	$20,000	23.F.

SCHEDULED ALLOWANCES - SRF ELIGIBLE BID ITEMS – ALTERNATIVES
Item A-1- Pavement Restoration in Town Roadways

Item Number	Description	Amount	Bid Item
1	Traffic Markings	$25,000	15.L.

SCHEDULED ALLOWANCES - SRF ELIGIBLE BID ITEMS – ALTERNATIVES
Item A-2 - Pumping Station No. 3 Tributary Area

Item Number	Description	Amount	Bid Item
1	Traffic Markings	$25,000	15.L.
2	Removal and Relaying and/or Replacement of Existing Gas Mains and Services	$50,000	16.C.
3	Removal and Relaying and/or Replacement of Existing Miscellaneous Utilities	$25,000	16.D.
4	Electric Company Connection/Service Fee	$25,000	23.D.
5	Telephone Company Connection/Service Fee	$10,000	23.E.
6	Planting Operations	$10,000	23.F.

1.06 - SELECTION OF PRODUCTS UNDER ALLOWANCES

A. Engineer's duties are as follows:

1. Make selection in consultation with the Owner and obtain Owner's written decision, designating:
    a. Product, model and finish.
    b. Accessories and attachments.
    c. Cost to the Contractor, delivered to the Project Site or installed, as applicable.
2. Transmit Owner's decision to the Contractor.
3. Prepare Change Orders.

B. Contractor's duties are as follows:

1. Obtain proposals from suppliers and installers when requested by the Engineer.
2. Make appropriate recommendations for consideration by the Engineer.
3. Notify the Engineer promptly of:
    a. Any reasonable objections the Contractor may have against any supplier, or party under consideration for installation.
    b. Any effect on the construction schedule anticipated by selections under consideration.

1.07 - ADJUSTMENT OF COSTS

A. Should the net cost be more or less than the specified amount of the allowance, the Contract Price shall be adjusted accordingly by Change Order.

1. The amount of the Change Order will recognize any changes in handling costs at the Project Site, labor, installation costs, overhead, profit and other expenses caused by the selection under the allowance.

B. Submit any claims for anticipated additional costs at the Project Site, or other expenses caused by the selection under the allowance, prior to execution of the Work.

C. Submit documentation or actual additional costs at the Project Site, or other expenses caused by the selection under the allowance, within 60 days after completion of execution of the Work.

D. Failure to submit claims within the designated time will constitute a waiver of claims for additional costs.

E. At Contract closeout, reflect all approved changes in Contract Price in the final statement of accounting.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

SECTION 01025

MEASUREMENT AND PAYMENT

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PART 1 - GENERAL

1.01 - SCOPE

A. The purpose of this section is to define the basis of measurement and payment for each of the unit price or lump sum items listed in DOCUMENT 00410, FORM OF GENERAL BID. If no quantity or bid item appears in DOCUMENT 00410, FORM OF GENERAL BID for any of the following described items, no Work of that description is anticipated on the project.

B. The Contractor shall become acquainted with all Work associated with each Payment Item and shall have no claim for additional compensation due to unfamiliarity with the Work required to complete each Item in accordance with the Contract Documents.

C. No payment will be made for any item of Work until all documentation required by the Contract Documents has been reviewed and approved by the Engineer. No payment will be made for additional materials that are not installed on the Project. The Owner reserves the right to withhold the fair market value for work not completed in addition to the retainage on work completed. Unbalanced bid items will specifically be subject to review and to this potential withholding from periodic payment applications.

1.02 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.03 - PAYMENT ITEMS

A. SRF Eligible Items

Item	Description
1	Mobilization/Demobilization
2	Sewer and Storm Drainage Pipelines and Associated Fittings
3	Precast Concrete Manholes and Structures
4	Manhole Frames, Covers and Grates
5	Interior Manhole Drop Connections
6	Chimneys
7	Miscellaneous Cement Concrete
8	Rock and/or Boulder Excavation
9	Replacement of Unsuitable Material
10	Experimental Excavation
11	Fill for Embankments – Not Used
12	Sheeting and/or Shoring Ordered Left in Place – Not Used
13	Soil Compaction Tests
14	Road Gravel
15	Pavement Restoration
16	Remove and Relay or Replace Existing Utilities
17	Uniformed Traffic Police Officers
18	Engineer's Field Office
19	Environmental Protection
20	Dewatering
21	Temporary By-Pass Pumping – Not Used
22	Highway Crossing
23	Pumping Stations
24	Fiber Optic Conduits and Handholes

B. SRF Eligible Bid Items - Alternatives

Item	Description
A-1	Pavement Restoration in Town Roadways
A-2	Pumping Station No. 3 Tributary Area
A-3	Fiber Optic Conduits, Associated Fittings and Handholes
A-4	Tracer Wire in Town Roadways
A-5	Highway Crossing Using Jacking

C. SRF Ineligible Bid Items

Item	Description
B-1	Replacement of Water Services
B-2	Replacement of Canal Road Water Main
B-3	Water Quality Improvements

1.04 - BASIS OF MEASUREMENT AND PAYMENT – SRF ELIGIBLE ITEMS

ITEM 1 - MOBILIZATION/DEMOBILIZATION

A. General. The price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include transporting, mobilization, demobilization, utility connection fees, permits, licenses, bonds, insurance and all other incidental Work relative thereto.

B. Measurement. Measurement for mobilization/demobilization shall be made based on the lump sum amount bid as approved by the Engineer.

C. Payment. Payment for mobilization/demobilization listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the lump sum price bid under this Bid Item. The amount of this lump sum shall not exceed five (5) percent of the Contract amount, excluding Item 1, and no payment shall be made in excess of this amount. An amount of seventy-five (75) percent of the amount bid under Item 1 (exclusive of normal Contract retainage) will be made when the Contractor has mobilized to the Project site(s) and is ready to start construction. The remaining twenty-five (25) percent (exclusive of normal Contract retainage) will be made following demobilization from the Project site(s) following final completion and acceptance of the work by the Owner.

ITEM 2 - SEWER PIPELINES AND ASSOCIATED FITTINGS

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include: transportation, handling and dispersal of materials; clearing and grubbing; saw cutting and removal of existing bituminous and cement concrete or reinforced cement concrete pavement; excavation (excluding that which is specified to be paid for under a separate Bid Item); backfill above trench grade including all bedding materials (excluding material used to replace unsuitable material, controlled density fill and road gravel); removal and legal disposal of all existing utility lines not being relaid (including pipes, services, manholes and appurtenances); removal and legal disposal of existing utility materials (as required); compacting trenches (excluding soil compaction tests specified to be paid for separately); sheeting and shoring not ordered left in place; loaming and seeding; landscaping; removing and resetting curbing, property markers, signs and mail boxes; connections to existing pipeline(s) and services; dust control including mechanical sweeping; all permanent and temporary fittings, caps, plugs, restraints and the like; two-way sewer lateral cleanout; service check valves, low pressure sewer service lateral and curb box, traffic control devices, flushing and testing; dewatering of trenches; polyethylene encasement; cleaning and television inspection of sewer lines, daily cleanup; restoration of all areas disturbed by the Contractor's operations; all Work as specified in DIVISION 1 – GENERAL REQUIREMENTS (excluding Environmental Protection specified to be paid for under a separate Bid Item); and all other incidental Work relative thereto.

B. Measurement. Measurement for furnishing and installing pipelines and associated fittings shall be as follows:

1. The length of pipe and fittings (pipeline), to be paid for shall be the horizontal measured length of pipeline in place from centerline of manhole to centerline of manhole. Measurement shall be by the linear foot with no deductions made for manholes, fittings or valves. The measurement for depth of gravity sewers shall be made vertically from the existing ground surface above the pipeline to the invert of the sewer.

2. The length of pipe and fittings to be paid for shall be the measured length of pipeline in place. Measurement shall be by the linear foot with no deductions made for fittings or valves.

3. Measurement for service connections shall be by the linear foot with no deductions made for fittings or valves.

   a. Measurement for sewer service connections shall be the horizontal measured length of pipeline in place from the face of the wye, tee or chimney to the terminus of the service pipeline.

   b. Measurement shall be as stated above with a minimum payment of five (5) linear feet.

4. Measurement for wyes, blow offs, air vents (manual or automatic), service connections and the like shall be per each installation, as approved by the Engineer.

C. Payment. Payment for furnishing and installing pipelines and associated fittings of the various types, diameters and depths listed in DOCUMENT 00410, FORM OF GENERAL BID, shall be made at the unit prices bid under the applicable divisions of this Bid Item.

1. Only eighty-five (85) percent of the price bid per linear foot of pipeline shall be paid for upon its installation, the balance shall be withheld until such time as pipeline(s) have been successfully flushed and tested (as required), accepted by the Owner for incorporation into the existing pipeline system and the site(s) has been fully restored. This percentage is exclusive of normal Contract retainage.

2. An additional five (5) percent shall be withheld until such time as the complete system has been cleaned and televised with records accepted by the Owner. This percentage is exclusive of normal Contract retainage.

3. The Contractor shall provide water for flushing and testing (as applicable) for each section of pipeline (transmission main and force main only) installed. Water utilizing the Owner's water system may be available, however, the Owner does not guarantee that its water supply will be available at any time during the duration of the Project. If available, water required for testing, puddling and/or jetting of trenches shall be provided by the Owner at no cost to the Contractor. All water shall be metered and the use of backflow prevention device(s) shall be required as approved by the Owner.

4. Payment for furnishing and installing fittings, restraints, solid sleeves, flexible couplings, transition couplings and the like shall be made under and included in the prices bid per linear foot.

5. Payment for service connections including fittings and/or valves shall be made at the unit price bid per linear foot.

6. Payment for sewer service wyes shall be made at the unit price bid for each approved installation. Payment will be made without regard to size.

ITEM 3 - PRECAST CONCRETE MANHOLES AND STRUCTURES

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include excavation, installation, steel reinforced copolymer polypropylene plastic steps, lifting rings, sealing materials in horizontal joints, pipe penetrations, dampproofing, invert, electrical and mechanical equipment, valves and fittings, external manhole encapsulation system, backfill, mancatchers on manholes over twenty (20) feet in depth, removal and legal disposal of existing structures to be replaced, as specified and/or shown on the Contract Drawings and all other incidental Work relative thereto.

B. Measurement. Measurement for furnishing and installing precast concrete manholes shall be as follows:

1. For sewer and drain manholes, measurement for depth shall be from the top of frame to the lowest invert in the manhole, as approved by the Engineer.

2. For air release and flushing/drain manholes, measurement shall be per each installation, regardless of depth, as approved by the Engineer.

3. For sump drain manholes and catch basins, measurement shall be from the top of frame to the lowest invert or sump in the structure, as approved by the Engineer.

4. For leaching catch basins measurement shall be from the top of frame to the lowest invert or sump in the structure, as approved by the Engineer.

C. Payment. Payment for furnishing and installing precast concrete manholes listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit prices bid under the applicable divisions of this Bid Item.

1. Payment for air vacuum and air release valve and/or flushing drain manholes shall be per each approved installation.
2. Payment for leaching catch basins shall be per each approved installation.
3. Only eighty-five (85) percent of the price bid for each manhole shall be paid for upon its installation, the balance shall be withheld until such time as the manhole has been successfully tested and accepted by the Owner. This percentage is exclusive of normal Contract retainage.
4. An additional ten (10) percent shall be withheld until such time as the invert, manhole steps, pig catchers, and mancatchers have been installed and accepted by the Owner. This percentage is exclusive of normal Contract retainage.
5. Only twenty (20) percent of the price bid for each:(a) Inline Flushing Manhole with Combination Air Valve; and (b) Terminal Flushing Manhole with Combination Air Valve manhole shall be paid for upon its installation, the balance shall be withheld until such time as the manhole has been successfully tested and accepted by the Owner. This percentage is exclusive of normal Contract re.

ITEM 4 - MANHOLE FRAMES, COVERS AND GRATES

A. General. The prices bid under each division of Item 4 shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include setting frames, covers and grates to existing grade initially and resetting frames, covers and grates to final grade prior to final pavement restoration and all other incidental Work relative thereto.

B. Measurement. Measurement for furnishing and installing manhole frames, covers and grates shall be per each installation as approved by the Engineer.

C. Payment. Payment for furnishing and installing manhole frames, covers and grates of the various types and sizes listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit prices bid per each under the applicable divisions of Item 4.

ITEM 5 - MANHOLE DROP CONNECTIONS

A. General. The prices bid under Item 5 shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include excavation, assembly, drop piping, fittings, hardware, and all other incidental Work relative thereto.

B. Measurement. Measurement for furnishing and installing interior manhole drop connections shall be from the invert of the manhole to the top of the drop connection.

C. Payment. Payment for furnishing and installing interior manhole drop connections listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid per vertical foot under Item 5.

ITEM 6 - CHIMNEYS

A. General. The price bid under Item 6 shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include excavation, vertical piping, wye fittings, caps, concrete encasement, and all other incidental Work relative thereto.

B. Measurement. Measurement for chimneys shall be from the top of the chimney to the top of the wye fitting for each installation as approved by the Engineer.

C. Payment. Payment for chimneys listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid under Item 6.

ITEM 7 - MISCELLANEOUS CEMENT CONCRETE

A. General. The price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, including thrust blocks, support for utilities, pipe encasements, and the like and any other incidental Work relative thereto.

B. Measurement. Measurement of miscellaneous cement concrete shall be the actual cubic yardage placed as approved by the Engineer.

C. Payment. Payment for miscellaneous cement concrete listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid per cubic yard under this Bid Item.

1. Payment for concrete used for manhole bases, joints and inverts, for setting frames and covers, for manhole drop connections and for chimneys shall be included as specified under the applicable Bid Item.

ITEM 8 - ROCK AND/OR BOULDER EXCAVATION

A. General. The price bid under Item 8 shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified which shall include excavation, use of drilling and blasting (if allowed); hydraulic hammers; hydraulic splitters; and/or drilling and expansion cement/grout. pre-blast survey(s), permit(s) and license(s), vibration monitoring, removal and legal disposal of rock and/or boulders, furnishing and placing replacement material, backfilling and compaction, and any other incidental Work relative thereto. The Contractor shall assume that Rock and/or Boulders may occur anytime throughout the Project Area and that the unanticipated discovery of Rock and/or Boulders is not a basis for a change in conditions.

B. Measurement. Measurement of rock and/or boulder excavation shall be made based on the volume removed and replaced as approved by the Engineer computed as follows:

1. Only boulders greater than one (1) cubic yard in volume, defined by the Engineer shall be measured and paid for under this Bid Item. Measurement shall be based on the length, width and depth of boulders excavated within the trench limits.

2. Rock in pipe trenches shall be measured from its surface to a point six (6) inches below the invert of the pipe and as follows:

   a. For pipe twenty-four (24) inches or less in diameter a width of five (5) feet for depths twelve (12) feet or less and a width of seven (7) feet for depths greater than twelve (12) feet.

   b. For pipe greater than twenty-four (24) inches in diameter a width of three (3) feet plus the inside diameter of the pipe for depths of twelve (12) feet or less and a width of five (5) feet plus the inside diameter of the pipe for depths greater than twelve (12) feet.

3. Rock or boulders encountered in other excavations, which are to be paid for separately, shall be measured from its surface to a point six (6) inches below the base of structure and to a width of one (1) foot outside the face of the structure.

4. Where more than one (1) pipe is installed in the same trench, payment shall be made on the basis of a common trench with the maximum trench width of seven (7) feet.

C. Payment. Payment for rock and/or boulder excavation listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid per cubic yard under this Bid Item.

1. No additional payment will be made for frost removal or for any other materials encountered in the excavations, no matter how stiff or compact of consistency, even if drilling and blasting (if allowed); hydraulic hammers; hydraulic splitters; and/or drilling and expansion cement/grout is required for removal. Soft or disintegrated rock that can be removed without the use of drilling and blasting (if allowed); hydraulic hammers; hydraulic splitters; and/or drilling and expansion cement/grout shall not be paid for under this Bid Item.

2. No additional payment will be made for rock and/or boulder excavation where existing utilities are removed and relaid to facilitate the Work within the trench limits defined hereinbefore.

3. Masonry or concrete structures encountered during the course of constructing the Work, which require drilling and blasting (if allowed); hydraulic hammers; hydraulic splitters; and/or drilling and expansion cement/grout for removal, shall be paid for subject to the limits and conditions described herein.

4. No payment will be made for excavation of rock and/or boulders beyond the specified limits.

The unit price for rock and/or boulder excavation shall be a minimum of $80 per cubic yard which shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified using drilling and blasting (if allowed); hydraulic hammers; hydraulic splitters; and/or drilling and expansion cement/grout.

ITEM 9 - REPLACEMENT OF UNSUITABLE MATERIAL

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified which shall include excavation, sheeting or shoring not ordered left in place, dewatering, removal and legal disposal of unsuitable materials, filter cloth, furnishing and placing replacement materials, transportation, backfilling, compaction and any other incidental Work relative thereto.

B. Measurement. Measurement for replacement of unsuitable material above and below trench grade and/or subgrade shall be made based on the volume removed and replaced as approved by the Engineer and as follows:

1. Unsuitable material below trench grade shall be measured from a point six (6) inches below the invert of pipe to the bottom of the excavation and as follows:

   a. For pipe twenty-four (24) inches or less in diameter a width of five (5) feet for depths twelve (12) feet or less and a width of seven (7) feet for depths greater than twelve (12) feet.

   b. For pipe greater than twenty-four (24) inches in diameter a width of three (3) feet plus the inside diameter of the pipe for depths of twelve (12) feet or less and a width of five (5) feet plus the inside diameter of the pipe for depths greater than twelve (12) feet.

2. Unsuitable material above trench grade shall be measured from a point one (1) foot plus the thickness of permanent pavement thickness below the existing pavement surface or from a point six (6) inches below the existing unpaved surface to a point one (1) foot above the pipe and as follows:

   a. For pipe twenty-four (24) inches or less in diameter a width of five (5) feet for depths twelve (12) feet or less and a width of seven (7) feet for depths greater than twelve (12) feet.

   b. For pipe greater than twenty-four (24) inches in diameter a width of three (3) feet plus the inside diameter of the pipe for depths of twelve (12) feet or less and a width of five (5) feet plus the inside diameter of the pipe for depths greater than twelve (12) feet.

3. Unsuitable material below precast concrete manholes shall be measured from a point six (6) inches below the base of the manhole to the bottom of the excavation and to a width of two (2) feet plus the outside diameter of the manhole.

4. Unsuitable material below foundations for structures shall be measured from the bottom of foundation varying in width on a forty-five (45) degree angle down from the bottom of foundation to a depth approved by the Engineer.

C. Payment. Payment for replacement of unsuitable material above and below trench grade and/or subgrade listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid per cubic yard under the applicable division of this Bid Item.

1. No payment will be made for replacement of unsuitable material above trench grade when suitable excess excavated material is available from other excavations made under this Project.

2. Bedding material placed from a point six (6) inches below the invert of pipe, to a point one (1) foot above the top of the pipe shall be included for payment under the applicable pipe laying Bid Item.

3. When more than one (1) pipe is installed in the same trench, payment will be based on a common trench with a minimum width of seven (7) feet.

4. No payment will be made for unsuitable material replaced beyond the limits approved by the Engineer.

ITEM 10 - EXPERIMENTAL EXCAVATION

A. General. The price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include notification of utility owners, machine and/or hand excavation to locate utilities, backfill, compaction, maintaining utility marking locations, repair to utilities damaged while performing experimental excavations, temporary bituminous concrete patch, furnishing assistance to the Engineer and all other incidental Work relative thereto.

B. Measurement. Measurement of experimental excavation shall be made based on the volume excavated and backfilled as approved by the Engineer.

C. Payment. Payment for experimental excavation listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid per cubic yard under this Bid Item. No payment will be made for any cost associated with damages caused to existing utilities made during the performance of experimental excavation operations.

ITEM 11 - FILL FOR EMBANKMENTS – Not Used

ITEM 12 - SHEETING AND/OR SHORING ORDERED LEFT IN PLACE – Not Used

ITEM 13 - SOIL COMPACTION TESTS

A. General. The price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include excavation, sampling, sieve analysis, laboratory and field testing, backfill, compaction and any other incidental Work relative thereto.

B. Measurement. Measurement of compaction testing shall be per each test as approved by the Engineer.

C. Payment. Payment for soils compaction tests listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid per each under this Bid Item.

1. For the purpose of payment, a test shall include, but not be limited to, exploratory excavation, laboratory analysis (sieve analysis and modified proctor), field testing (density test), backfill and compaction of excavations.

2. No payment will be made for any test that fails to meet the specified compaction requirements.

ITEM 14 - ROAD GRAVEL

A. General. The price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include transportation, preparation of sub-grade, placement, grading, compaction and any other incidental Work relative thereto.

B. Measurement. Measurement of road gravel as a subbase for permanent resurfacing shall be based on the approved volume furnished and placed as approved by the Engineer computed as follows:

1. The length of main trench shall be defined as the length of roadway surface disturbed by the pipeline Work. The length of service trench shall be defined as the length of roadway surface disturbed by the service line Work less three (3) feet from the centerline of the main sewer or water pipeline trench.

2. The width of main or service trench shall be defined as follows:

a. For pipe twenty-four (24) inches or less in diameter a width of five (5) feet for depths of twelve (12) feet or less and a width of seven (7) feet for depths greater than twelve (12) feet.

b. For pipe greater than twenty-four (24) inches in diameter a width of three (3) feet plus the inside diameter of the pipe for depths of twelve (12) feet or less and a width of five (5) feet plus the inside diameter of the pipe for depths greater than twelve (12) feet.

3. The width for manholes shall be measured from a width of two (2) feet plus the outside diameter of the manhole.

4. When more than one (1) pipe is installed in the same trench, payment will be based on a common trench with a maximum width of seven (7) feet.

5. The thickness of road gravel in local roadways shall be twelve (12) inches, unless otherwise specified or approved by the Engineer.

6. The thickness of road gravel in State Roadways shall be equal to the thickness of the existing undisturbed road gravel adjacent to the trench.

7. No payment will be made for road gravel course material when suitable excess excavated material is available from other excavations made under this Project.

C. Payment. Payment for furnishing and placing road gravel material listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid per cubic yard under this Bid Item.

ITEM 15 - PAVEMENT RESTORATION

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools, and materials necessary to complete the Work as specified, which shall include, preparation of subgrade, cutting and recutting of bituminous and cement concrete pavement, full width pavement removal, reshaping of the roadway surface, reshaping, loaming and seeding of roadway shoulders, furnishing and placing bituminous concrete dense graded gravel, furnishing and placing bituminous concrete (temporary and permanent), maintenance and protection of roadway surfaces, repainting of traffic control lines/wording, resetting of structures and utility boxes, milling of bituminous concrete surfaces, replacement of pavement markings (temporary and permanent), replacement of vehicle loop detectors, repair to roadways used as detours, and all other Work incidental thereto and all other Work incidental thereto.

B. Measurement. Measurement for pavement restoration shall be as follows:

1. Bituminous Concrete Trench Pavement in State Roadways

   a. Measurement for Temporary Bituminous Concrete Trench Pavement in State Roadways shall be based on the horizontal measured length of main line trench defined as the length of roadway disturbed by the main line Work from centerline of manhole to centerline of manhole. Measurement shall be by the linear foot with no deductions made for manholes, fittings or valves.

   b. Measurement for Permanent Bituminous Concrete Trench Pavement in State Roadways shall be based on the horizontal measured length of service trench defined as the length of roadway surface disturbed by the service line Work less three (3) feet from the centerline of the main sewer or water pipeline trench. Measurement shall be by the linear foot with no deductions made for fittings or valves.

   c. Measurement for Permanent Bituminous Concrete Trench Pavement in State Roadway for trenches with more than one (1) pipe laid in the same trench shall be treated as a common trench, unless otherwise approved by the Engineer.

2. Permanent Bituminous Concrete Trench Pavement

   a. Measurement for Permanent Bituminous Concrete Trench Pavement shall be based on the horizontal measured length of main line trench defined as the length of roadway disturbed by the main line Work from centerline of manhole to centerline of manhole. Measurement shall be by the linear foot with no deductions made for manholes, fittings or valves.

   b. Measurement for Permanent Bituminous Concrete Trench Pavement shall be based on the horizontal measured length of service trench defined as the length of roadway surface disturbed by the service line Work less three (3) feet from the centerline of the main sewer or water pipeline trench. Measurement shall be by the linear foot with no deductions made for fittings or valves.

   c. Measurement for Permanent Bituminous Concrete Trench Pavement for trenches with more than one (1) pipe laid in the same trench shall be treated as a common trench, unless otherwise approved by the Engineer.

3. Permanent Bituminous Concrete Full Width Overlay Pavement. Refer to SRF ELIGIBLE BID ITEMS - ALTERNATIVES.
4. Dense Graded Gravel
    a. Measurement for dense graded gravel shall be defined as the length of roadway surface disturbed by the width of the roadway. Measurement shall be by the linear foot with no deductions made for manholes, fittings or valves.
    b. Measurement for Permanent Bituminous Concrete Trench Pavement for trenches with more than one (1) pipe laid in the same trench shall be treated as a common trench, unless otherwise approved by the Engineer.
5. Miscellaneous Bituminous Concrete. Measurement for Miscellaneous Bituminous Concrete placed where directed by the Engineer shall be by the ton based on certified weight slips delivered daily to the Engineer.
6. Replacement of Vehicle Loop Detectors. Measurement for Replacement of Vehicle Loop Detectors shall be based on each location replaced as approved by the Engineer and MassDOT. Each location paid for shall be for the vehicle loop detector replaced following Permanent Bituminous Concrete Trench Pavement and replaced following Permanent Bituminous Concrete Full Width Overlay Pavement.
7. Repainting of Traffic Markings. Refer to SECTION 01020, ALLOWANCES.
8. Payment limits for pavement restoration specified above supersede the MassDEP Policy Memorandum CG-8.

C. Payment. Payment for pavement restoration listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made under the applicable divisions of this Bid Item.

1. Temporary Bituminous Concrete Trench Pavement – Not Used
2. Permanent Bituminous Concrete Trench Pavement. Payment for Permanent Bituminous Concrete Trench Pavement whether placed by machine or by hand listed in DOCUMENT 00410, FORM OF GENERAL BID will be made at the unit price bid per linear foot under the applicable divisions of this Bid Item.
3. Permanent Bituminous Concrete Full Width Pavement. Refer to SRF ELIGIBLE BID ITEMS - ALTERNATIVES.
4. Miscellaneous Bituminous Concrete. Payment for Miscellaneous Bituminous Concrete whether placed by machine or by hand, for leveling of existing roadways, driveway aprons, sidewalks, repairs to roadways used for detours, and other areas outside the trench limits listed in DOCUMENT 00410, FORM OF GENERAL BID will be made at the unit price bid per ton.
5. Dense Graded Gravel. Payment for furnishing and placing dense graded gravel listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit price bid per cubic yard under this Bid Item.
6. Vehicle Loop Detectors. Payment for replacement of vehicle loop detectors listed in DOCUMENT 00410, FORM OF GENERAL BID shall be at the unit price bid per each location under this Bid Item.
7. The following utility allowance(s) shall be included in the applicable subdivision of this Bid Item:
    a. Repainting of Traffic Markings – Refer to SECTION 01020, ALLOWANCES.
8. Price Adjustment - Liquid Asphalt, Diesel, Gasoline and Portland Cement
    a. The intent of this provision is to insure adequate and fair compensation for unpredictable and fluctuating costs which, from time to time, occur in the prices of Liquid Asphalt, Diesel Fuel, Gasoline and Portland Cement. The price adjustment provisions are made part of the Contract to assure more realistic bidding and encourage competition. Price Adjustments will be based on the variance in price, for the material component only, between the Base Price and the Period Price. They shall not include transportation or other charges. Price Adjustments will occur on a monthly basis for Liquid Asphalt and at the end of the Project for Diesel Fuel, Gasoline and Portland Cement.
    b. Base Price - The Base Price of liquid asphalt on a project is a fixed price determined by the MassDOT at the time of the bid using the same method as the determination of the Period Price detailed below. The Base Price shall be used in all bids.

The March 2020 base prices are as follows: liquid asphalt at $552.50 per ton and Portland cement at $135.50. The February 2020 base prices are as follows: diesel fuel at $2.094 per gallon and gasoline at $1.915 per gallon. MassDOT posts the Price Adjustments on their Highway Division's website at https://www.mass.gov/service-details/2019-massdot-contract-price-adjustments under the following link sequences: (1) Doing Business With Us; (2) Construction; and (3) Price Adjustments.

1. Hot Mix Asphalt

   a) Period Price - The Period Price is the price of liquid asphalt for each monthly period as determined by the MassDOT using the average selling price per standard ton of PG64-28 paving grade (primary binder classification) asphalt, FOB manufacturer's terminal, as listed under the "East Coast Market - New England, Boston, Massachusetts area" section of the Poten & Partners, Inc. "Asphalt Weekly Monitor". This average selling price is listed in the issue having a publication date of the second Friday of the month and will be posted as the Period Price for that month. The MassDOT will post this Period Price on its website at http://www.mhd.state.ma.us/ within two (2) business days following its receipt of the relevant issue of the "Asphalt Weekly Monitor". Poten and Partners has granted the MassDOT the right to publish this specific asphalt price information sourced from the Asphalt Weekly Monitor. This method of period price determination was formerly called the New Asphalt Period Price Method. Separate website postings using both the New Asphalt Period Price Method and the Old Asphalt Period Price Method were discontinued after June 2013.

   b) Price Adjustment Determination, Calculation and Payment - Price Adjustments, as herein provided, either upwards or downwards, will be made after the work has been performed using the monthly period price for the month during which the work was performed. Price Adjustments will be paid only if the variance from the Base Price is 5 percent or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5 percent from either upward or downward adjustments. The Price Adjustment applies only to the actual virgin liquid asphalt content in the mixture placed on the job in accordance with the Standard Specifications for Highways and Bridges, Division III, Section M3.11.03. No adjustment will be paid for work done beyond the completion date. Price Adjustments for a positive price adjustment (a payment) and a negative price adjustment (a deduction) will be calculated using the following equation:

   c) Price Adjustment = Tons of HMA Placed x Liquid Asphalt Content % x RAP Factor x (Period Price - Base Price).

2. Diesel Fuel` and Gasoline

   a) Price period - The Period Price will be the average of prices charged to the State, including State Tax for the bulk purchases made during each month.

   b) Price Adjustment Determination, Calculation and Payment - Price Adjustments, as herein provided, either upwards or downwards, will be made after the work has been performed using the monthly period price for the month during which the work was performed. This adjustment will be based on fuel usage factors for various items of work developed by the Highway Research Board in Circular 158, dated July 1974. These factors will be multiplied by the quantities of work done in each item during each monthly period and further multiplied by the variance in price from the Base Price to the Period Price. The Base Price of Diesel Fuel and Gasoline will be the price as indicated in the Department's web site (www.MassDOT.state.ma.us) for the month in which the contract was bid, which includes State Tax. This adjustment will be affected only if the variance from the Base Price is 5 percent or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5 percent from either upward or downward adjustments. Any adjustment (increase or decrease) to estimated quantities made to each item at the time of final payment will have the fuel price adjustment figured at the average period price for the entire term of the project for the difference of quantity. No adjustment will be paid for work done beyond the completion date. The fuel price adjustment will apply only to the following items of work at the fuel factors shown:

SRF Eligible Bid Item Covered	Diesel Fuel	Gasoline
2. Sewer and Storm Drainage Pipelines and Associated Fittings	X	X
3. Precast Concrete Manholes and Structures	X	X
8. Rock and/or Boulder Excavation	X	X
9. Replacement of Unsuitable Material	X	X
10. Experimental Excavation	X	X
14. Road Gravel	X	X
15. Pavement Restoration	X	Does Not Apply

9. No additional payment will be made beyond the payment limits noted or for maintenance or repair of trenches.

10. Payment for joint sealant and/or tack coat shall be included under the applicable division of this Bid Item for bituminous concrete Work.

11. Payment for adjusting frames and covers, valve boxes and all other castings prior to placement of permanent bituminous concrete pavement shall be included under the applicable division of this Bid Item for bituminous concrete Work.

12. Payment for reshaping of roadways and/or road shoulders, roadway reclamation, regrading and compaction of roadway base course materials and or providing leveling course over settled trenches shall be included under the applicable division of this Bid Item for bituminous concrete Work.

ITEM 16 - REMOVE AND RELAY OR REPLACE EXISTING UTILITIES

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified which shall include transportation, handling and dispersal of materials, removal and legal disposal of excess materials, furnishing and installation of new replacement materials (including but not limited to pipe and accessories, couplings, fittings, manholes and catch basins), excavation (excluding that which is specified to be paid for separately), backfill above trench grade including all bedding materials (excluding material used to replace unsuitable material and road gravel), compacting trenches, sheeting and shoring not ordered left in place, testing (excluding soil compaction tests specified to be paid for separately), daily cleanup, restoration of all areas disturbed by the Contractor's operations that are not included for payment under another Bid Item, and all other incidental Work relative thereto.

B. Measurement. Measurement for removal and relaying or replacing existing utilities shall be as follows:

1. Measurement for the removal and relaying or replacement of existing water, sewer, storm drain, and/or gas pipelines and appurtenances, within the allowable trench width only, will be made by multiplying the inside diameter of the relaid or replaced pipeline by the length of relaid or replaced pipeline. For measurement purposes, the allowable trench width will be defined as follows:

   a. For pipe twenty-four (24) inches or less in diameter a width of five (5) feet for depths twelve (12) feet or less and a width of seven (7) feet for depths greater than twelve (12) feet.

   b. For pipe greater than twenty-four (24) inches in diameter a width of three (3) feet plus the inside diameter of the pipe for depths of twelve (12) feet or less and a width of five (5) feet plus the inside diameter of the pipe for depths greater than twelve (12) feet.

2. Measurement for removal and resetting or replacement of manholes and catch basins will be made by multiplying the inside diameter of the manhole or catch basins by its height.

C. Payment. Payment for the removal and relaying or replacement of existing water, sewer, storm drain and/or gas pipelines and appurtenances listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the unit prices bid per inch-foot under the applicable divisions of this Bid Item.

1. Payment will only be made for the removal and relaying or replacement of existing water, sewer, storm drain and/or gas pipelines and appurtenances when (1) such utilities are removed and relaid or replaced as a result of conflicts in elevation with the grade of the new pipelines or (2) the length of such existing utilities within the allowable trench width that cross above the new pipeline is greater than two and one-half (2.5) times the width of the allowable trench limit or (3) such utilities lie completely within the allowable trench width and the existing utility invert is a minimum of two (2) feet above the crown of the new pipeline as approved by the Engineer.

2. Payment for removal and resetting or replacement of manholes and catch basins shall include resetting frames and covers or grates.

3. No payment will be made for the removal and relaying or replacement of utilities which lie either partially or completely beyond the allowable trench width.

4. Payment for the removal and relaying or replacement of miscellaneous utilities shall be made at the unit price bid under this item. Payment for planting materials shall be made based on the actual charges paid by the Contractor. An amount of 100 percent of each paid invoice (no retainage) will be made to the Contractor based on paid invoice receipts.

5. No payment will be made for the removal and relaying or replacement of utilities other water, sewer, storm drain, and/or gas pipelines and appurtenances which are damage due to the contractor's means and methods of construction.

6. The following utility allowance(s) shall be included in the applicable subdivision of this Bid Item:

b. Removal and Relaying and/or Replacement of Existing Gas Main and Services. Refer to SECTION 01020, ALLOWANCES.

c. Removal and Relaying and/or Replacement of Existing Miscellaneous Utilities. Refer to SECTION 01020, ALLOWANCES. This allowance includes the scope of work to Remove and Relay and/or Replace the Existing Underground Electrical System and Underground Irrigation System located at the Snow Library and The Village Green.

ITEM 17 - UNIFORMED TRAFFIC POLICE OFFICERS

A. General. Payment for the services of uniformed police officers shall be made at the prevailing rates of pay for special duty details in effect at the time of services, for each permanent, special or reserve officer and for graduated rank. Uniformed police officers shall be paid directly by the Owner. The Contractor is responsible for coordination of the police details.

1. Uniformed police officers used for special duty details are paid a four (4) hour minimum.

2. If arrangements have been made for uniformed police officers and inclement weather or other factors prohibit Work, the Contractor must contact the Police Department not later than two (2) hours before the scheduled start time on the day of Work to cancel the police detail.

3. If the Contractor fails to notify the Police Department of the cancellation of a scheduled detail, then it assumes all costs for the (4) hour minimum.

B. Measurement. Not Applicable

C. Payment. Not Applicable

ITEM 18 - ENGINEER'S FIELD OFFICE

A. General. The prices bid under each division of the Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to furnish, install maintain and remove the Engineer's Field Office as specified, including all other incidental Work relative thereto. The Engineer shall notify the Contractor when the Engineer's Field Office is to be removed from the site.

B. Measurement. Measurement for furnishing, installing, maintaining and removing the Engineer's Field Office shall be as follows:

1. Measurement for payment for furnishing, installing and subsequent removal of the Engineer's Field Office shall be for one (1) complete and acceptable unit as approved by the Engineer.

2. Measurement for payment for maintaining the Engineer's Field Office shall be per week as approved by the Engineer.

C. Payment. Payment for furnishing, installing, maintaining and subsequent removal of the Engineer's Field Office listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the lump sum and unit prices bid under the applicable divisions of this Bid Item.

1. Payment for furnishing, installing and removal of the Engineer's Field Office shall be made at the lump sum price bid under the applicable division of the Bid Item. The lump sum price bid shall include transporting, mobilization, demobilization, utility connection fees, permits, licenses, insurance, and all other labor, materials, and equipment required to furnish the Engineer's Field Office as specified. An amount of seventy-five (75) percent of the amount bid (exclusive of normal contract retainage) will be made when the Engineer's Field Office is ready for occupancy and use on the Project. The remaining twenty-five (25) percent (exclusive of normal contract retainage) will be made following the removal of the Engineer's Field Office from the Project.

2. Payment for maintaining the Engineer's Field Office shall be made at the unit price bid per week under the applicable division of this Bid Item. Maintaining the Engineer's Field Office shall include all maintenance, rental fees, utility charges, sanitary fees, equipment rental charges, and all other costs related to the weekly operation of the Engineer's Field Office. Payment will be made for those periods of time that the Engineer has directed the Contractor to provide the Engineer's Field Office. No payment will be made for the Engineer's Field Office that was not requested by the Engineer, or that remained on the Project after the Engineer notified the Contractor to remove it.

3. The Owner reserves the right to delete from the Work any or all divisions of this Bid Item without penalty.

4. No payment shall be made once the Contractor's time for completion has been reached.

ITEM 19 - ENVIRONMENTAL PROTECTION

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include furnishing, installing, maintaining and removing sedimentation control barriers and structures and all other incidental Work relative thereto.

B. Measurement. Measurement for Environmental Protection shall be as follows:

1. Measurement for furnishing, placing, maintaining, and removal of sedimentation barriers shall be per linear foot of measured length of in-place barrier as approved by the Engineer.

2. Measurement for furnishing, placing, maintaining, and removal of sedimentation control structures shall be per each as approved by the Engineer.

C. Payment. Payment for Environmental Protection listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made under the applicable divisions of this Bid Item as follows:

1. Payment for sedimentation control barriers shall be made at the unit price bid per linear foot.
2. Payment for sedimentation control structures shall be made of the unit price bid per each approved installation.
3. No additional payment will be made for maintaining or replacing sedimentation barriers or control structures during the course of the Work.

ITEM 20 - DEWATERING

A. General. The price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified which shall include Work performed by the Contractor, Contractor's Subcontractor(s) or Consultants, design, permits, installation, operation, maintenance and removal of the dewatering system (including but not limited to pumps, well points, header pipes and approved discharge point preparation and restoration), legal disposal of all water discharged during the operation of the dewatering system, restoration of all areas disturbed by the Contractor's operations and all other incidental Work relative thereto. The Contractor shall engage a Commonwealth of Massachusetts Registered Professional Engineer with experience in the design of dewatering systems consisting of only well points in order to pre-drain the area prior to excavation below the groundwater level

B. Measurement. Measurement for dewatering shall be by the linear foot of pipe trench dewatered as approved by the Engineer.

C. Payment. Payment for dewatering listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made at the linear foot price bid under this Bid Item and as follows:

1. Payment will be made for well point dewatering systems utilized to dewater the trench excavation.
2. No payment will be made for other type of dewatering systems including dewatering systems utilized within the limit of the trench excavation.

ITEM 21 - TEMPORARY BY-PASS PUMPING – Not Used

ITEM 22 - HIGHWAY CROSSING VIA HORIZONTAL DIRECTIONAL DRILLING

A. General. The lump sum price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified including work performed by the Contractor, Subcontractor, or Contractor's Consultants, for the design, installation, and drilling operation. The work shall also include all piping, fittings, valves, conduits, pipe/conduit supports/spacers, temporary structures, excavation, backfill and compaction, legal disposal of excess materials, coordination with MassDOT, drilling pits, connections to existing pipes and conduits located at the Pay Limits, dewatering operations (well points, pumps, electrical controls, suction and discharge piping, environmental controls, etc.), monitoring wells, control survey, dewatering operations, furnishing and maintaining safety warning signs and devices and all other incidental work relative thereto. The Contractor has the option to: (a) Drill the 48-inch Casing shown on the drawings followed by the installation of the three 8-inch pipelines and two 4-inch conduits or (b) Individually drill each 8-inch pipeline and the two 4-inch conduits.

B. Measurement. Measurement for Highway Crossing via Horizontal Directional Drilling shall include all work for the installation of the piping and conduits located within the Pay Limit shown on the Contract Drawings.

C. Payment. Payment for the Highway Crossing via Horizontal Directional Drilling listed in DOCUMENT 00410, FORM FOR GENERAL BID shall be made at the lump sum price bid under the Bid Item.

1. The Lump Sum bid under this item shall include any MassDOT fees not specified to be paid by the Owner, all permits, insurance and bonds required by the MassDOT for the complete Highway Crossing.
2. No other payment Item will be used for compensation of Work performed under this Bid Item.
3. The following utility allowance(s) shall be included in the applicable subdivision of this Bid Item:
   a. MassDOT Inspections. Refer to SECTION 01020, ALLOWANCES.

ITEM 23 - PUMPING STATIONS

A. General. The prices bid under each division of the Bid Item shall be considered as fair compensation for all labor, equipment, tools, and materials necessary to complete the Work, as specified, located within the limit of Work shown for the construction of each Pumping Station shown on the Contract Drawings. This shall include all Work performed by the Contractor, Subcontractor(s) or Contractor's Consultant(s) for the construction of a complete pumping station including but not limited to, wetwell, valve vault, piping, values, flow measurement device, odor control system, control pedestal, emergency generator, planting operations, restoration, utility company coordination/fees, start-up and testing, and all other incidental Work relative thereto.

In addition to the above, the Work shall include the following:

1. Pumping Station No. 1
    a. Coordination of Work to maintain continuous operation of the existing sanitary system, pumping station and leaching field.
    b. Connection of existing sanitary service into the new collection system upon acceptance by the Owner of the new collection system.
2. Pumping Station No. 2
    a. Coordination of Work to maintain continuous operation of the existing sanitary system, pumping station and treatment facility and leaching field.
    b. Upon completion and acceptance by the Owner of the new collection system, demolish and legally dispose of the existing on-site sewage disposal system.
    c. Upon completion and acceptance by the Owner of the new collection system, demolish and legally dispose of the existing Bioclere Innovative Alternative treatment facility.
    d. Connection of existing sanitary service into the new collection system upon acceptance by the Owner of the new collection system.

B. Measurement

1. Measurement for each pumping station constructed shall be made based on a percentage of the total lump sum amount bid under each subdivision of this Bid Item, as approved by the Engineer.
2. Measurement for utility charge allowance(s) shall be based on the actual paid invoices by the Contractor to each utility company and/or nursery. The following utility and nursey allowance(s) shall be included in the applicable subdivision of this Bid Item:
    a. Electric Company Connection/Service Fee. Refer to SECTION 01020, ALLOWANCES
    b. Telephone Company Connection/Service Fee. Refer to SECTION 01020, ALLOWANCES
    c. Planting Operations. Refer to SECTION 01020, ALLOWANCES

C. Payment.

1. Payment for each pumping station constructed listed in DOCUMENT 00410, FORM FOR GENERAL BID shall be made at the lump sum price bid under each subdivision of this Bid Item. Payment for each pumping station constructed shall be made as follows: An amount of 60 percent of applicable division of this Bid Item (exclusive of normal contract retainage) shall be made when each pumping station is completely constructed which includes all site and utilities Work. The remaining 40 percent (exclusive of normal contract retainage) shall be made following acceptance of each pumping station by the Owner, including startup and testing, training of Owner personnel, delivery and approval of Operation and Maintenance Manual(s) and receipt by Owner of all specified spare parts.
2. Payment for utility company charges shall be made based on the actual charges paid to each utility by the Contractor. An amount of 100 percent of each paid invoice (no retainage and not markup) will be made to the Contractor based on paid invoice receipts.

3. Payment for planting operations charges shall be made based on the actual charges paid to each landscaper and/or nursery by the Contractor. An amount of 100 percent of each paid invoice (no retainage and not markup) will be made to the Contractor based on paid invoice receipts.

4. No other payment Item will be used for compensation of Work performed within the limit of work line shown on the Contract Drawings for each pump station.

ITEM 24 – TRACER WIRE IN STATE ROADWAYS

A. General. The price bid under the Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include placement of tracer wire, connectors, termination points, grounding, testing and all other incidental Work relative thereto.

B. Measurement. Measurement for furnishing and installing tracer wire shall be the horizontal measured length of tracer wire installed.

C. Payment. Payment for furnishing and installing tracer wire listed in DOCUMENT 00410, FORM OF GENERAL BID, shall be made at the unit price bid per linear foot under Item 24.

1.05 – BASIS OF MEASUREMENT AND PAYMENT – SRF ELIGIBLE BID ITEMS - ALTERNATIVES

ITEM A-1 – PAVEMENT RESTORATION IN TOWN ROADWAYS

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools, and materials necessary to complete the Work as specified, which shall include, repair of holes, settlements, etc. of the trenches; cutting of bituminous and cement concrete pavement; reshaping of the roadway surface; resetting of structures and utility boxes; milling of bituminous concrete surfaces; repainting of traffic control lines/wording and markings (permanent); replacement of vehicle loop detectors; reshaping, loaming and seeding of roadway shoulders; repair to roadways used as detours; and all other Work incidental thereto and all other Work incidental thereto.

The Work for ITEM A-1 – PAVEMENT RESTORATION IN TOWN ROADWAYS for the SRF ELIGIBLE BID ITEMS – ALTERNATIVES is shown on the Contract Drawing(s) numbered:

00 G-001	00 G-002	00 G-003	00 C-001	01 C-101	01 C-102	01 C-103	00C-104
00 C-105	01 C-106	01 C-107	01 C-108	01 C-109	02 C-104	02 C-105	02 C-107
02 C-108	02 C-109	02 C-110	03 C-101	03 C-102	03 C-103	03 C-104	03 C-105
03 C-106	03 C-107	03 C-108	03 C-109	03 C-110	03 C-111	03 C-115	03 C-117

B. Measurement. Measurement for pavement restoration shall be as follows:

1. Permanent Bituminous Concrete Full Width Overlay Pavement. Measurement for Permanent Bituminous Concrete Full Width Overlay Pavement with or without milling will be made based on either: (a) Certified weight slips delivered daily to the Engineer or (b) the actual length and width of roadway overlaid as approved by the Engineer.

2. Miscellaneous Bituminous Concrete. Measurement for Miscellaneous Bituminous Concrete placed where directed by the Engineer shall be by the ton based on certified weight slips delivered daily to the Engineer.

3. Replacement of Vehicle Loop Detectors. Measurement for Replacement of Vehicle Loop Detectors shall be based on each location replaced as approved by the Engineer and MassDOT. Each location paid for shall be for the vehicle loop detector replaced following Permanent Bituminous Concrete Trench Pavement and replaced following Permanent Bituminous Concrete Full Width Overlay Pavement.

4. Repainting of Traffic Markings. Refer to SECTION 01020, ALLOWANCES.

5. Payment limits for pavement restoration specified above supersede the MassDEP Policy Memorandum CG-8.

C. Payment. Payment for pavement restoration listed in DOCUMENT 00410, FORM OF GENERAL BID shall be made under the applicable divisions of this Bid Item.

1. Permanent Bituminous Concrete Full Width Pavement. Payment for Permanent Bituminous Concrete Full Width Pavement including milling, if applicable, listed in DOCUMENT 00410, FORM OF GENERAL BID will be made at the unit price bid per ton under the applicable divisions of this Bid Item.

   a. The factor of 0.055 tons per square yard per inch of thickness shall be used for weight-volume conversions for bituminous concrete.

   b. Certified weight slips for all bituminous concrete delivered to the site(s) and certified volume slips for all controlled density fill delivered to the site(s) shall be submitted to the Engineer on a daily basis.

   c. Payment for furnishing and placing permanent bituminous concrete pavement shall be made at the unit price bid per ton computed using one of the following methods:

      1) Method 1 (Measured in Place): The Engineer shall multiply the pavement area by the specified pavement thickness by the factor to obtain the tonnage of bituminous concrete.

      2) Method 2 (Delivered): Certified weight slips shall be used. Any bituminous concrete placed outside the payment limits, unless approved by the Engineer, shall be deducted (using Method 1) from the total tonnage obtained from the certified weight slips.

      3) Payment for furnishing and placing temporary and permanent bituminous concrete will be made based on the number of tons obtained using either Method 1 or Method 2, whichever is less.

2. Miscellaneous Bituminous Concrete. Payment for Miscellaneous Bituminous Concrete whether placed by machine or by hand, for leveling of existing roadways, driveway aprons, sidewalks, repairs to roadways used for detours, and other areas outside the trench limits listed in DOCUMENT 00410, FORM OF GENERAL BID will be made at the unit price bid per ton.

3. Vehicle Loop Detectors. Payment for replacement of vehicle loop detectors listed in DOCUMENT 00410, FORM OF GENERAL BID shall be at the unit price bid per each location under this Bid Item.

4. The following utility allowance(s) shall be included in the applicable subdivision of this Bid Item:

   a. Repainting of Traffic Markings – Refer to SECTION 01020, ALLOWANCES.

   b. Removal and Relaying and/or Replacement of Existing Gas Main and Services. Refer to SECTION 01020, ALLOWANCES.

   c. Removal and Relaying and/or Replacement of Existing Miscellaneous Utilities. Refer to SECTION 01020, ALLOWANCES.

5. Price Adjustment - Liquid Asphalt, Diesel, Gasoline and Portland Cement

   a. The intent of this provision is to insure adequate and fair compensation for unpredictable and fluctuating costs which, from time to time, occur in the prices of Liquid Asphalt, Diesel Fuel, Gasoline and Portland Cement. The price adjustment provisions are made part of the Contract to assure more realistic bidding and encourage competition. Price Adjustments will be based on the variance in price, for the material component only, between the Base Price and the Period Price. They shall not include transportation or other charges. Price Adjustments will occur on a monthly basis for Liquid Asphalt and at the end of the Project for Diesel Fuel, Gasoline and Portland Cement.

   b. Base Price - The Base Price of liquid asphalt on a project is a fixed price determined by the MassDOT at the time of the bid using the same method as the determination of the Period Price detailed below. The Base Price shall be used in all bids.

      The March 2020 base prices are as follows: liquid asphalt at $552.50 per ton and Portland cement at $135.50. The February 2020 base prices are as follows: diesel fuel at $2.094 per gallon and gasoline at $1.915 per gallon. MassDOT posts the Price Adjustments on their Highway Division's website at https://www.mass.gov/service-details/2019-massdot-contract-price-adjustments under the following link sequences: (1) Doing Business With Us; (2) Construction; and (3) Price Adjustments.

1. Hot Mix Asphalt

   a) Period Price - The Period Price is the price of liquid asphalt for each monthly period as determined by the MassDOT using the average selling price per standard ton of PG64-28 paving grade (primary binder classification) asphalt, FOB manufacturer's terminal, as listed under the "East Coast Market - New England, Boston, Massachusetts area" section of the Poten & Partners, Inc. "Asphalt Weekly Monitor". This average selling price is listed in the issue having a publication date of the second Friday of the month and will be posted as the Period Price for that month. The MassDOT will post this Period Price on its website at http://www.mhd.state.ma.us/ within two (2) business days following its receipt of the relevant issue of the "Asphalt Weekly Monitor". Poten and Partners has granted the MassDOT the right to publish this specific asphalt price information sourced from the Asphalt Weekly Monitor. This method of period price determination was formerly called the New Asphalt Period Price Method. Separate website postings using both the New Asphalt Period Price Method and the Old Asphalt Period Price Method were discontinued after June 2013.

   b) Price Adjustment Determination, Calculation and Payment - Price Adjustments, as herein provided, either upwards or downwards, will be made after the work has been performed using the monthly period price for the month during which the work was performed. Price Adjustments will be paid only if the variance from the Base Price is 5 percent or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5 percent from either upward or downward adjustments. The Price Adjustment applies only to the actual virgin liquid asphalt content in the mixture placed on the job in accordance with the Standard Specifications for Highways and Bridges, Division III, Section M3.11.03. No adjustment will be paid for work done beyond the completion date. Price Adjustments for a positive price adjustment (a payment) and a negative price adjustment (a deduction) will be calculated using the following equation:

   c) Price Adjustment = Tons of HMA Placed x Liquid Asphalt Content % x RAP Factor x (Period Price - Base Price).

2. Diesel Fuel` and Gasoline

   a) Price period - The Period Price will be the average of prices charged to the State, including State Tax for the bulk purchases made during each month.

   b) Price Adjustment Determination, Calculation and Payment - Price Adjustments, as herein provided, either upwards or downwards, will be made after the work has been performed using the monthly period price for the month during which the work was performed. This adjustment will be based on fuel usage factors for various items of work developed by the Highway Research Board in Circular 158, dated July 1974. These factors will be multiplied by the quantities of work done in each item during each monthly period and further multiplied by the variance in price from the Base Price to the Period Price. The Base Price of Diesel Fuel and Gasoline will be the price as indicated in the Department’s web site (www.MassDOT.state.ma.us) for the month in which the contract was bid, which includes State Tax. This adjustment will be affected only if the variance from the Base Price is 5 percent or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5 percent from either upward or downward adjustments. Any adjustment (increase or decrease) to estimated quantities made to each item at the time of final payment will have the fuel price adjustment figured at the average period price for the entire term of the project for the difference of quantity. No adjustment will be paid for work done beyond the completion date. The fuel price adjustment will apply only to the following items of work at the fuel factors shown:

SRF Eligible Bid Items – Alternatives Covered	Diesel Fuel	Gasoline
2. Sewer and Storm Drainage Pipelines and Associated Fittings	X	X
3. Precast Concrete Manholes and Structures	X	X
8. Rock and/or Boulder Excavation	X	X
9. Replacement of Unsuitable Material	X	X
10. Experimental Excavation	X	X
14. Road Gravel	X	X
15. Pavement Restoration	X	Does Not Apply

6. No additional payment will be made beyond the payment limits noted or for maintenance or repair of trenches.

7. Payment for joint sealant and/or tack coat shall be included under the applicable division of this Bid Item for bituminous concrete Work.

8. Payment for adjusting frames and covers, valve boxes and all other castings prior to placement of permanent bituminous concrete pavement shall be included under the applicable division of this Bid Item for bituminous concrete Work.

9. Payment for reshaping of roadways and/or road shoulders, roadway reclamation, regrading and compaction of roadway base course materials and or providing leveling course over settled trenches shall be included under the applicable division of this Bid Item for bituminous concrete Work.

ITEM A-2 – PUMPING STATION NO. 3 TRIBUTARY AREA

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include: transportation; handling and dispersal of materials; cutting and removal of existing bituminous and cement concrete or reinforced cement concrete pavement; excavation, backfill above trench grade including all bedding materials (controlled density fill and road gravel); conduits and handholes; compacting trenches; sheeting and shoring not ordered left in place; loaming and seeding; landscaping; removing and resetting curbing, property markers, signs and mail boxes; dust control including mechanical sweeping; all fittings, caps, plugs, restraints and the like; traffic control devices; flushing/cleaning of conduits; testing (pressure, leakage, compaction, etc.); dewatering of trenches; daily cleanup; restoration of all areas disturbed by the Contractor's operations; all Work as specified in DIVISION 1 – GENERAL REQUIREMENTS; and all other incidental Work relative thereto.

The Work for ITEM A-2 - PUMPING STATION NO. 3 TRIBUTARY AREA for the SRF ELIGIBLE BID ITEMS - ALTERNATIVES is shown on the Contract Drawing(s) numbered:

00 G-001	00 G-002	00 G-003	00 C-001	03 C-101	03 C-102	03 C-103	03 -C-104
03 C-105	03 C-106	03 C-107	03 C-108	03 C-109	03 C-110	03 C-111	03 C-112
03 C-113	03 C-114	03 C-115	03 C-116	03 C-117	03 C-401	99 C-501	99 C-502
99 C-503	99 C-504	99 C-505	99 C-506	99 C-507	99 C-508	99 C-509	99 C-510
99 C-511	99 C-601	99 C-602	99 C-603	00 D-001	00 D-002	00 D-003	03 D-101
99 D-501	00 E-001	00 E-601	03 E-001	03 E-002	03 E-101	03 E-601	03 E-602
03 E-603	99 E-501	99 E-502	99 E-503	00 DI-001	00 DI-601	03 DI-601	03 DI-602
99 DI-601							

In addition to the above, the Work shall include the following:

3. Pumping Station No. 3

   c. Coordination of Work to maintain continuous operation of the existing sanitary system, pumping station and leaching field.

   d. Upon completion and acceptance by the Owner of the new collection system, demolish and legally dispose of the existing on-site sewage disposal system.

   e. Connection of existing sanitary service into the new collection system upon acceptance by the Owner of the new collection system.

B. Measurement. Measurement for the work associated with the divisions of this Bid Item shall be in accordance with the measurement descriptions under the SRF ELIGIBLE BID ITEMS - BASE BID.

2. Measurement for utility charge allowance(s) shall be based on the actual paid invoices by the Contractor to each utility company and/or nursery. The following utility and nursey allowance(s) shall be included in the applicable subdivision of this Bid Item:

   a. Electric Company Connection/Service Fee. Refer to SECTION 01020, ALLOWANCES

   b. Telephone Company Connection/Service Fee. Refer to SECTION 01020, ALLOWANCES

   c. Planting Operations. Refer to SECTION 01020, ALLOWANCES

C. Payment. Payment for the work associated with the divisions of this Bid Item shall be in accordance with the payment descriptions under the SRF ELIGIBLE BID ITEMS - BASE BID.

ITEM A-3 - FIBER OPTIC CONDUITS ASSOCIATED FITTINGS AND HANDHOLES

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include: transportation; handling and dispersal of materials; cutting and removal of existing bituminous and cement concrete or reinforced cement concrete pavement; excavation, backfill above trench grade including all bedding materials (controlled density fill and road gravel); conduits, fittings and handholes; compacting trenches; sheeting and shoring not ordered left in place; loaming and seeding; landscaping; removing and resetting curbing, property markers, signs and mail boxes; dust control including mechanical sweeping; all fittings, caps, plugs, restraints and the like; traffic control devices; flushing/cleaning of conduits; testing (pressure, leakage, compaction, etc.); dewatering of trenches; daily cleanup; restoration of all areas disturbed by the Contractor's operations; all Work as specified in DIVISION 1 – GENERAL REQUIREMENTS; and all other incidental Work relative thereto.

The Work for ITEM A-3 - FIBER OPTIC CONDUITS ASSOCIATED FITTINGS AND HANDHOLES for the SRF ELIGIBLE BID ITEMS – ALTERNATIVES is shown on the Contract Drawing(s) numbered:

00 G-001	00 G-002	00 G-003	00 C-001	01 C-101	01 C-102	01 C-103	00C-104
00 C-105	01 C-106	99 C-506	99 C-507	00 E-001	00 E-002	00 E-003	00 E-601
01 E-001	02 E-001	03 E-001	99 E-501	99 E-502			

B. Measurement. Measurement for furnishing and installing fiber optic conduits, fittings and handholes shall be as follows:

1. The length of conduits to be paid for under the appropriate subdivision of this Bid Item shall be the horizontal measured length of conduit in place from centerline of handhole to centerline of handhole. Measurement shall be by the linear foot with no deductions made for fittings.

2. The number of handholes to be paid under the appropriate subdivision of this Bid Item and shall be equal to the actual number installed.

C. Payment. Payment for furnishing and installing conduits, fittings and handholes listed in DOCUMENT 00410, FORM OF GENERAL BID, shall be made at the unit prices bid under the applicable divisions of this Bid Item.

1. Only eighty-five (85) percent of the price bid per linear foot of conduit shall be paid for upon its installation, the balance shall be withheld until such time as the conduits have been successfully cleaned and tested (as required) and the site(s) has been fully restored. This percentage is exclusive of normal Contract retainage.

2. Payment for handholes will be paid under the appropriate subdivisions of this Bid Item and shall be equal to the actual number installed.

ITEM A-4 - TRACER WIRE IN TOWN ROADWAYS

A. General. The price bid under the Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include placement of tracer wire, connectors, termination points, grounding, testing and all other incidental Work relative thereto.

The Work for ITEM A-4 -TRACER WIRE IN TOWN ROADWAYS for the SRF ELIGIBLE BID ITEMS – ALTERNATIVES is shown on the Contract Drawing(s) numbered:

00 G-001	00 G-002	00 G-003	00 C-001	01 C-101	01 C-102	01 C-103	00C-104
00 C-105	01 C-106	01 C-107	01 C-108	01 C-109	02 C-104	02 C-105	02 C-107
02 C-108	02 C-109	02 C-110	03 C-101	03 C-102	03 C-103	03 C-104	03 C-105
03 C-106	03 C-107	03 C-108	03 C-109	03 C-110	03 C-111	03 C-115	03 C-117
99 C-508							

B. Measurement

1. Measurement for furnishing and installing tracer wire along the gravity sewer or low-pressure sewer shall be the horizontal measured length of tracer wire in place from centerline of manhole to centerline of manhole. Measurement shall be by the linear foot with no deductions made for manholes, connections and the like.

2. Measurement for furnishing and installing tracer wire along the force main shall be the horizontal measured length of tracer wire in place from the face of the Pumping Station Valve Vault to the centerline of the terminus manhole. Measurement shall be by the linear foot with no deductions made for manholes, connections and the likes.

3. Measurement for furnishing and installing tracer wire along the service connections shall be the horizontal measured length of tracer wire in place from the face of the wye, tee or chimney to the terminus of the service pipeline. Measurement shall be by the linear foot with no deductions made for manholes, connections and the likes.

C. Payment. Payment for furnishing and installing tracer wire listed in DOCUMENT 00410, FORM OF GENERAL BID, shall be made at the unit price bid unit linear foot under this Bid Item.

ITEM A-5 - HIGHWAY CROSSING VIA JACKING

A. General. The lump sum price bid under this Bid Item shall be considered as fair compensation for the additional cost for all labor, equipment, tools and materials necessary to complete the Highway Crossing using Jacking in place of using Horizontal Directional Drilling as specified under Item 22 of the SRF ELIGIBLE BID ITEMS - BASE BID as specified including work performed by the Contractor, Subcontractor, or Contractor's Consultants, for the design, installation, and jacking operation, The work shall also include all piping, fittings, valves, conduits, pipe/conduit supports/spacers, temporary structures, excavation, backfill and compaction, legal disposal of excess materials, coordination with MassDOT, jacking and receiving pits, connections to existing pipes and conduits located at the Pay Limits, grouting, filling the voids between the pipes conduits and the steel casing, dewatering operations (well points, pumps, electrical controls, suction and discharge piping, environmental controls, etc.), monitoring wells, control survey, dewatering operations, furnishing and maintaining safety warning signs and devices and all other incidental work relative thereto.

The Work for ITEM A-5 - HIGHWAY CROSSING VIA JACKING for the SRF ELIGIBLE BID ITEMS – ALTERNATIVES is shown on the Contract Drawing(s) numbered:

00 G-001	00 G-002	00 G-003	00 C-001	01 C-104	01 C-105	99 C-501	99 C-502
99 C-503	99 C-504	99 C-505	99 C-506	99 C-507	99 C-508	99 C-509	99 C-510
99 C-511	99 C-601	99 C-602	99 C-603	00 E-001	00 E-002	00 E-601	99 E-501
99 E-501							

B. Measurement. Measurement for Highway Crossing shall include the additional cost to complete the Highway Crossing using Jacking with a steel casing and all work for the installation of the piping and conduits located within in place of using Horizontal Directional Drilling as specified under Item 22 of the SRF ELIGIBLE BID ITEMS - BASE BID.

C. Payment. Payment for the Highway Crossing listed in DOCUMENT 00410, FORM FOR GENERAL BID shall be made at the lump sum price bid under the Bid Item.

1. The Lump Sum bid under this item shall be the additional cost to complete the Highway Crossing using Jacking in place of using Horizontal Directional Drilling as specified under Item 22 of the SRF ELIGIBLE BID ITEMS - BASE BID.

2. The Lump Sum price bid under this item shall include the removal of 100 cubic feet of rock and/or boulders located within the steel casing.

3. No other payment Item will be used for compensation of Work performed under this Bid Item.

1.06 - BASIS OF MEASUREMENT AND PAYMENT – SRF INELIGIBLE ITEMS

ITEM B-1 – REPLACEMENT OF WATER SERVICES

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include: transportation. handling and dispersal of materials; cutting and removal of existing bituminous and cement concrete or reinforced cement concrete pavement; excavation, backfill above trench grade including all bedding materials (controlled density fill and road gravel); removal and legal disposal of all existing water services and appurtenances being replaced; compacting trenches; sheeting and shoring not ordered left in place; loaming and seeding; landscaping; removing and resetting curbing, property markers, signs and mail boxes; connections to existing water pipeline(s) and services; dust control including mechanical sweeping; all permanent and temporary fittings, caps, plugs, restraints and the like; traffic control devices; flushing/cleaning of services; testing (pressure, leakage, bacteriological, compaction, etc.); dewatering of trenches; daily cleanup; restoration of all areas disturbed by the Contractor's operations; all Work as specified in DIVISION 1 – GENERAL REQUIREMENTS; and all other incidental Work relative thereto.

The Work for ITEM B-1 – REPLACEMENT OF WATER SERVICES for the SRF INELIGIBLE BID ITEMS is shown on the Contract Drawing(s) numbered:

00 G-001	00 G-002	00 G-003	00 C-001	01 C-101	00 C-109	00 C-110	02 C-101
02 C-102	02 C-103	02 C-104	02 C-105	02 C-106	02 C-107	02 C-108	02 C-109
02 C-110	03 C-102	03 C-103	03 C-113	03 C-114	03 C-116	03 C-117	

Note: Funding for this Bid Item is anticipated to be obtained at the Annual Town Meeting proposed to be held in May 2020. Therefore, performing the scope of work specified under this Bid Item is subject to this future appropriation and no payment will be made without written approval by the OWNER.

B. Measurement. Measurement for replacement of water services and associated fittings and valves shall be as follows:

1. Measurement shall be the horizontal measured length of water service in place from the face of the corporation to the terminus of the water service at the property line.

2. Measurement shall be as stated above with a minimum payment of five (5) linear feet.

3. Measurement for the following divisions of this Bid Item shall be in accordance with the measurement descriptions under the SRF ELIGIBLE BID ITEMS - BASE BID:

a. Road Gravel Material

b. Permanent Bituminous Concrete Trench Pavement

4. No other measurement Item will be used for compensation of Work performed under this Bid Item.

C. Payment. Payment for replacement of water services and associated fittings listed in DOCUMENT 00410, FORM OF GENERAL BID, shall be made at the unit prices bid under the applicable divisions of this Bid Item.

1. Payment for water services shall be made at the unit price bid per linear foot.

2. Payment for the following divisions of this Bid Item shall be in accordance with the payment descriptions under the SRF ELIGIBLE BID ITEMS - BASE BID:

a. Road Gravel Material

b. Permanent Bituminous Concrete Trench Pavement

3. No other payment Item will be used for compensation of Work performed under this Bid Item.

ITEM B-2 – REPLACEMENT OF CANAL ROAD WATER MAIN

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include: transportation. handling and dispersal of materials; cutting and removal of existing bituminous and cement concrete or reinforced cement concrete pavement; excavation, backfill above trench grade including all bedding materials (controlled density fill and road gravel); removal and legal disposal of all existing water mains, water services, fire hydrants, gate valves, etc. being replaced (including pipes, services, and appurtenances); temporary water polyethylene wrap; reconnecting existing fire hydrants; compacting trenches; sheeting and shoring not ordered left in place; loaming and seeding; landscaping; removing and resetting curbing, property markers, signs and mail boxes; connections to existing water pipeline(s) and services; dust control including mechanical sweeping; all permanent and temporary fittings, caps, plugs, restraints and the like; traffic control devices; flushing/cleaning of water mains; testing (pressure, leakage, bacteriological, compaction, etc.); dewatering of trenches; polyethylene encasement; daily cleanup; restoration of all areas disturbed by the Contractor's operations; all Work as specified in DIVISION 1 – GENERAL REQUIREMENTS; and all other incidental Work relative thereto.

The Work for ITEM B-2 – REPLACEMENT OF CANAL ROAD WATER MAIN for the SRF INELIGIBLE BID ITEMS is shown on the Contract Drawing(s) numbered:

00 G-001	00 G-002	00 G-003	00 C-001	03 C-105	03 C-108	03 C-109	03 C-110
99 C-501	99 C-502	99 C-503	99 C-504	99 C-505	99 C-506	99 C-507	99 C-508
99 C-509	99 C-510	99 C-511	99 C-601	99 C-602	99 C-603		

Note: Funding for this Bid Item is anticipated to be obtained at the Annual Town Meeting proposed to be held in May 2020. Therefore, performing the scope of work specified under this Bid Item is subject to this future appropriation and no payment will be made without written approval by the OWNER.

B. Measurement. Measurement for furnishing and installing water mains and associated fittings, water services fire hydrants and valves shall be as follows:

1. The length of water mains to be paid for shall be the horizontal measured length of pipeline in place from the start of the replacement to the end of the replacement (i.e. connection to existing water main to remain to connection to existing water main to remain). Measurement shall be by the linear foot with no deductions made for fittings or valves.

2. Measurement for water services shall be by the linear foot.
    a. Measurement for water services shall be the horizontal measured length of pipeline in place from the face of the corporation to the terminus of the water service at the property line.
    b. Measurement shall be as stated above with a minimum payment of five (5) linear feet.
3. The number of valves to be paid under the appropriate subdivisions of this Bid Item and shall be equal to the actual number installed.
4. The number of hydrants to be paid under the appropriate subdivisions of this Bid Item and shall be equal to the actual number installed.
5. Measurement for the following divisions of this Bid Item shall be in accordance with the measurement descriptions under the SRF ELIGIBLE BID ITEMS - BASE BID:
    a. Road Gravel Material
    b. Permanent Bituminous Concrete Trench Pavement
6. No other measurement Item will be used for compensation of Work performed under this Bid Item.

C. Payment. Payment for furnishing and installing water mains and associated fittings and water services of the various types, diameters and depths listed in DOCUMENT 00410, FORM OF GENERAL BID, shall be made at the unit prices bid under the applicable divisions of this Bid Item.

1. Only eighty-five (85) percent of the price bid per linear foot of water main shall be paid for upon its installation, the balance shall be withheld until such time as water main(s) have been successfully flushed and tested (as required), accepted by the Owner for incorporation into the existing water system and the site(s) has been fully restored. This percentage is exclusive of normal Contract retainage.
2. Payment for water services shall be made at the unit price bid per linear foot.
3. Payment for valves will be paid under the appropriate subdivisions of this Bid Item and shall be equal to the actual number installed.
4. Payment for fire hydrants will be paid under the appropriate subdivisions of this Bid Item and shall be equal to the actual number installed.
5. Payment for the following divisions of this Bid Item shall be in accordance with the payment descriptions under the SRF ELIGIBLE BID ITEMS - BASE BID:
    a. Road Gravel Material
    b. Permanent Bituminous Concrete Trench Pavement
6. The Contractor shall provide water for flushing and testing (as applicable) for each section of water main installed. Water utilizing the Owner's water system may be available, however, the Owner does not guarantee that its water supply will be available at any time during the duration of the Project. If available, water required for testing, puddling and/or jetting of trenches shall be provided by the Owner at no cost to the Contractor. All water shall be metered and the use of backflow prevention device(s) shall be required as approved by the Owner.
7. No other payment Item will be used for compensation of Work performed under this Bid Item.

ITEM B-3 – WATER QUALITY IMPROVEMENTS

A. General. The lump sum price bid under each division of the Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, including work performed by the Contractor, Subcontractor, or Contractor's Consultants, necessary to complete the Work as specified, which shall include: transportation. handling and dispersal of materials; cutting and removal of existing bituminous and cement concrete or reinforced cement concrete pavement; excavation, backfill above trench grade including all bedding materials (controlled density fill and road gravel); removal and legal disposal of all excess materials; pipes and fittings; compacting trenches; sheeting and shoring not ordered left in place; removal and relaying/replacement of existing water main; loaming and seeding; landscaping; removing and resetting curbing, property markers, signs and

mail boxes; temporary pavement restoration; dust control including mechanical sweeping; traffic control devices; flushing/cleaning of pipe and structures; dewatering of trenches; daily cleanup; restoration of all areas disturbed by the Contractor's operations; all Work as specified in DIVISION 1 – GENERAL REQUIREMENTS; and all other incidental Work relative thereto.

The Work for ITEM B-3 – WATER QUALITY IMPROVEMENTS for the SRF INELIGIBLE BID ITEMS is shown on the Contract Drawing(s) numbered:

00 G-001 00 G-002 00 G-003 00 C-001 02 C-104

Note: Funding for this Bid Item is anticipated to be obtained at the Annual Town Meeting proposed to be held in May 2020. Therefore, performing the scope of work specified under this Bid Item is subject to this future appropriation and no payment will be made without written approval by the OWNER.

B. Measurement. Measurement for Water Quality Improvements shall made based on a percentage of the total lump sum amount bid under each subdivision of this Bid Item, as approved by the Engineer.

C. Payment. Payment for the Water Quality Improvements listed in DOCUMENT 00410, FORM FOR GENERAL BID shall be made at the lump sum price bid under each subdivision of this Bid Item.

1. The Lump Sum price bid under this item shall include the removal of 10 cubic feet of rock and/or boulders located within the excavation.

2. No other payment Item will be used for compensation of Work performed under this Bid Item.

PART 2 - PRODUCTS – Not Used

PART 3 – EXECUTION – Not Used

END OF SECTION

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SECTION 01026

PAYMENT PROCEDURES

PART 1 – GENERAL 1
1.01 - FORMAT 1
1.02 - SUBMITTAL PROCEDURES 1
1.03 - APPLICATIONS FOR PAYMENT 2
1.04 - INVOICES 2
1.05 - SUBSTANTIATING DATA 2
1.06 - PAYMENT PROCEDURES 2
PART 2 – PRODUCTS – Not Used 3
PART 3 – EXECUTION – Not Used 3

PART 1 – GENERAL

1.01 - FORMAT

A. Form of General Bid, submitted by the Successful Bidder, as modified by any executed Change Order, will be the basis of all payments to the Contractor. The Engineer may require further breakdown of certain lump sum items to be included as deemed necessary by the Engineer. The Form of General Bid will serve as the basis for progress payments and will be incorporated into a form of Application for Payment as specified herein.

B. Contractor shall submit two Applications for Payment and invoices, covering the Work, less retainage, as specified in the Agreement, performed in each calendar month, for each month for the duration of the Work.

C. Contractor shall submit to the Engineer an Application for Payment on the specified form, provided by the Engineer in Microsoft Excel format, and attach a separate invoice, for the Work completed in the calendar month covered by that Application for Payment. Contractor shall submit each Application for Payment using AECOM Form S702 – Application and Certification for Payment, and AECOM Form S703 – Continuation Sheet, attached to this Specification. The Form of General Bid shall form the basis for Form S703.

D. The Engineer shall return, without review, any invoice not accompanied by completed S702 and S703 forms.

1.02 - SUBMITTAL PROCEDURES

A. Contractor shall submit original Application for Payment and invoice, and one copy of each, to the Engineer's Work Order Representative for review.

B. Once invoice is approved by Engineer, Contractor shall submit invoice to Owner per the requirements in the Agreement.

C. Contractor shall submit invoices at intervals not less than 30 days. Contractor shall submit an invoice for each month no later than the invoice closing date of the following month as set by the Engineer.

D. Contractor shall prepare a final Application for Payment and invoice as specified in Specifications SECTION 01700, CONTRACT CLOSEOUT.

1.03 - APPLICATIONS FOR PAYMENT

A. An Application for Payment form is attached with this Specification. A completed copy of the attached AECOM Forms S702 and S703 shall accompany each invoice.

B. Applications for Payment shall be executed and certified by signature of authorized officer of Contractor in the space indicated on Form S702.

C. Contractor shall list original Work Order amount, and each authorized Change Order and Work Change Directive, listing Change Order or Work Change Directive number and dollar amount.

D. Retainage in the amount of 5 percent shall be withheld as specified in the Agreement. This retainage shall be itemized on the Form S702 and Form S703 form.

E. Fair market value for work not completed shall be withheld as specified in the Agreement. This fair market value shall be itemized on the Form S702 and Form S703 form

1.04 - INVOICES

A. Each invoice shall be accompanied by the specified Application for Payment form and shall show the following:

1. The date of the Contract Documents.
2. Purchase Order Number.
3. Purchase Order Date.
4. A description of the Work performed (the description of the Work shall document site location, Project code number, and detail the actual Work performed and completed).

B. Invoices that include previously approved Work performed on a Time and Materials (T&M) or Cost Plus (CP) basis shall be supported with copies of daily time sheets, and Contractor shall attach photocopies of receipts for all materials and expenses claimed as T&M or CP Work. Lack of complete documentation for T&M or CP Work will be just cause for refusal by the Engineer to certify payment for such claimed costs, pending submittal of required documentation. All documentation shall be submitted and approved prior to invoice submittal. Contractor shall submit backup copies of all required paperwork that was previously submitted as a part of a daily or weekly submittal.

C. Each invoice shall be accompanied by Certified Payroll for the entire period of the invoice.

1.05 - SUBSTANTIATING DATA

A. The Engineer may request substantiating data for any claimed payment. When the Engineer requires substantiating data, Contractor shall submit within 30 days data justifying quantities of Work and dollar amounts in question. The Engineer may conditionally approve any claimed payment pending submittal of acceptable substantiating data. Unsubstantiated claims for payment will result in withholding of the unsubstantiated amounts from subsequent payment claims.

B. Contractor shall submit one copy of substantiating data with cover letter for each request for substantiating data. Each submittal of substantiating data shall show Application for Payment number, date and pay item by number and description.

1.06 - PAYMENT PROCEDURES

A. For unit price bid items, the product of the actual measured quantities suitably installed and accepted and the unit prices from the accepted bid proposal constitutes the extended total for payment. The extended total is the unit price times the quantity indicated. An adjustment of the unit price bid for an item in the proposal will only be considered if the actual quantity furnished and installed is greater than 25 percent above or below the estimated quantity. Said adjustment will only be applicable to that measured quantity which is 25 percent above or below the estimated quantity. For Lump Sum items suitability installed and completed the lump sum amount listed in the accepted bid proposal constitutes the total for payment.

B. Progress Payments; Retainage. OWNER shall make progress payments on account of the Contract Price on the basis of CONTRACTOR's Applications for Payment as recommended by ENGINEER, and in accordance with the applicable Massachusetts General Law during construction. All such payments will be measured by the schedule of values established in

C. Article 14.01 of the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements.

D. Progress payments will be made in an amount equal to 95 percent of Work completed (with the balance being retainage) but, in each case, less the aggregate of payments previously made and less such amounts as ENGINEER shall determine, or OWNER may withhold, in accordance with the General Conditions.

E. Final Payment. Upon final completion and acceptance of the Work in accordance with the General Conditions, OWNER shall pay the remainder of the Contract Price as recommended by ENGINEER.

PART 2 – PRODUCTS – Not Used

PART 3 – EXECUTION – Not Used

END OF TEXT

SEE ATTACHED PAYMENT FORM

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APPLICATION AND CERTIFICATION FOR PAYMENT **Form S702** PAGE ONE OF PAGES

TO: Town of Orleans, MA

PROJECT: Downtown Area Collection System and Pumping Stations

APPLICATION NO:

Distribution to:
☐ ENGINEER
☐ CONTRACTOR

FROM CONTRACTOR:

PERIOD ENDING:

ENGINEER'S PROJECT NO:

CONTRACT FOR:

CONTRACT DATE:

Application is made for payment, as shown below, in connection with the Contract. AECOM Form S703 Continuation Sheet is attached.

1. ORIGINAL CONTRACT PRICE $ _____
2. Net change by Change Orders $ _____
3. CONTRACT PRICE TO DATE (Line 1 + 2) $ _____
4. TOTAL COMPLETED & STORED TO DATE (Column G on Continuation Sheet) $ _____
5. RETAINAGE/FAIR MARKET VALUE:
   a. 5% of Completed Work (Column D + E on Continuation Sheet) $ _____
   b. Materials Stored to Date (Column F on Continuation Sheet) $ _____
   c. Fair Market Value for Work Not Completed $ _____
   Total $ _____
6. TOTAL EARNED LESS RETAINAGE / FAIR MARKET VALUE (Line 4 Less Line 5 Total) $ _____
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT (Line 6 from prior Certificate) $ _____
8. CURRENT PAYMENT DUE $ _____
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 Less Line 6) $ _____

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief, the Work covered by this Application for Payment has been completed in accordance with the Specifications and Drawings, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By:_____ Date:_____

State of: County of:
Subscribed and sworn to before me this ___ day of _____, ____
Notary Public:
My Commission expires:

ENGINEER'S RECOMMENDATION FOR PAYMENT

In accordance with the Agreement, Specifications and Drawings, based on on-site observations and the data comprising the application, the Engineer recommends that to the best of the Engineer's knowledge, information and belief, the Work has progressed as indicated, the quality of the Work is in accordance with the Specifications and Drawings, and the Contractor is entitled to payment of the Amount Recommended.

AMOUNT RECOMMENDED $ _____

(Attach explanation if Amount Recommended differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner		
Total approved this Month		
TOTALS		
NET CHANGES by Change Order		

ENGINEER:

By: _____ Date: _____

OWNER:

By: _____ Date: _____

CONTINUATION SHEET **Form S703** PAGE __ OF __ PAGES

1. Form S702, APPLICATION AND CERTIFICATION FOR PAYMENT, APPLICATION NO:

   including Contractor's signed certification is attached. APPLICATION DATE:

2. In tabulations below, amounts are stated to the nearest dollar. PERIOD ENDING:

3. Use Column I on contracts where variable retainage for line items may apply.

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED		MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D+E+F)	% (G/C)	BALANCE TO FINISH (C - G)	RETAINAGE / FAIR MARKET VALUE
			TOTAL FROM PREVIOUS APPLICATION	THIS PERIOD					
	GRAND TOTALS								

SECTION 01030

SPECIAL REQUIREMENTS

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PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes the furnishing of all labor, materials, tools and equipment required to perform Special Requirements as specified herein.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for Work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT and as follows:

1. All costs associated with locating, maintaining location marks, excavation, refilling, compaction, repairing utilities broken due to the Contractor's operations, time delays relative to existing utilities and all other Work associated with utilities shall be included for payment under the applicable pipe laying item included in DOCUMENT 00300, BID FORM.

2. All costs associated with the legal disposal of excess materials shall be borne by the Contractor.

3. No additional payment will be made for corrective work associated with furnishing and installing bedding materials for refill of excavations carried to grades lower than specified. If inadequate dewatering methods cause softening of subgrade areas then remove the unsuitable material and replaced with common fill and shall be borne by the Contractor.

4. No payment will be made for temporary shoring of trench walls utilizing trench boxes and/or steel plates. Where timber or steel sheeting is used and is not specified to be paid for separately and ordered left in place by the Engineer, the Contractor has the option of leaving it in or removing it after it has been cut off one (1) foot above the top of the pipe.

5. Pay all fees for permits associated with blasting operations. Unauthorized excavations in rock, or excavations made beyond or below the specified limits shall be refilled and compacted with common fill and shall be borne by the Contractor. Perform blasting operation(s) in such a manner that no existing utilities are disturbed. All damage to existing utilities or roadway surfaces outside the trench limits caused by the Work of the Contractor or its Subcontractor(s) shall be repaired and/or replaced immediately and shall be borne by the Contractor.

6. No additional payment will be made for the relocation and/or support of any obstruction encountered along the line of Work.

7. Testing, puddling and/or jetting of trenches utilizing the Owner's water system may be available, however the Owner does not guarantee that its water supply will be available at any time during the duration of the Project. Contractor is responsible for making all arrangements and gathering necessary permissions from the Owner's water district for use of water. Use of water shall be at the Contractor's expense. All necessary piping, hoses, fittings, and the like shall be provided by the Contractor and shall be borne by the Contractor. All water shall be metered and the use of backflow prevention device(s) shall be required as approved by the Owner.

8. Provide detailed plan(s) to the Owner and/or appropriate governing body for all proposed detours and/or partial roadway closings made necessary by the Work. Obtain written approval for all proposed detours and/or partial roadway closings prior to the start of Work. No payment will be made for Work performed in areas of the Project that require an approved traffic management plan until it has been secured. All work shall be in accordance with SECTION 01570, TRAFFIC MANAGEMENT AND MAINTENANCE.
9. All costs associated with repairing settlement of trenches shall be borne by the Contractor.
10. All costs associated with meeting the requirements of all environmental permits, state highway permits and the removal and/or reinstallation of existing utilities shall be borne by the Contractor and shall be included for payment under the applicable pipe laying item included in DOCUMENT 00300, BID FORM.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Submit to the Engineer for approval, shop drawings, certificates of compliance and/or catalog cuts for all items to be furnished under this Contract. All submittals shall be provided in accordance with DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Digital Videodisc Recording

1. Prior to the start of construction, video record, in color, the entire Project site(s) in the presence of the Engineer. Video recordings shall be in digital videodisc (DVD) format. Particular attention shall be made to the existing condition of roadway surfaces, curbing, berms, sidewalks, driveways, property bounds, landscaped areas, and any other items that might be affected by the Work.
2. Video recordings shall be of excellent quality including clear and concise audio descriptions of the existing site(s) conditions. A copy of the first Existing video recording shall be furnished to the Engineer, prior to the start of construction, in order to establish the requirement for visual and audio quality. Two (2) copies of all video recordings shall be provided to the Engineer. Any recordings furnished which, in the opinion of the Engineer, are of poor quality or incomplete, shall be redone at no additional cost to the Owner.
3. Video recordings shall be made by the Contractor in the presence of the Owner/Engineer.
4. No construction activities shall commence until the video recordings have been Existing, submitted to the Engineer and approved by the Engineer.

C. Health and Safety Plan

1. Prior to the start of construction, prepare and submit a site-specific Health and Safety Plan which includes consideration of all known and potential hazards at the site. Work may not proceed at the project site until the Contractor's Health and Safety Plan has been received by the Engineer.

2. Contractor shall be cognizant of the minimum standards set forth in OSHA 29 CMR 1910.120. The Health and Safety Plan shall include, but not be limited to the following:

   a. Identification of Contractor's Site Safety Officer.

   b. Identification of hazards and risks associated with the Project.

   c. Contractor's standard operating procedures, including personnel training and field orientation.

   d. Respiratory protection training requirements.

   e. Levels of protection and selection of equipment procedures.

   f. Type of medical surveillance program.

   g. Personal of hygiene requirements and guidelines.

   h. Zone delineation of the Project site.

   i. Site security and entry control procedures.

   j. Field monitoring of site contaminants.

   k. Contingency and emergency procedures.

   l. Listing of emergency contacts.

3. The personal protective equipment required to provide the appropriate level of dermal and respiratory protection shall be determined based on the results of continuous air monitoring performed by the Contractor and the standards set forth in the Contractor's Health and Safety Plan.

D. Utilize the Shop Drawing Transmittal Forms supplied by the Engineer for all required submittals.

1.05 - PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer's written recommendations.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.07 - SPECIFICATIONS AND DRAWINGS

A. All Work shall conform to these specifications and the accompanying drawings entitled:

TOWN OF ORLEANS, MASSACHUSETTS
DOWNTOWN AREA COLLECTION SYSTEM AND PUMPING STATIONS
CONTRACT NO. 2019-02
SRF CONTRACT NO. 4486

Dated January 2020 consisting of 103 sheets, all made by the Engineer, on file with the Owner, and any changes, drawings, plans, and directions that may be furnished from time to time by the Engineer.

1.08 - PROGRESS OF WORK

A. Promptly start and continue actual construction Work under this Contract with the necessary equipment to properly execute and complete the Work in the specified time. No cessation of construction activities will be allowed without the written approval of the Owner.

B. Furnish to the Engineer a progress schedule for the Work prior to the start of construction.

C. Furnish to the Engineer a "two-week look ahead" that summarizes the anticipated construction activities. The "two-week look ahead" shall be provide to the Engineer on Thursday of every week throughout the duration of the Project.

1.09 - DETOURS AND ROAD ACCESSIBILITY

A. Contact the responsible heads of the MassDOT, Department of Public Works and Natural Resources, Fire Department, Police Department, and other appropriate governing bodies of the municipality having jurisdiction over all or part of the proposed Project, in order to obtain all necessary permits and determine the requirements of these governing bodies, with regards to traffic control.

B. There are no guarantees that total roadway closures will be permitted. Incorporate into the construction schedule the ability to maintain one (1) lane of traffic at all times during the execution of the Work and complete the Work within the Completion date. Where the roadway under construction is the only means of vehicular access to a particular area provide continual access to the area for residents and emergency vehicles.

C. Wherever detours are permitted, the size, construction and location of signs shall conform to local and state requirements and/or standards. Detour routes shall be adequately posted to assist the motorist to return to the normal route of travel for the duration of the Work and for a minimum of two (2) weeks prior to the start of construction in the areas of the Project affected by the Work.

D. Detours and road accessibility shall be in accordance with SECTION 01570, TRAFFIC MANAGEMENT AND MAINTENANCE and as shown of the drawings.

1.10 - CHANGE IN AMOUNT OF WORK

A. The Owner reserves the right to increase or decrease the amount of any item of the Work listed as may be found desirable or necessary during the carrying out of this Contract and the unit prices included in DOCUMENT 00300, BID FORM shall apply without change to such variation in the quantity of each of the Bid items to the extent provided by law.

B. Based on the actual work required, the increase or decrease in the quantity of any bid item of the Work included in DOCUMENT 00300, BID FORM shall apply without changes to the unit prices.

1.11 - SCOPE OF WORK AND SEQUENCE OF CONSTRUCTION

A. The Work to be done under this Contract consists of furnishing and installing wastewater infrastructure, water main replacement and water quality improvements as specified and/or as shown on the Contract Drawings.

B. The scope of work includes constructing approximately 32,200 linear feet of 8-inch, 10-inch, 12-inch and 18-inch PVC gravity sewer and appurtenances, approximately 11,400 linear feet of 6-inch and 8-inch PVC and HDPE force main and appurtenances, approximately 2,100 linear feet of 2-inch low pressure sewer and appurtenances and 3 Submersible Pumping Stations and appurtenances all to provide wastewater service to the Downtown Area of Orleans, MA.

C. The Work of the Project shall be completed within 751 calendar days following execution of the Contract Document using not more than 304 working days via the following:

1. Preparation, Submittal and Approval of Shop Drawings and Permits

a) Collection System, Water Main Replacement and Water Improvements – 45 calendar days; and

b) Pumping Stations – 90 calendar days.

2. Construction

a) Main Line (Gravity Sewers and Low-Pressure Sewers), Force Mains, Service Connections, Pumping Stations and Appurtenances shall be Existing within 706 calendar days, using not more than 269 working days and working Mondays through Fridays, 8 hours per days and using a minimum of one main line crew, one service connection crew and one cleanup/restoration/paving crew.

b) Final Roadway Paving and Restoration - 45 calendar days, using not more than 35 working days and working Mondays through Fridays, 8 hours per days and using a minimum of two paving crews and two cleanup/restoration/paving crews.

D. The Work requires the Contractor to utilize a minimum number of main line crews, one service connection crew and one cleanup/restoration/paving crew all operating simultaneously. Each crew shall consist of all necessary labor, materials and equipment necessary to be self-sufficient. Failure to comply with this requirement will result in no payment for work performed.

E. The Contractor shall develop a Project Schedule that complies with the order specified in the following Sequence of Construction schedule. Failure to comply with this requirement will result in no payment for work performed. Each Section identified shall be substantially complete except for final paving. The purpose of this Sequence of Construction is to connect properties into the collection system as each pipe segment is substantially complete. Based on the contactor's means and methods of construction, the Contractor has the option of proposing an alternative sequence of construction which satisfies the goal of connecting properties into the collection system as each pipe segment is substantially complete.

Sequence of Construction					
Section Number	**Location**	**Type**	**Drawing Number**	**Manhole**	
				From	**To**
Pump Station No. 1 Tributary Area					
1A	Old Colony Way	GS	01 C-106	PS No. 1	SMH F-03-06
1B	Old Colony Way	GS	01 C-106	SMH F-03-06	SMH G-03-04
1C	West Road	GS	01 C-104	SMH G-03-04	SMH G-03-05
1D	West Road	GS	01 C-104	SMH G-03-05	SMH G-03-06
1E	West Road	GS	01 C-104 01 C-103	SMH G-03-06	SMH G-03-07
1F	West Road	GS	01 C-103	SMH G-03-07	SMH G-03-08
1G	West Road	GS	01 C-103	SMH G-03-08	SMH G-03-09
1H	West Road	GS	01 C-103	SMH G-03-09	SMH G-03-10
1I	West Road	GS	01 C-103 01 C-102	SMH G-03-10	SMH G-03-11
1J	Eldredge Park Way	GS	01 C-102	SMH G-03-11	SMH G-03-12

Sequence of Construction					
Section Number	**Location**	**Type**	**Drawing Number**	**Manhole**	
				From	**To**
1I\K	Lots Hollow Road	GS	01 C-102	SMH G-03-12	SMH G-03-13
1L	Lots Hollow Road	GS	01 C-102	SMH G-03-13	SMH G-03-14
1I\M	Lots Hollow Road	GS	01 C-102 01 C-101	SMH G-03-14	SMH H-03-01
1N	Lots Hollow Road	GS	01 C-102	SMH H-03-12	SMH H-03-02
1I\O	Lots Hollow Road	GS	01 C-102	SMH H-03-02	SMH H-03-03
1P	Lots Hollow Road	GS	01 C-102	SMH H-03-03	SMH H-03-04
1Q	Lots Hollow Road	GS	01 C-102	SMH H-03-04	SMH H-03-05
2A	Old Colony Way	GS	01 C-106	SMH F-03-06	SMH F-03-05
2B	Old Colony Way	GS	01 C-106	SMH F-03-05	SMH F-03-04
2C	Old Colony Way	GS	01 C-106	SMH F-03-04	SMH F-03-01
2D	Old Colony Way	GS	01 C-106 01 C-107	SMH F-03-01	SMH F-03-02
2E	Old Colony Way	GS	01 C-107	SMH F-03-02	SMH F-03-03
2F	Old Colony Way	GS	01 C-107	SMH F-03-03	SMH F-04-43
2G	Old Colony Way	GS	01 C-107	SMH F-04-43	SMH F-04-44
2H	Old Colony Way	GS	01 C-107 01 C-108	SMH F-04-44	SMH F-04-45
2I	Old Colony Way	GS	01 C-108	SMH F-04-45	SMH F-04-46
2J	Old Colony Way	GS	01 C-108	SMH F-04-46	SMH F-04-47
2K	Old Colony Way	GS	01 C-108	SMH F-04-47	SMH F-04-48
3A	Old Tote Road	GS	01 C-109	SMH F-03-01	SMH G-03-01
3B	Old Tote Road	GS	01 C-109	SMH G-03-01	SMH G-03-02
3C	Old Tote Road	GS	01 C-109	SMH G-03-02	SMH G-03-03
3D	Old Tote Road	GS	01 C-109	SMH G-03-03	SMH G-04-01

Sequence of Construction					
Section Number	**Location**	**Type**	**Drawing Number**	**Manhole**	
				From	**To**
4A	Cranberry Highway Route 6A	GS	01 C-110	SMH G-03-11	SMH G-03-15
4B	Cranberry Highway Route 6A	GS	01 C-110	SMH G-03-15	SMH G-03-16
4C	Cranberry Highway Route 6A	GS	01 C-110	SMH G-03-16	SMH G-03-17
4D	Cranberry Highway Route 6A	GS	01 C-110	SMH G-03-17	SMH G-03-18
4E	Cranberry Highway Route 6A	GS	01 C-110	SMH G-03-18	SMH G-03-19
4F	Cranberry Highway Route 6A	GS	01 C-110	SMH G-03-19	SMH G-04-02
Pump Station No. 2 Tributary Area					
5A	Cranberry Highway Route 6A	GS	02 C-102	SMH F-04-22	SMH F-04-23
5B	Cranberry Highway Route 6A	GS	02 C-102 02 C-101	SMH F-04-23	SMH G-04-07
5C	Cranberry Highway Route 6A	GS	02 C-101	SMH G-04-07	SMH G-04-06
5D	Cranberry Highway Route 6A	GS	02 C-101	SMH G-04-06	SMH G-04-05
5E	Cranberry Highway Route 6A	GS	02 C-101	SMH G-04-05	SMH G-04-04
5F	Cranberry Highway Route 6A	GS	02 C-101	SMH G-04-04	SMH G-04-03
6A	Cranberry Highway Route 6A	GS	02 C-102	SMH F-04-22	SMH F-04-52
6B	Cranberry Highway Route 6A	GS	02 C-102	SMH F-04-52	SMH F-04-53
6C	Cranberry Highway Route 6A	GS	02 C-102	SMH F-04-53	SMH F-04-54
7A	Cranberry Highway Route 6A	GS	02 C-103	Existing SMH F-04-14	SMH E-04-31
7B	Cranberry Highway Route 6A	GS	02 C-103	SMH E-04-31	SMH E-04-30

Sequence of Construction					
Section Number	**Location**	**Type**	**Drawing Number**	**Manhole**	
				From	**To**
8A	Brewster Cross Road	GS	02 C-105	Existing SMH F-04-15	SMH F-04-16
8B	Brewster Cross Road	GS	02 C-105	SMH F-04-16	SMH F-04-17
8C	Brewster Cross Road	GS	02 C-105	SMH F-04-17	SMH F-04-18
8D	Brewster Cross Road	GS	02 C-105 02 C-104	SMH F-04-18	SMH F-04-19
8E	Brewster Cross Road	GS	02 C-104	SMH F-04-19	SMH F-04-20
8F	Brewster Cross Road	GS	02 C-104	SMH F-04-20	SMH F-04-21
8G	Brewster Cross Road	GS	02 C-104	SMH F-04-21	SMH F-04-22
9A	South Orleans Road Route 28	GS	02 C-106	Existing SMH F-04-31	SMH F-04-32
9B	South Orleans Road Route 28	GS	02 C-106	SMH F-04-32	SMH F-04-33
9C	South Orleans Road Route 28	GS	02 C-106	SMH F-04-33	SMH F-04-34
9D	South Orleans Road Route 28	GS	02 C-106	SMH F-04-34	SMH F-04-06
10A	Cove Road	GS	02 C-107	SMH F-04-32	SMH F-04-40
10B	Cove Road	GS	02 C-107	SMH F-04-40	SMH F-04-41
10C	Cove Road	GS	02 C-107	SMH F-04-41	SMH F-04-42
11A	Cummings Road	GS	02 C-108	Existing Stub	SMH F-04-35
11B	Cummings Road	GS	02 C-108	SMH F-04-35	SMH F-04-36
11C	Cummings Road	GS	02 C-108	SMH F-04-36	SMH F-04-37
11D	Cummings Road	GS	02 C-108	SMH F-04-37	SMH F-04-38
11E	Doane Terrace	GS	02 C-108	SMH F-04-38	SMH F-04-39
12A	Cove Road	GS	02 C-109	SMH F-04-17	SMH F-04-56
12B	Cove Road	GS	02 C-109	SMH F-04-56	SMH F-04-25
12C	Cove Road	LPS	02 C-109	SMH F-04-24	SMH F-04-25
13A	Cove Road	LPS	02 C-110	SMH F-04-49	SMH F-04-32

Sequence of Construction					
Section Number	Location	Type	Drawing Number	Manhole	
				From	To
14A	Snow Library	GS	02 C-402	PS No. 2	SMH F-04-51
14B	Snow Library	GS	02 C-402	SMH F-04-51	SMH F-04-50
Pump Station No. 3 Tributary Area					
15A	Stop & Shop Parking Lot	GS	03 C-111	PS No. 3	SMH D-05-11
15B	Stop & Shop Parking Lot	GS	03 C-111	SMH D-04-11	SMH D-04-01
15C	Stop & Shop Parking Lot	GS	03 C-111 03 C-110	SMH D-04-01	SMH D-04-02
15D	Stop & Shop Parking Lot	GS	03 C-110	SMH D-04-02	SMH D-04-03
15E	Stop & Shop Parking Lot	GS	03 C-110	SMH D-04-03	SMH D-04-04
15F	Stop & Shop Parking Lot	GS	03 C-110	SMH D-04-04	SMH D-04-10
15G	Stop & Shop Parking Lot	GS	03 C-110	SMH D-04-10	SMH D-04-09
15H	Cross Country	GS	03 C-110	SMH D-04-09	SMH D-04-08
16A	Canal Road	GS	03 C-109	SMH D-04-08	SMH D-05-07
16B	Canal Road	GS	03 C-109	SMH D-04-07	SMH D-05-06
16C	Canal Road	GS	03 C-109	SMH D-04-06	SMH D-05-05
16D	Canal Road	GS	03 C-109	SMH D-04-05	SMH D-05-04
17A	Canal Road	GS	03 C-109 03 C-108	SMH D-04-08	SMH D-04-05
17B	Canal Road	GS	03 C-109 03 C-108	SMH D-04-05	SMH D-04-06
17C	Canal Road	GS	03 C-108	SMH D-04-06	SMH D-04-07
17D	Canal Road	GS	03 C-108	SMH D-04-07	SMH D-04-08
17E	Canal Road	GS	03 C-108	SMH D-04-08	SMH D-04-11
17F	Canal Road	GS	03 C-108 03 C-107	SMH D-04-11	SMH E-04-14
17G	Canal Road	GS	03 C-108	SMH E-04-14	SMH E-04-31
17H	Canal Road	GS	03 C-108	SMH E-04-31	SMH E-04-30
17I	Canal Road	GS	03 C-108	SMH E-04-30	SMH E-04-29
17J	Canal Road	GS	03 C-108	SMH E-04-29	SMH E-04-28

Sequence of Construction					
Section Number	**Location**	**Type**	**Drawing Number**	**Manhole**	
				From	**To**
18A	Locust Road	GS	03 C-104	SMH E-04-14	SMH E-04-15
18B	Locust Road	GS	03 C-104	SMH E-04-15	SMH E-04616
18C	Locust Road	GS	03 C-104 03 C-103	SMH E-04-16	SMH E-04-17
18D	Locust Road	GS	03 C-103	SMH E-04-17	SMH E-04-18
18E	Locust Road	GS	03 C-103	SMH E-04-18	SMH E-04-19
18F	Locust Road	GS	03 C-103	SMH E-04-19	SMH E-04-20
18G	Locust Road	GS	03 C-103 03 C-102	SMH E-04-20	SMH E-04-21
18H	Locust Road	GS	03 C-102	SMH E-04-21	SMH E-04-22
18I	Locust Road	GS	03 C-102	SMH E-04-22	SMH E-04-23
18J	Locust Road	GS	03 C-102	SMH E-04-23	SMH E-04-24
18K	Locust Road	GS	03 C-102	SMH E-04-24	SMH E-04-25
19A	Main Street	GS	03 C-101	SMH E-04_25	SMH E-04-26
19B	Main Street	GS	03 C-101	SMH E-04-26	SMH E-04-27
19C	Main Street	GS	03 C-101	SMH E-04-27	SMH F-04-55
20A	Liberty Lane	GS	03 C-106	SMH E-04-28	SMH E-04-36
20B	Liberty Lane	GS	03 C-106	SMH E-04-36	SMH E-04-35
20C	Liberty Lane	GS	03 C-106	SMH E-04-35	SMH E-04-34
20D	Liberty Lane	GS	03 C-106	SMH E-04-34	SMH E-04-33
21A	Jones Road	GS	03 C-105	SMH D-04-08	SMH D-04-09
21B	Jones Road	GS	03 C-105	SMH D-04-09	SMH D-04-10
22A	Stop & Shop Parking Lot	GS		SMH D-05-11	SMH E-05-01
22B	Stop & Shop Parking Lot	GS		SMH E-05-01	SMH E-05-02
22C	Stop & Shop Parking Lot	GS		SMH E-05-02	SMH E-05-03
22D	Stop & Shop Parking Lot	GS		SMH E-05-03	SMH E-05-04

Sequence of Construction					
Section Number	**Location**	**Type**	**Drawing Number**	**Manhole**	
				From	**To**
23A	Cranberry Highway Route 6A	GS	03 C-113	SMH E-05-04	SMH E-05-05
23B	Cranberry Highway Route 6A	GS	03 C-113	SMH E-05-05	SMH E-05-06
23C	Cranberry Highway Route 6A	GS	03 C-113	SMH E-05-06	SMH E-05-07
23D	Cranberry Highway Route 6A	GS	03 C-113	SMH E-05-07	SMH E-05-13
23E	Cranberry Highway Route 6A	GS	03 C-113 03 C-112	SMH E-05-13	SMH E-04-07
23F	Cranberry Highway Route 6A	GS	03 C-112	SMH E-04-07	SMH E-04-08
23G	Cranberry Highway Route 6A	GS	03 C-112	SMH E-04-08	SMH E-04-09
23H	Cranberry Highway Route 6A	GS	03 C-112	SMH E-04-09	SMH E-04-10
24A	Cranberry Highway Route 6A	GS	03 C-113 03 C-114	SMH E-05-04	SMH E-05-09
24B	Cranberry Highway Route 6A	GS	03 C-114	SMH E-05-09	SMH E-05-10
24C	Cranberry Highway Route 6A	GS	03 C-114	SMH E-05-10	SMH D-05-01
24D	Cranberry Highway Route 6A	GS	03 C-114	SMH D-05-01	SMH D-05-02
24E	Cranberry Highway Route 6A	GS	03 C-114	SMH D-05-02	SMH D-05-03
25A	South Orleans Road Route 28	GS	03 C-116	SMH E-04-01	SMH E-04-02
25B	South Orleans Road Route 28	GS	03 C-116	SMH E-04-02	SMH E-04-03
25C	South Orleans Road Route 28	GS	03 C-116	SMH E-04-03	SMH E-04-04
25D	South Orleans Road Route 28	GS	03 C-116	SMH E-04-04	SMH E-04-05
26A	Old County Road	GS	03-C-115	SMH E-05-10	SMH E-05-11
26B	Old County Road	LPS	03 C-115	SMH D-05-12	SMH E-05-11
27A	Cottage Street	LPS	03 C-117	SMH E 04-32	SMH E-04-02
27B	North Cottage Street	LPS	03 C-117	SMH E-05-08	Cottage Street

F. Additional Construction Constraints

1. Winter Season Work

   a. The project involves work near roadways which are heavily traveled during the summer season (May 15 through September 15). Therefore, work is required to be performed on specified roadways during the Winter Season (October 15 through March 31).

   b. The project involves work near roadways which are not heavily traveled during the winter season and therefore work on the roadways is allowed at the following locations:

      - Cottage Street
      - Cove Road – South of Route 28
      - Cranberry Cove Plaza
      - North Cottage Street
      - Old County Road

   c. The Contractor is required to place Permanent Bituminous Concrete Trench Pavement each and every Friday. If Permanent Bituminous Concrete Pavement is not available, the Contractor shall place Hot Mix Pavement at no additional cost to the Owner and shall replace the Hot Mix Pavement once Permanent Bituminous Concrete Pavement is available.

   d. The Contractor is responsible for maintaining (i.e. snow plowing, regrading, etc.) the roadways throughout the winter season.

2. Summer Season Work

   a. The project involves work near roadways which are heavily traveled during the summer season (May 15 through September 15). Therefore, work on the roadways located as part of this project is not allowed except for the following locations:

      - Brewster Crossroads
      - Canal Road - Roundabout to Locust Road
      - Center Place
      - Cove Road – North of Route 28
      - Jones Road
      - Liberty Lane
      - Route 6 Crossing

   b. The Contractor is required to place Permanent Bituminous Concrete Trench Pavement each and every Friday.

3. Installation of the wastewater infrastructure work occurs at the following intersections each of which have active vehicle loop detectors:

   a. Intersection of Cranberry Highway with Eldredge Park Way and West Road; and

   b. Intersection of Cranberry Highway with Old County Road and Stop and Shop Plaza Entrance.

   Following the installation of the wastewater infrastructure and Permanent Bituminous Concrete Trench Pavement and/or Permanent Bituminous Concrete Full Width Pavement, the vehicle loop detectors are required to be replaced in accordance with MassDOT Standard Specification for Traffic Control Devices (Section 800), and the latest NEMA standards. Refer to SECTION 02503, PAVING, CURBING, SIDEWALKS AND ROADWAYS for additional requirements.

   Following the final pavement restoration, the vehicle loop detectors are required to be replaced in accordance with MassDOT Standard Specification for Traffic Control Devices (Section 800), and the latest NEMA standards. Refer to SECTION 02503, PAVING, CURBING, SIDEWALKS AND ROADWAYS for additional requirements.

4. Installation of the infrastructure (SMH F-04-46 to Pumping Station No. 2 and Pumping Station No. 2)

   a. Snow Library

      1) The Snow Library has only one entrance/exit which is located off Main Street.

         a) The installation of the wastewater infrastructure (gravity sewer, force man, fittings and manholes) from SMH F-04-46 to SMH F-04-47 in the paved entrance/exit shall occur during period of time when the Snow Library is closed.

         b) The installation of the remaining wastewater infrastructure (Pumping Station Components, gravity sewer, force main, fittings, manholes, electrical, demolition, etc.) shall occur as to maximize access to the Snow Library.

      2) Maintain complete operation of the existing on-site wastewater disposal system during installation of the new wastewater infrastructure (pipe, fittings, manholes, pumping station and electrical system). Failure to comply with this requirement will result in a penalty of $5,000 per violation plus any fines imposed by the MassDEP.

      3) Demolition of the existing on-site wastewater system shall occur following written approval by the Engineer that the new wastewater infrastructure (collection system, pumping station, force main, etc.) is substantially complete and ready for service. Obtain a Demolition Permit from the Orleans' Board of Health. It should be noted that this will not occur until the Spring of 2012 when Contract No. 2019-01 - Wastewater Treatment Facility and Effluent Disposal is substantially complete and ready for service.

Partial Demolition	**Complete Demolition**
(a) Pump existing structures and legally dispose of all contents; (b) Remove and legally disposal of Pumping System and associated controls and electrical system; (c) Puncture six three-inch diameter holes in bottom of all structures; (d) Plug existing pipes and conduits entering and exiting structures; (e) Demolish top three-feet of all structures and legally dispose of all debris; and (f) Backfill and compact remaining voids with common fill.	(a) Pump existing structures and legally dispose of all contents; (b) Plug existing pipes entering and exiting structures; (c) Demolish entire structure and foundation and appurtenances and legally dispose of all debris; and (d) Backfill and compact excavations with common fill
• Septic Tank	• Distribution Boxes
• Pump Chamber	

      4) In addition to the above demolition the Contractor is responsible for the following additional Site Demolition and Site Restoration:

         1) Site Demolition

            • Electrical System: (a) Obtain a Demolition permit from the Orleans's Building Department; (b) Disconnect electrical wiring and control wiring at the Pump Chamber and Control Panel; (c) Remove and legally dispose of all above grade components of the Electrical System; and (d) Cut and legally disposal of and plug existing conduits at the Control Panel three feet below grade.

         2) Site Restoration

            • Trench Pavement: (a) Cut back each side of trenches by a minimum of 1-foot; (b) Furnish and place 2-inch permanent bituminous concrete trench width pavement (base course); and (c) Furnish and place 1-1/2-inch permanent bituminous concrete trench width pavement (top course).

            • Loam and Seed: (a) Grade all disturbed grass areas; (b) Furnish and place 4-inches of loam; and (3) Hydroseed all loam areas.

- Landscaping: (a) Grade all disturbed landscaping areas; and (b) Furnish and place 2-inches of bark mulch.
- Electrical System: If disturbed by the Contractor, Remove and Relay and/or Replace the Existing Underground Electrical System located at the Snow Library and The Village Green. Payment will be made via Bid Item 16D.
- Irrigation System: If disturbed by the Contractor, Remove and Relay and/or Replace the Existing Underground Irrigation System located at the Snow Library and The Village Green. Payment will be made via Bid Item 16D.

It is the Contractor's responsibility to inform all personnel of these requirements, including their staff, subcontractors and suppliers. No exceptions shall be made. Failure to comply with these requirements will result in a penalty of $5,000 per violation.

b. The Village Green - The installation of the wastewater infrastructure occurs near The Village Green. No activities shall occur on The Village Green. It is the Contractor's responsibility to inform all personnel of these requirements, including their staff, subcontractors and suppliers. No exceptions shall be made. Failure to comply with these requirements will result in a penalty of $5,000 per violation. In addition, the Contractor will be fully responsible for any and all restoration required at no cost to the Owner.

c. Middles School - The installation of the pump station control panel, emergency generator, conduits, etc. occurs near the Middle School. The Contractor is required to limit their activities to within the limits of work shown on the Contract Drawings. The Contractor is required to coordinate their activities with the School Department. It is the Contractor's responsibility to inform all personnel of these requirements, including their staff, subcontractors and suppliers. No exceptions shall be made. Failure to comply with these requirements will result in a penalty of $5,000 per violation. In addition, the Contractor will be fully responsible for any and all restoration required at no cost to the Owner.

5. Installation of the infrastructure (SMH D-05-11 to SMH D-05-08, SMH D-05-11 to SMH E-05-04 and Pumping Station No. 3)

a. Entry into and from the Cranberry Cove Plaza shall be from the entrance located off of Cranberry Highway (Route 6A) where the wastewater infrastructure (pipe, fittings, manholes, pumping station and demolition of the existing on-site wastewater system, etc.) is to be installed. It is the Contractor's responsibility to inform all personnel of this requirement, including their staff, subcontractors and suppliers. No exceptions shall be made. Failure to comply with this requirement will result in a penalty of $5,000 per violation.

b. Installation of the new wastewater infrastructure (pipe, fittings, manholes and pumping station) and demolition of the existing on-site wastewater system shall occur during the off-season (October 15 through May 15). No exceptions shall be made. Failure to comply with this requirement will result in no payment for work performed.

c. Maintain complete operation of the existing on-site wastewater system during installation of the new wastewater infrastructure (pipe, fittings, manholes and pumping station). Failure to comply with this requirement will result in a penalty of $5,000 per violation plus any fines imposed by the MassDEP.

d. Demolition of the existing on-site wastewater system shall occur following written approval by the Engineer that the new wastewater infrastructure is substantially complete (collection system, pumping station, force main, etc.) and ready for service. Obtain a Demolition Permit from the Orleans' Board of Health. It should be noted that this will not occur until the Spring of 2021 when Contract No. 2019-01 - Wastewater Treatment Facility and Effluent Disposal is substantially complete and ready for service. The existing on-site wastewater system is as shown on "The Stop & Shop Supermarket Company, Cranberry Cove Plaza, Store No. 026, Orleans, MA, Septic System Upgrade, Bioclere System Addition" by Woodard & Curran, Inc. dated September2, 1995.

Partial Demolition	Complete Demolition
(a) Pump existing structures and legally dispose of all contents; (b) Puncture six three-inch diameter holes in bottom of all structures; (c) Plug existing pipes entering and exiting structures; (d) Demolish top three-feet of all structures and legally dispose of all debris; and (e) Backfill and compact remaining voids with common fill	(a) Pump existing structures and legally dispose of all contents; (b) Plug existing pipes entering and exiting structures; (d) Demolish entire structure and foundation, electrical systems and appurtenances and legally dispose of all debris; and (e) Backfill and compact excavations with common fill
• Septic Tank	• Bioclere Secondary Treatment System
• Valve Chamber	• Distribution Boxes
• Pump Chamber	

e. In addition to the above demolition the Contractor is responsible for the following additional Site Demolition and Site Restoration:

1) Site Demolition

- Electrical System: (a) Obtain a Demolition permit from the Orleans's Building Department; (b) Disconnect electrical wiring and control wiring at the Pump Chamber and Control Panel; (c) Remove and legally dispose of all above grade components of the Electrical System; and (d) Cut and legally disposal of and plug existing conduits at the Control Panel three feet below grade.

2) Site Restoration

- Trench Pavement: (a) Cut back each side of trenches by a minimum of 1-foot; (b) Furnish and place 2-inch permanent bituminous concrete trench width pavement (base course); and (c) Furnish and place 1-1/2-inch permanent bituminous concrete trench width pavement (top course).
- Loam and Seed: (a) Grade all disturbed grass areas; (b) Furnish and place 4-inches of loam; and (3) Hydroseed all loam areas.
- Landscaping: (a) Grade all disturbed landscaping areas; and (b) Furnish and place 2-inches of bark mulch.
- Electrical System: If disturbed by the Contractor, Remove and Relay and/or Replace the Existing Underground Electrical System located at the Snow Library and The Village Green. Payment will be made via Bid Item 16D.
- Irrigation System: If disturbed by the Contractor, Remove and Relay and/or Replace the Existing Underground Irrigation System located at the Snow Library and The Village Green. Payment will be made via Bid Item 16D.

6. Installation of the wastewater infrastructure work includes the installation of service laterals. These service laterals will cross existing brick sidewalks. Care shall be taken to minimize the number of bricks removed and to replace the existing brick following installation of the service laterals. Saw cutting and/or splitting of existing bricks is not allowed. Refer to SECTION 02503, PAVING, CURBING, SIDEWALKS AND ROADWAYS for additional requirements.

7. The intent of the Project is to backfill, compact and place Permanent Bituminous Concrete Trench Pavement on the trenches at the end of each and every Friday. In addition, the Contractor is required to make all roadways passable at the end of each and every workday utilizing utilized Millings and/or Compacted Gravel (at no additional cost to the Owner). However, in order to minimize the construction duration and complete the various project phases within the specified duration, the Contractor may use steel plates over the trenches on a limited basis pending approval by the Owner and MassDOT (if applicable). The use of steel plates is contingent upon meeting the following requirements:

- Able to withstand H-20 traffic loading without any movement.
- Fabricated to meet ASTM A36 steel requirements.
- Before steel plates are installed, the excavation shall be adequately shored to support the bridging and traffic loads.
- Edges properly secured and feathered with asphalt.
- Wedges or other non-asphaltic devices used for leveling as required to eliminate rocking of the plates.
- Compacted temporary asphalt used to fill all gaps between the plates and existing pavement surfaces.
- Edges of the steel plates are marked/painted to improve visibility.
- Roadway and trench wall conditions are constantly reevaluated to ensure safety.
- Not deviate more than 1/4 inch when measured with a 10-foot straight edge along the length of the plate.
- Minimum of 12-inches overlap and/or tack welded together at each corner to reduce or eliminate vertical movement.
- Minimum of 12-inches beyond the edges of the excavation.
- Plates countersunk due to uneven roadways.
- Plates should be coated with an anti-skid coating.
- Advance warning signs (i.e. Steel Plate Ahead, Bump Ahead, etc.) are installed.
- Written notification of Owner and MassDOT of plate locations.
- Conduct end of the day inspections and provide written notification to the Owner and MassDOT before leaving site.

8. The Work of the Project involves roadways that are heavily traveled. The following requirements shall be maintained during the Work of this Project. Incorporate these requirements into the Project Schedule.

   a. Complete all Work within each section of roadway (intersection to intersection) prior to proceeding to the next section or next roadway.

   b. No Work shall be started on the Project until a detailed Project Schedule and Engineered Traffic Management Plan has been submitted to and approved by the Engineer and MassDOT. In addition, during the construction of the Project update the Project Schedule weekly and inform the Engineer, Owner, MassDOT for work in the State Highway Layout, and all other applicable utilities or other entities affected by the Work in writing of changes to the approved Project Schedule.

   c. For additional requirements refer to SECTION 01570, TRAFFIC MANAGEMENT AND MAINTENANCE.

   d. The Contractor shall provide up to four Portable Changeable Message Signs to provide advance warning to motorists prior to entering the construction area in accordance with SECTION 01570, TRAFFIC MANAGEMENT AND MAINTENANCE. The locations of the Portable Changeable Message Signs shall be as determined by the MassDOT, the Owner and Engineer.

   e. Failure to comply with this requirement will result in no payment for work performed.

9. Roadway Restoration

   a. Method A - Permanent Surfacing of State Roadways

      (1) Prior to the start of construction, the Contractor and Contractor's paving subcontractor shall meet with the Owner, MassDOT and the Engineer to review roadway restoration.

      (2) Temporary Trench Pavement - Furnish and place a 4-inch bituminous concrete trench width pavement. The Temporary trench pavement shall be placed at the end of each workday unless otherwise approved by MassDOT and the Engineer.

      (3) Permanent Trench Pavement - Cut back each side of trenches by a minimum of 1-foot. Furnish and place 7-inch permanent superpave bituminous concrete trench width pavement (3-inch base course

and 4-inch intermediate course or 7-inch intermediate course). The 7-inch permanent superpave bituminous concrete trench width pavement shall be laid in two layers. Permanent trench pavement shall occur between 90 to 180 days after pipeline installation subject to OWNER and MassDOT approval.

(4) Overlay - Mill 2-inches and furnish and place 2-inch permanent superpave bituminous concrete full width pavement (top course). Overlay shall be placed the following construction season, allowing the trench to settle over a winter freeze thaw cycle. Mill and overlay shall occur following the completion of the permanent trench pavement subject to OWNER and MassDOT approval.

Permanent Bituminous Concrete Trench Pavement and Permanent Bituminous Concrete Full Width Pavement of State Roadways shall occur in the following locations:

Location	**Drawing Number**	**Manhole or Station ***	
		From	**To**
Cranberry Highway	01 C-110	SMH G-04-02	SMH G-03-11
Cranberry Highway	02 C-101 thru 02 C-102	SMH G-04-03	SMH F-04-54
Cranberry Highway	02 C-103	SMH F-04-14	SMH E-04-30
Cranberry Highway	03 C-112	SMH E-04-10	SMH E-04-01
South Orleans Road	03 C-112 thru 03 C-114	SMH E-04-01	SMH D-05-03
South Orleans Road	02 C-106	Exist. SMH F-04-31	SMH E-04-06
South Orleans Road	03 C-116	SMH E-04-01	SMH E-04-06

* Note: Final location to be determined in the field.

b. Method B - Permanent Surfacing of Local Streets

(1) Prior to the start of construction, the Contractor and Contractor's paving subcontractor shall meet with the Owner and the Engineer to review roadway restoration.

(2) Temporary Trench Pavement – Not Used.

(3) Permanent Trench Pavement - Cut back each side of trenches by a minimum of 1-foot. Furnish and place 4-1/2-inch permanent bituminous concrete trench width pavement (base course). Permanent trench pavement shall occur between 90 to 180 days after pipeline installation subject to OWNER approval.

(4) Overlay - Furnish and place 1-1/2-inch permanent bituminous concrete full width pavement (top course). Overlay shall be placed the following construction season, allowing the trench to settle over a winter freeze thaw cycle. Mill and overlay shall occur following the completion of the permanent trench pavement subject to OWNER approval.

Permanent Bituminous Concrete Trench Pavement and Permanent Bituminous Concrete Full Width Pavement of Local Roadways shall occur in the following locations:

Location	Drawing Number	Manhole or Station *	
		From	To
Center Place	02 C-109	SMH F-04-17	SMH F-04-25
Jones Road	03 C-105	SMH D-04-08	SMH D-04-10
Liberty Lane	03 C-106	SMH E-04-18	SMH E-04-33
Old County Road	03 C-115	SMH E-05-10	SMH D-05-12

* Note: Final location to be determined in the field.

c. Method D - Permanent Surfacing of Local Streets

(1) Prior to the start of construction, the Contractor and Contractor's paving subcontractor shall meet with the Owner and the Engineer to review roadway restoration.

(2) Temporary Trench Pavement – Not Used.

(3) Permanent Trench Pavement - - Cut back each side of trenches by a minimum of 1-foot. Furnish and place 4-1/2-inch permanent bituminous concrete trench width pavement (base course). Trench pavement shall be Existing between 90 to 180 days after pipeline installation subject to OWNER approval

(4) Overlay - Mill 1-1/2-inches and furnish and place 1-1/2-inch permanent bituminous concrete full width pavement (top course). Overlay shall be placed the following construction season, allowing the trench to settle over a winter freeze thaw cycle.

Permanent Bituminous Concrete Trench Pavement and Permanent Bituminous Concrete Full Width Pavement of Local Roadways shall occur in all other locations not specified.

d. Miscellaneous Restoration of Local Roadways

(1) Roadways located between and adjacent to the wastewater infrastructure in the following locations shall be restored as follows:

Location	Drawing Number	Manhole or Station *		Type of Restoration
		From	To	
Cranberry Highway	02 C-101	SMH G-04-02	SMH G-04-03	Method A
Cranberry Highway	02 C-103 and 03 C-112	SMH E-04-30	SMH E-04-09	Method A
South Orleans Road	03 C-114	SMH D-05-03	Town Line	Method A
Main Street	03 C-101	SMH F-04-55	Exist. SMH F-04-09	Method A
Center Place	02 C-109	SMH F-04-24	SMH F-04-19	Method A
Cummings Road	02 C-108	Main Street Exist. SMH F-04-05	SMH F-04-38	Method D
Cove Road	02 C-107	Cranberry Highway Sta. 38+00	SMH F-04-42	Method D
Liberty Lane	03 C-106	SMH E-04-29	End of Cul-d-Sac	Method B

Location	Drawing Number	Manhole or Station *		Type of Restoration
		From	To	
Canal Road	03 C-107 and 03 C-112	SMH E-04-28	South Orleans Road Sta. 58+00	Method D

* Note: Final location to be determined in the field.

Permanent Bituminous Concrete Trench Pavement and Permanent Bituminous Concrete Full Width Pavement of Local Roadways shall occur in all other locations not specified.

(2) Temporary Trench Pavement – Not Used.

G. Highway Crossing

1. The project involves work near the Route 6 roadway which is heavily traveled and an active highway. The Highway Crossing shall be performed via jacking as specified in SECTION 02150, HIGHWAY CROSSING (JACKING).

2. The work shall be performed in accordance with the requirements specified herein and per the following:

   a. "Geotechnical Section Application Requirements and Permit Conditions: Trenchless Pipe Installation" by the Massachusetts Department of Transportation, dated March 2015;

   b. "Geotechnical Section Application Requirements and Permit Conditions: Trenchless Pipe Installation" by the Massachusetts Department of Transportation, dated June 1996; and

   c. MassDOT Permit Requirements.

   Failure to comply with this requirement will result in additional retainage from monthly payment requests.

3. Blasting is not allowed within the MassDOT Route 6 Highway Right-of-Way. Rock encountered in this area shall be removed by drilling and splitting using rock splitters, feathers and wedges, jackhammers, or by hand.

H. For the protection of life and property all backfilling operations shall follow closely behind pipe laying. Insure that no excavation is left open, unguarded, or water filled during any period of time when Work is not actually in progress. It is the purpose and intent that all excavations and backfill, including consolidation operations, and temporary surfacing within an area be accomplished expeditiously before proceeding to other Work areas.

I. The Owner reserves the right to schedule the Work at any location within the Project area. At the same time the Owner may schedule the suspension of Work at any location. Construction in seasonally heavily traveled roadways shall be avoided during the heavily traveled period.

J. The Work of this Contract may require existing utilities to be bypassed, removed and relaid. The Contractor shall pay for all costs associated with this Work at no additional cost to the Owner except as specified in SECTION 01025, MEASUREMENT AND PAYMENT.

K. The Owner has obtained various permits for this Project, which are included as DOCUMENT 00858, SPECIAL CONDITIONS – PERMITS AND LICENSES. Meet all requirements/conditions of these permits during the construction of this Project. All costs associated with this Work shall be borne by the Contractor and included in the prices bid under the applicable items of DOCUMENT 00300, BID FORM.

L. Cleanup/restoration of all disturbed areas shall be Existing each and every week or after a maximum of 500 linear feet of pipeline installation, throughout the duration of the Project. Cleanup/restoration consists of, but is not limited to, restoration of the area to preconstruction conditions, removal of all excess materials, removal of all pipe, fittings, manholes, removal of all construction equipment and materials, and removal of all construction debris. Failure to comply with this requirement may result in withholding the fair market value for the cleanup/restoration of all disturbed areas not Existing from monthly payment requests until this requirement has been met.

M. Pre-blasting of ledge is not allowed on this Project. No payment will be made for ledge removal on this Project in areas where pre-blasting has occurred.

N. All damage to existing utilities, roadways, and the like shall be repaired and/or replaced by the Contractor as approved by the utility company and shall be borne by the Contractor.

O. The control of dust shall be accomplished by the application of clean water. The Contractor is responsible for making all arrangements and gaining necessary permissions from the Owner to utilize the Owner's water system. However, the Owner does not guarantee that water will be available at any time during the duration of the Project. Water required for the control of dust shall be provided by the Contractor at no additional cost to the Owner. All necessary piping, hoses, fittings, and the like shall be provided by the Contractor and the costs shall be borne by the Contractor. All water shall be metered and the use of backflow prevention device(s) shall be required as approved by the Owner. The use of calcium chloride to control dust is not allowed.

P. Compaction of Trenches

1. The compaction of trenches shall be accomplished by puddling and/or jetting.

2. The Contractor is responsible for making all arrangements and gaining necessary permissions from the Owner to utilize the Owner's water system. However, the Owner does not guarantee that water will be available at any time during the duration of the Project. Water required for the puddling and/or jetting of trenches shall be paid for by the Contractor.

3. All necessary piping, hoses, fittings, and the like shall be provided by the Contractor and the costs shall be borne by the Contractor.

4. All water shall be metered and the use of backflow prevention device(s) shall be required as approved by the Owner.

5. The Contractor shall provide four Metering Systems including the following:

Item Number	Description
BMTS450BHYD	3-inch Fire Hydrant Meter TSM 450FH
BTS450L-2	M450 3-inch Turbo Local Register (gallons)
H81-98HS	3-inch MIP x 2-1/2-inch FEM NST SWVL UPD (#09-215-2)
MC81-98-NL	3-inch x 2-1/2-inch Bushing No Lead (#XNL114-4840)
FI88-84 HYD	2.5-inch Hydrant Check Valve (#07-1-0B)
FGGV-8	2-1/2-inch FIP Gate Valve (#0818-25NL)
H88-88H	2-1/2-inch MIP x 2-1/2-inch Male NST (UPD #14-146-12)

Product information from Stiles Company, 922 Pleasant Street, Norwood, MA 02062, 800-426-6246

6. The Metering Systems shall be used by the Contractor on this Project only, refurbished in accordance with the manufacturer's requirements, and shall be provided to the OWNER at the completion of the project.

Q. Pipeline Camera System

1. Provide an all-inclusive, ready to use, portable color video inspection system using a television camera specifically designed and constructed for inspection of small diameter sewer lines (2 inches and greater).

2. The system shall consist of the following:
    a. Heavy gauge and corrosion resistant stainless-steel XL coiler with 400 foot push cable length with 0.517-inch rigid push cable (0.236-inch fiberglass rod) for larger pipeline applications.
    b. Push cables with exclusive HDPE jackets.
    c. On-screen customizable distance counter.
    d. Pan and tilt camera for mainline or large pipe applications features continuous 360 deg rotation and pan. Pan and tilt functionality shall be fully integrated into the systems' controller; built-in multi-frequency 512 Hz and 8kHz sonde transmitter.
    e. Standard SR3 self-leveling camera for 2-inch to 12-inch pipelines and an advanced pan and tilt camera head for 4-inch and greater pipelines.
    f. Video titling with multiple predefined and customizable screens which is retained in memory for efficient operation.
    g. Digital recorder features USB mpg recording and playback of video and screenshot picture images.
    h. Wireless digital video for operation with a other remote location with receiver.
    i. Locator/receiver for accurate camera location in metallic and non-metallic pipelines.
    j. Quadrature footage interface for external asset management software.
    k. Line trace post for 128Hz, 1kHz, 8Hz and 33kHz locating.
    l. Full featured control unit with advanced text writing, observation coding, and digital recording in a weather/water resistant enclosure.
    m. Large 8.4-inch industrial grade optically bonded monitor that features a quick connect mount for attaching to the coiler.
    n. Digital recorder with integrated controls featuring intuitive buttons for all recording and playback functions. Features dual drive recording for redundancy and file safety.
    o. System Interface connection that includes video, audio, and 12VDC outputs and a video input. Quadrature footage output for optional asset management software.
    p. Internal Li-Ion Battery with Intellicharge technology offers 4+ hours of continuous use on a single charge. Also accepts AC and 12 VDC power input.
    q. The operation is fully integrated with intuitive controls.
    r. 16GB external and 128GB internal memory is included.
    s. Operate the MPlus+ anywhere with either 110 AC mains power, 12VDC power or the advanced internal Li-Ion battery delivering 4+ hours of use on a single charge.
3. The system shall be MPlus+ XL as manufactured by CUES, 3600 Rio Vista Avenue, Orlando, FL 32805, 800-327-7791 or equivalent systems as manufactured by, Aries Industries, 550 Elizabeth Street, Waukesha, WI 53186, 800-234-7205 or Ratech Electronic, 260 Spinnaker Way, Unit 7 Vaughan, Ontario, L4K 4P9, Canada, 800-461-9200.

R. Archaeological Sensitive Areas

1. The Contractor is hereby notified that work of this Project will occur in Archaeological Sensitive Areas and therefore an experienced archaeologist from The Public Archaeology Laboratory, Inc (ENGINEER's Subconsultant) will monitor construction activities. Because potentially significant pre- and/or post-contact archaeological deposits could be present beneath the existing roadways and/or other paved areas assigned as having low archaeological sensitivity, an Unanticipated Discoveries Plan (UDP) consistent with the Massachusetts Unmarked Burial Law will be implemented during construction to formalize procedures guiding the discovery of human remains and/or significant cultural resources. The UDP will be developed by the ENGINEER's Subconsultant in consultation with the Massachusetts Historical Commission (MHC), and in accordance with the MGL Chpt. 38, Sec. 6; Chpt 9, Sec. 26A and 27C; and Chpt 7, Sec. 38A; all as amended).

2. Cultural Resources Training

   a. The ENGINEER's Subconsultant will prepare action plans for unanticipated discoveries, such as burials and conduct cultural resource training of personnel from the General Contractor and their Subcontractors/Subconsultants as well as personnel from the OWNER, Owners Project Manager and ENGINEER and their Subconsultants (Bryant Associates, Inc. and Keville Enterprises, Inc.) who will be monitoring all of the construction excavation.

   b. The purpose of this training will be to provide an overview of the general cultural history of the Project area, so that personnel will be aware of the kinds of archaeological resources that may be encountered in the field. In addition, the training program will emphasize the exact procedures to be followed, as outlined in the UDP, regarding actions to be taken and notification required in the event of a significant site discovery, such as human remains, during construction.

   c. Personnel from the General Contractor and their Subcontractors/Subconsultants are required to attend the Cultural Resources Training prior to any construction activities occurring in the identified areas. Failure to comply with this requirement will result in a penalty of $10,000 plus any fines and restoration costs required by federal, state and local authorities.

3. Archaeological Machine Monitoring Methodology

   a. ENGINEER's Subconsultant will monitor and observe all excavations for the wastewater infrastructure located in areas assessed as having high archaeological sensitivity. The archaeological machine monitoring shall involve the close visual examination of exposed subsoils by the project Archaeologist to identify any potential archaeological deposits and/or human remains that may be located within construction impact areas. The goal of the machine monitoring will be to ensure that if any significant archaeological resources, including human remains and/or burials, are exposed during the construction activities that they are treated appropriately in accordance with the Massachusetts Unmarked Burial Law.

   b. Based on the sensitivity assessment conducted by the ENGINEER's Subconsultant in 2017, the following locations have been assessed as having a preliminary high archeological sensitivity due to the proximity of recorded archaeological sites and general lack of development:

      1) The section of Route 28, from Academy Place to where it intersects with Route 6A;

      2) The short residential connectors that lie closest to Town Landing (Cottage Street and Cove Road, and Cummings Road);

      3) The Route 6A loop around to Canal Road;

      4) Jones Road;

      5) Liberty Lane in the Cedar Pond Area;

      6) The southern end of Old Tote Road;

      7) Pump Station 1 Area; and

      8) Pump Station 2 Area.

c. The remaining areas to be impacted could contain sites due to their proximity to wetlands and/or previously recorded sites, however, based on a review of project plans showing existing underground utilities, these areas are assessed as having low archaeological sensitivity.

S. The testing of tanks and/or pipelines shall be accomplished by using clean water. The Contractor is responsible for making all arrangements and gaining necessary permissions from the Owner to utilize the Owner's water system. However, the Owner does not guarantee that water will be available at any time during the duration of the Project. Water required for the testing of tanks and/or pipelines shall be paid for by the Contractor. All necessary piping, hoses, fittings, and the like shall be provided by the Contractor and the costs shall be borne by the Contractor. All water shall be metered and the use of backflow prevention device(s) shall be required as approved by the Owner.

T. Temporary paving, where applicable, is required to be placed whenever the Contractor ceases operations in an area for more than 12 hours or every day of the week, whichever comes first, throughout the duration of the Project and/or as directed by the Engineer. Include all costs associated with completing this Work under the applicable Bid item specified in SECTION 01025, MEASUREMENT AND PAYMENT. No payment will be made for temporary paving placed in areas not prepared in accordance with the Contract Documents. Failure to comply with this requirement may result in withholding the fair market value for temporary pavement not Existing from monthly payment requests until this requirement has been met.

U. Except for an emergency condition as approved by the Owner in writing, premium wages will not be paid for Work performed on Sunday, holiday or work days longer than eight (8) hours. All costs incurred by the Owner caused by the Contractor's Work performed on Sunday, holiday or work days longer than eight (8) hours shall be borne by the Contractor which will be deducted from monthly payment requests.

V. Manhole sections, pipe, fittings, frames and covers, and other material and/or equipment shall not be stockpiled along roadways. At the beginning and end of each work day, the Contractor shall transport all materials and/or equipment to and from an offsite temporary storage yard that they have legal access to on a daily basis. The Contractor shall secure use of space that they will use for the temporary storage yard.

W. The Contractor shall secure use of space that they have legal access to for the temporary buildings specified under SECTION 01500, TEMPORARY FACILITIES. The temporary buildings shall not be placed along the edge of roadways. The Contractor shall be responsible for clearing, grubbing, grading, providing of grading materials, permits, and full restoration of the temporary building location(s).

X. All equipment, material and supplies to be provided under this contract shall be American made.

Y. No construction activity shall be allowed on the following dates and for the two working days prior to the following dates, unless otherwise approved by the owner:

- New Year's Day - January 1*
- Martin Luther King Jr. Day – Third Monday in January
- Presidents' Day - Third Monday in February
- Patriot's Day – Third Monday in April
- Memorial Day - Last Monday in May
- Independence Day - July 4
- Labor Day - First Monday in September
- Columbus Day - Second Monday in October
- Veterans' Day - November 11
- Thanksgiving Day - Fourth Thursday in November
- Christmas Day - December 25

*If a holiday falls on a Sunday, the day following is observed as the legal holiday

All construction equipment and materials not incorporated in the Work to date shall be removed from the Work areas where construction activity is ceased. All excavations shall be backfilled and paved as specified and/or directed by the Engineer. Incorporate this requirement into the Project Schedule. Failure to comply with this requirement will result in no payment for work performed.

Z. All shop drawings shall be approved by the ENGINEER prior to any on-site construction activities occurring. Failure to comply with this requirement will result in no payment for work performed.

AA. Full mobilization by the Contractor shall occur, including manhole sections, pipe, fittings, frames and covers, and other material and/or equipment and all temporary facilities prior to any on-site construction activities occurring. Failure to comply with this requirement will result in no payment for work performed.

1.12 - EXISTING UTILITIES

A. The location and size of existing sewers, drains, culverts, water mains, gas mains, cables, service pipes, and other utilities shown on the Contract Drawings, were obtained from the results of surveys and existing records and are shown as approximate only, to guide the Bidders in the preparation of their Bid. The various utility companies will determine the location and depth of existing utilities by marking them out upon the ground and by experimental excavations by the Contractor prior to and as the Work progresses. The Contract Drawings do not show the exact location and depth of all utilities, nor do they show all utilities or the number of lines for each utility that may be encountered.

B. Assume that there are existing utility connections to each and every building or structure along the line of Work, whether they appear on the Contract Drawings or not. Notify the proper utility companies and obtain and preserve the marked location(s) of all existing utilities that may be encountered along the line of Work, until such time as such markings are no longer required.

C. Experimental trench excavations are to be made prior to commencing pipe laying operations. Excavate by hand as necessary in advance of the trenching equipment to determine the exact location and depth of each utility that may be encountered. Excavation equipment shall not be used within three (3) feet of the utility to be crossed. Continue to excavate by hand around these utilities after ascertaining their exact location and depth.

D. Experimental excavations shall be made at all existing potable water mains located within ten (10) feet of the proposed gravity sewer(s) and/or force mains prior to commencing trench excavations. Determine the exact location, materials of construction, size and elevation of these existing water main(s). The location and depth of the proposed gravity sewer(s) and/or force mains shown on the Contract Drawings shall be adjusted as approved by the ENGINEER, in order to maintain the required separation as specified herein, and to maintain a continuous upward or downward slope for force mains and to maintain the necessary line and grade for gravity sewers.

E. All utilities interfered with or damaged shall be replaced and/or repaired immediately. Carefully bed, tamp and fully consolidate refill material around and under all existing utilities encountered or crossed unless otherwise specified as approved by the Engineer.

F. Protection of all existing utilities in the vicinity of the Work and the assurance of uninterrupted service from existing utilities throughout construction is the responsibility of the Contractor.

G. In the event that the Contractor’s Work results in damages to existing utilities, provide all necessary materials, equipment and labor necessary to satisfactorily repair damaged utilities immediately at no cost to the Owner.

H. Notify the Water Utility 24 hours prior to connecting to and/or bypassing any existing water main, or as required by the utility. Do not operate any existing water system valves. All such operations shall be coordinated with and performed by Water Utility personnel.

1.13 - VISITS TO THE SITE(S)

A. Before submitting a Bid, visit the site(s) to examine existing conditions and become thoroughly acquainted with the effort required to perform the Work.

B. Study the Contract Documents and compare the same with the information gathered during examination of the site(s), as no extra compensation will be authorized for extra Work caused by unfamiliarity with the site(s) and/or Contract Documents or the conditions peculiar to this Project.

1.14 - DISPOSAL OF EXCESS MATERIAL

A. All pavement road base, surplus suitable material removed from the excavations, loam not required for re-use in the Work shall be legally disposed of by the Contractor.

B. Legally dispose of all unsuitable material removed as part of the Work.

1.15 - TECHNICAL SPECIFICATIONS

A. Where reference is made to ASTM, AWWA, AASHTO specifications or other associations, it is understood that the latest revisions as of the date of the Contract Documents shall apply.

1.16 - PERMITS, FEES AND BONDS

A. Obtain and comply with all required permits, pay all fees and provide all bonds necessary to complete the Work as specified. Be solely responsible for performing any necessary acts and providing any materials required in order to comply with any and all terms and conditions set forth in any permits and licenses.

B. Refer to DOCUMENT 00858, SPECIAL CONDITIONS - PERMITS AND LICENSES for all permits, which have been obtained for the Project. The Owner has not obtained all permits and licenses required for this Project. The Contractor shall obtain and pay for any other permits required to complete the Project including but not limited to Road Opening Permit, Blasting, and Phase II General Stormwater Permit for small construction projects.

1.17 - NOTIFICATION OF CONSTRUCTION

A. At least 5 business days prior to initiating excavation Work, notify the following entities, in writing, of where and when excavation(s) are scheduled.

1. Town of Orleans Department of Public Works and Natural Resources – (508) 240-3790
2. Town of Orleans Highway Department – (508) 240-3790
3. Town of Orleans Water Department – (508) 255-1200
4. Town of Orleans Fire and Rescue – (508) 255-0050
5. Town of Orleans Police Department - (508) 255-0117
6. Dig Safe – 811
7. MassDOT, District 5 Highway Division – (508) 824-6633
8. AECOM – (508)-237-7161

1.18 - BOUNDS AND PROPERTY MARKERS

A. Prior to initiating construction, engage an independent Registered Land Surveyor (in the State where the Project is located) to provide permanent reference points for all bounds and property markers along the line of the Work that may be disturbed during construction. Submit copies of all ties to the bounds and property markers to the Engineer prior to excavation at the site(s).

B. Any bounds or markers disturbed shall be replaced utilizing the services of a Professional Land Surveyor in the State where the Project is located. The cost of replacing markers disturbed by the Contractor's operations shall be at the Contractor's expense.

1.19 - TWENTY-FOUR HOUR EMERGENCY SERVICE

A. Maintain a 24-hour, 7-day a week telephone service. The Contractor’s emergency personnel and equipment shall be within 30 minutes travel time to the Project site(s) in order to handle emergency requirements such as, but not limited to, settled trenches, clogged drains, and rain damage and/or any other emergency situation relating to the Contractor’s Work. A list of the personnel and their telephone numbers, pager numbers, and cell phone numbers, shall be submitted to the Engineer, the Owner and to the local Police and Fire Departments.

B. This requirement shall apply for the duration of the Project and shall be updated as necessary. This list shall be submitted on the Contractor's letterhead and shall state that should an emergency arise during the implementation of the Project, these people are to be contacted. Submit this letter to the Engineer prior to initiating construction.

1.20 - UNIFORMED POLICE OFFICERS

A. Payment of uniformed police officers used for pedestrian and vehicle control on this Project are to be paid for directly by the Owner without any Contractor involvement other than the Contractor's input as to traffic control requirements and canceling of planned details.

B. Uniformed police officers are paid a four (4) hour minimum. If arrangements have been made for uniformed police officers and inclement weather or other factors prohibit Work, contact the Police Department no later than 5:30 a.m. of the day of scheduled Work to cancel the police detail.

C. Should the Contractor fail to notify the Police Department as required, the Contractor shall assume all costs for the four (4) hour minimum police details not canceled in time. Separate billings will be issued by the Police Department for non-canceled police details and the Contractor shall pay such bills on a monthly basis.

D. No uniformed private security forces shall be employed in this capacity without the express written approval of the Owner.

1.21 - HOURS OF OPERATION

A. The Contractor, including all subcontractors, materialmen, and all other relating to this Project, shall conform to the following Work schedule.

1. No outdoor activity on or adjacent to the site will be permitted before 7:00 a.m. or after 5:00 p.m., unless other arrangements are made with the Owner.

2. No outdoor activity shall take place on Saturdays, Sundays, legal holidays recognized by the Owner and the two days preceding legal holidays as noted in herein, except for emergency conditions, which, if practical, shall be reviewed and approved by the Owner.

1.22 - DISPOSAL OF DEBRIS

A. During the prosecution of the Work, maintain the Project site(s) and adjoining areas in a neat and orderly manner and eliminate the accumulation of construction debris. A rubbish container shall be kept at the Project site(s) at all times and be emptied as required to prevent odors and vermin.

B. Store and remove all debris from the Project site(s) and legally dispose of the debris in accordance with federal/state/local regulations. Should the Contractor neglect or refuse to maintain the Project site(s) free of accumulated debris, the Owner reserves the right to have the service performed by others and cost thereof deducted from monthly progress payment requests.

C. At the conclusion of the Work, remove and legally dispose of any surplus excavation, broken pavement, lumber, equipment, temporary structures, and any other refuse remaining from construction operations, and leave the entire Project site(s) of the Work in a neat and orderly condition.

1.23 - RECORD DRAWINGS

A. Throughout the course of completing the Work, continually maintain a set of record drawings that incorporate all approved changes made by the Contractor and all subcontractors to the Drawings included in the executed Contract between the Owner and the Contractor. Clearly and concisely mark up the individual Drawings and/or incorporate sketches that show approved changes made during the execution of the Work. Following completion of the Work, incorporate all approved changes electronically into one (1) complete set of record drawings. Record drawings shall be complete in every way and shall show the full extent of the executed Work. Special attention shall be given to concealed Work.

B. Change Orders, Addenda items and field changes shall be included where applicable. Additional specific requirements relative to record drawings may be called for in the individual sections of the Specifications. Submit a review copy to the Engineer for approval and make any revisions required by the Engineer in order to make the record drawings complete. After acceptance by the Engineer, deliver a full scale reproducible hard copy and a compact disk with Auto Cad files of the record drawings to the Engineer.

C. Tie cards (8 ½ inches by 11 inches) of all exterior buried utilities such as but not limited to piping, tubing, conduits, wye/tee connections, fittings, cleanouts, and valves, shall be fully dimensioned both horizontally and vertically, so that the exterior buried utilities can be located in the field. A minimum of three (3) ties shall be provided for each item requiring a tie. Submit the tie cards on a weekly basis or as directed by the Engineer. If, in the opinion of the Owner and/or Engineer, insufficient data is provided to properly locate the exterior buried utilities, uncover the buried utilities and perform the necessary measurements and provide updated tie cards at no additional cost to the Owner.

D. GPS coordinates of all exterior buried utilities such as but not limited to manholes, piping, tubing, conduits, wye/tee connections, fittings, cleanouts, and valves shall be fully dimensioned both horizontally and vertically, so that the exterior buried utilities can be located in the field. Submit the electronic information on a weekly basis or as directed by the Engineer. If, in the opinion of the Owner and/or Engineer, insufficient data is provided to properly locate the exterior buried utilities, uncover the buried utilities and perform the necessary measurements and provide updated tie electronic information at no additional cost to the Owner

E. An electronic copy of the Engineer's Auto Cad files shall be made available to the Contractor for the purpose of completing the required computer drafted record drawings.

1.24 - PHOTOGRAPHS OF THE PROJECT

A. Once a month employ the services of a professional photographer to take 48 digital color photographs of the Work in progress. View and orientation of the photographs shall be as determined by the Engineer in the field.

B. Proofs of the digital color photographs shall be submitted to the Engineer for final selection of up to 24 photographs. If 24 photographs cannot be selected from the 48 proofs taken, as determined by the Engineer, then the Contractor shall take an additional 48 photographs for review at no additional cost to the Owner. Formally submit the 24 photographs selected by the Engineer as 8 inch by 10 inch color glossy prints on a monthly basis.

C. In the event that insufficient progress has been made in the previous month to justify the total number of photographs specified above, the Owner reserves the right to have additional views taken in any succeeding month so that the total number will be equal to 24 times the number of months in the Contract period.

D. Each digital photograph shall be identified by a neatly typed index given the Project's name Contractor's name, the date taken, the subject, and the orientation (looking north, looking south, etc.).

E. At the completion of the Contract, all digital images shall become the property of the Owner and shall be delivered to the Owner. Any view not properly identified or otherwise not acceptable will not be counted in the total number of photographs required.

1.25 - INITIAL OPERATION OF NEW FACILITIES

A. Operation and maintenance manuals shall be submitted to the Engineer in accordance with DOCUMENT 00700, GENERAL CONDITIONS at least one (1) month prior to the scheduling of any manufacturers training.

B. Perform pressure and/or leakage testing of all pipelines, storage tanks and basins prior to prestart-up testing of all equipment and/or systems. Provide the initial filling of all pipelines, storage tanks and basins with potable water as necessary for start-up of individual systems throughout the facility.

C. Initial start-up of new equipment and/or systems shall not commence until all of the manufacturers services, checkout, and training have been Existing as approved by the Engineer.

D. Perform an 8 hour or less, if approved by the Engineer, prestart-up test of all individual equipment prior to incorporating equipment into their appropriate systems.

E. Perform an 8 hour or less, if approved by the Engineer, prestart-up test of all systems prior to conducting the performance test of the facility.

F. Provide all labor, power, chemicals, operations and maintenance from the initial start-up of the individual equipment and systems until the final performance test of the facility is accepted by the Owner as substantially complete at no additional cost to the Owner.

1.26 - CONTINUOUS OPERATING CRITERIA

A. Conduct operations in such a manner and sequence that shall neither result in a disruption of the amenities, nor interfere with the functional organization and workings of existing facilities.

B. Furnish, install and operate any piping, equipment and appurtenances necessary to provide the temporary services, facilities, and bypasses required during construction including, but not limited to, bypass pumping, flow barriers and diversions.

C. The Owner will operate and maintain all existing systems and equipment. Notify and coordinate with the Owner all temporary modifications to existing facilities operations required for construction within, or interfacing with, the existing facilities. Operate and maintain all proposed facilities until such time as the Owner accepts them.

D. A carefully planned and detailed construction schedule must be submitted to the Engineer for approval before any construction starts, showing the proposed sequences of operation and the methods to be used for maintaining continued operations of existing facilities.

E. Refer to SECTION 01500, TEMPORARY FACILITIES for additional requirements.

1.27 - SCHEDULE OF VALUES

A. Submit a schedule of values for use in preparing the monthly progress payments described in the DOCUMENT 00700, GENERAL CONDITIONS.

B. The schedule of values shall be prepared in conformance with the following format:

1. General Conditions
    a. Subheadings
2. All Structures
    a. Subheadings by specification division and section
3. General Site Work
    a. Subheadings by specification division and section
4. Unit Prices by Individual Items
5. Filed Sub-bid Categories, if applicable
    a. Subheadings by specification division and section
6. Change orders by individual items shall be added as approved by the Owner.

C. In addition to the above, each equipment line item in the schedule of values shall include the following breakdown:

1. Shop Drawings (10 percent of equipment value)
2. Equipment
3. Installation
4. Manufacturers' Checkout and Startup (2 percent of equipment value)
5. Equipment testing (10 percent of equipment value)
6. Manufacturers' Training of Owner Personnel (1 percent of equipment value)
7. Spare Parts (1 percent of equipment value)
8. Operation and Maintenance Manuals (1 percent of equipment value)

D. The schedule of values shall be submitted to the Engineer for review and approval at least 30 calendar days prior to the first progress payment request. The acceptable schedule of values shall be used for the duration of the Project.

1.28 - OPERATION AND MAINTENANCE MANUALS

A. Except as otherwise specified, four (4) copies of the Manuals shall be provided for each item of equipment, or system provided. Existing manuals shall be submitted to the Engineer no later than 60 days following approval of shop drawings.

B. All elements and components of the equipment or system shall be included in the Manuals.

1. The Manuals shall be customized including but not limited to all options, types, sizes, and configurations, shall be indicated, either as one (1) enclosure within the manuals listing them or by eliminating all incorrect references at each occurrence within a standard type of manual.

2. The Manuals shall contain a bill of materials which shall be a parts list detailing the part manufacturer and his catalog number of each equipment part. The Manuals shall include all necessary instructions for the operation, maintenance, repair, assembly, and disassembly of the equipment or system in accordance with the manufacturer's recommendations including troubleshooting charts and lubrication and maintenance schedules.

3. All drawings, plates, lists, schematics, and the like shall be included in the Manuals.

4. Any malfunction of, or damage to the equipment or system resulting from incomplete or incorrect instructions in the Manuals for the guarantee period specified elsewhere in this specification shall be repaired and/or replaced at no additional cost to the Owner.

5. The Manuals shall include a complete parts list, current parts price list, and recommended spare parts list.

6. Any and all capabilities for specified future modification; alteration or reconfiguration shall be completely indicated and described within the Manual.

7. The manuals shall contain the name, address, business telephone numbers and service telephone numbers for the manufacturer and its local distributor/representative.

8. Each Manual for each item of equipment or system shall be bound separately in a permanent binder.

C. The form entitled "Operation and Maintenance Manual Review checklist" shall be utilized and submitted for each specification section to insure completeness of the manual. The form is attached to the end of this section.

D. The Engineer has the right to reject the Manuals submitted as being unsatisfactory or to require the submittal of additional information. The new Manuals or additional information shall be submitted no later than 30 days following notification by the Engineer.

1.29 - MANUFACTURER'S SERVICES

A. Installation and Start-up

1. Make arrangements with each equipment supplier or manufacturer to furnish the services of a factory-trained service engineer who is specifically trained on the type of equipment being furnished for the sole purpose and use of the Owner and Engineer to assist during installation and start-up of all equipment and systems furnished by that supplier or manufacturer.

2. Minimum length of time specified for this service shall be exclusive of travel time and of correction of defects, testing, and training.

3. The manufacturer's engineer will verify, in writing, that the equipment has been installed and serviced so as to be acceptable to the equipment manufacturer in order that it will provide safe and efficient operation as intended by the Engineer and the manufacturer. The Engineer will provide a form entitled "Certification of Proper Equipment Installation" which is to be signed by the manufacturer’s representative and the Contractor’s representative for each piece of equipment.

B. Correction of Defects

1. Nothing specified herein shall provide relief of the responsibility of providing sufficient service to place all equipment or systems into satisfactory operation.

2. All time and materials needed to correct defective equipment shall be provided at no cost to the Owner.

C. Testing

1. Prior to testing, each equipment supplier or manufacturer shall furnish a written certification that the equipment is ready for operation. A copy of this certification shall be furnished to the Engineer.

2. Furnish the labor, tools, equipment, power, and clean water necessary to perform field-testing to determine that the supplied equipment including controls and alarms meets hydraulic, electric, mechanical and performance requirements. All tests shall be performed in the presence of the Engineer.

D. Training

1. Wherever called for in the Specifications, have each equipment supplier or manufacturer furnish the services of a fully qualified field service engineer to provide operator training in the complete operation and maintenance of all equipment furnished by that supplier or manufacturer.

2. The minimum length of time specified for this service shall be exclusive of travel time and shall follow and be exclusive of installation and start-up, correction of defects and testing.

3. Schedule training sessions in conjunction with and as approved by the Engineer. This training will be witnessed and verified by a representative appointed by the Engineer. The Engineer has the right to reject the training by the equipment supplier or manufacturer and to require additional training. The items addressed by the training session shall include, but not be limited to, system description, system operation, system disassembly and reassembly, lubrication, routine maintenance, corrective maintenance, use of operation and maintenance manual, system troubleshooting and ordering of spare parts.

4. The Engineer will provide a form entitled "Verification of Manufacturer's Equipment Training" which is to be signed by all parties at the completion of each training session.

1.30 - SPARE PARTS

A. Spare parts for all equipment shall be supplied to the Owner as specified. Spare parts shall be individually protected and packaged in a suitable container for long-term storage with the contents therein properly identified on the outside of the container.

B. The Engineer will provide a form entitled "Spare Parts Inventory" which is to be fully Existing and submitted to the Engineer for each piece of equipment requiring spare parts.

1.31 - SPECIALTY TOOLS

A. Any specialty tools required for the adjustment, operation and/or maintenance of any equipment included in the Work shall be furnished with the respective equipment.

1.32 - STATUTORY REQUIREMENTS IN GENERAL

A. Owner and Contractor recognize that other rights, duties, and obligations with respect to public construction contracts are also provided by statute, notwithstanding the fact that they may not be specifically enumerated herein. Accordingly, any provisions required by statute to be included in this contract shall be deemed to be so included as though fully set forth herein. However, compliance with a statute does not diminish the Contractor’s responsibilities hereunder.

B. Contractor shall keep fully informed of all existing and future State and Federal Laws and municipal ordinances and regulations in any manner affecting those engaged or employed in the Work, or the materials used or employed in the Work, or in any way affecting the conduct of the Work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same and of all provisions required by law to be made a part of this Contract, all of which provisions are hereby incorporated by reference and made a part thereof.

C. If any discrepancy or inconsistency is discovered in the Contract Documents for this Work in relation to any such law, ordinance, regulation, order or decree, report the same to the Engineer in writing. Contractor shall, at all times, observe and comply with, and cause all agents and employees to observe and comply with all such existing and future laws, ordinances, regulations, orders and decrees; and shall protect and indemnify the Owner and Engineer and all of its and their officers, agents, and servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by itself or its employees or subcontractors.

D. All materials furnished and Work done shall comply with all State and Federal laws and regulations.

1.33 - RELATION OF SEWER MAINS TO WATER LINES

A. Horizontal Separation

1. Whenever possible, sewers should be laid at least 10 feet, horizontally, from any existing or proposed water mains.

2. Should local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet to a water main if:

a) It is laid in a separate trench;

b) It is laid in the same trench with the water mains located at one side on a bench of undisturbed earth; and

c) In either case the elevation of the crown of the sewer is at least 18 inches below the invert of the water main.

B. Vertical Separation

1. Whenever sewers must cross under water mains, the sewer shall be laid at such elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be buried to meet the above requirement, the water main shall be relocated to provide this separation or reconstruction with slip-on or mechanical-joint cast-iron pipe, or prestressed concrete cylinder pipe for a distance of 10 feet on each side of the sewer. One full length of water main shall be centered over the sewer so that both joints will be as far from the sewer as possible.

2. When a sewer crosses above a water main, the following measures will be taken:

a) Both pipes will be encased in concrete for a distance of 10 feet on either side of the crossing; or

b) The sewer will be encased in concrete and the water main will be constructed of mechanical joint ductile iron pipe for a distance of 10 feet on either side of the crossing.

C. Special Conditions

1. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, the water main shall be constructed of slip-on or mechanical-joint cast-iron pipe or prestressed concrete cylinder pipe and the sewer constructed of mechanical-joint cast-iron pipe and both services shall be pressure tested to assure water tightness.

1.34 - UTILITY COORDINATION

A. Contractor shall be responsible for contacting and coordinating with utility companies prior to commencing work in the area of utilities.

B. Special requirements may be necessary for work in the vicinity of some utilities and easements. Requirements may include but are not limited to the following; surface marking of crossings and easements, temporary fencing, temporary pipe support, additional padding or steel plates for heavy equipment, and coordination with utility field personnel.

1.35 - EPA CONSTRUCTION GENERAL PERMIT

A. Construction activities associate with the project are anticipated to disturb one or more acres and as such would be regulated under the National Pollutant Discharge Elimination System (NPDES) stormwater program.

B. Construction stormwater discharges are permitted under the Construction General Permit (CGP) and requires compliance with permit requirements, such as the development of a Stormwater Pollution Prevention Plan (SWPPP). Contractor shall be responsible for preparing and submitting an EPA Notice or Intent (NOI) through the EPA's electronic NOI system (eNOI). A copy of the SWPPP shall be provided to the Owner and Engineer. Contractor shall be responsible for creating the required SWPPP, updating this document as necessary to reflect changes, implementing the SWPPP and performing the required inspections.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION – Not Used

END OF TEXT

SEE THE FOLLOWING FORMS

1. Verification of Manufacturer's Equipment Training
2. Operation and Maintenance Manual Review Checklist
3. Spare Parts Inventory
4. Certification of Proper Equipment Installation

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VERIFICATION OF

MANUFACTURER'S EQUIPMENT TRAINING

CLIENT: Town of Orleans, MA		ENGINEER: AECOM Technical Services, Inc.	
PROJECT: Downtown Area Collection System and Pumping Stations, Contract No. 202-02		CONTRACTOR:	
Equipment:			
Specification Section:			
Date of Training:			
Instructor(s):			
Title:			
Representing:			
Facility Staff in Attendance			
AECOM Representative(s):			
Contractor's Representative(s):			
____ System Description		____ Corrective Maintenance	
____ System Operation		____ Use of Manufacturer's Manual	
____ System Disassembly and Reassembly		____ Ordering Spare Parts	
____ Lubrication		____ Other	
____ Routine Maintenance			
I have performed the training described above and concur with this verification.			
Witnessed by:		Manufacturer's Instructor Signature	
Title	Date	Title	Date

OPERATION AND MAINTENANCE MANUAL

REVIEW CHECKLIST

CLIENT: Town of Orleans, MA		ENGINEER: AECOM Technical Services, Inc.
PROJECT: Downtown Area Collection System and Pumping Stations, Contract No. 202-02		CONTRACTOR:
Equipment:		
Specification Section:		
Equipment Transmittal No.:		
O&M Manual Transmittal No.:		
	1.	Correct number of copies of Operation and Maintenance Manual Supplied
	2.	General
		a. Manual Customized
		b. Manual contains information on complete system (design, installation, operation and maintenance instructions)
		c. All material contained in manual is legible
		d. Permanent Binder and Labeled
		e. Index
	3.	Contact Information
		a. Name, address, and telephone number of manufacturer
		b. Name, address, and telephone number of nearest source of replacement parts and service
	4.	Equipment Information
		a. Equipment drawings, schematics, plates, and layouts
		b. Equipment Performance Curves
		c. Lubrication Schedule
		d. Maintenance Schedule
		e. Trouble Shooting Guide
		f. Parts List (part manufacturer, catalog number, etc.)
		g. Current Part Costs
		h. Recommended Spare Parts
		I. Special Tools Required
Remarks:		

SPARE PARTS INVENTORY

CLIENT: Town of Orleans, MA	ENGINEER: AECOM Technical Services, Inc.
PROJECT: Downtown Area Collection System and Pumping Stations, Contract No. 202-02	CONTRACTOR:
Equipment:	
Specification Section:	
AECOM Representative(s):	

Part Number	Part Description	Quantity	Owner	Initial Date	Initial Date

CERTIFICATION OF PROPER

EQUIPMENT INSTALLATION

CLIENT: Town of Orleans, MA	ENGINEER: AECOM Technical Services, Inc.
PROJECT: Downtown Area Collection System and Pumping Stations, Contract No. 202-02	CONTRACTOR:
Equipment:	
Specification Section:	
Date of Equipment Inspection:	
Manufacturer's Representative(s):	
Representing:	
Contractor's Representative(s)	
Equipment Installation	
____ Equipment Mounting / Supports	____ Lubrication
____ Safety (guards and/or signage)	____ Calibration
____ Electrical System	____ Spare Parts
____ Instrumentation and/or Control System	____ Other _____
Corrective Action Required:	
Corrective Action Existing:	
I hereby certify that the above noted equipment is ready for safe and efficient operation.	
Witnessed by: _____ Contractor's Representative Signature Date: _____	Certified by: _____ Manufacturer's Representative Signature Date: _____

SECTION 01046

CONTROL OF WORK

PART 1 - GENERAL 1
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1.06 - DESIGN CRITERIA – Not Used 2
1.07 - REFERENCED STANDARDS – Not Used 2
PART 2 - PRODUCTS AND SERVICES – Not Used 2
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3.01 - FACILITY AND HOURS OF CONSTRUCTION 2
3.02 - OCCUPYING PRIVATE LAND 2
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PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, equipment, tools, and materials necessary for the implementation of the Control of Work during the construction of the facilities.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 – SUBMITTALS – Not Used

1.06 - DESIGN CRITERIA – Not Used

1.07 - REFERENCED STANDARDS – Not Used

PART 2 - PRODUCTS AND SERVICES – Not Used

PART 3 - EXECUTION

3.01 - FACILITY AND HOURS OF CONSTRUCTION

A. Furnish facility and equipment which will be efficient, appropriate, and large enough to secure a satisfactory quality of work and a rate of progress which will insure the completion of the work within the Contract Time. If at any time such facility appears to the Engineer to be inefficient, inappropriate, or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, he may order the Contractor to increase the efficiency, change the character, or increase the facility equipment, and the Contractor shall conform to such order. Failure of the Engineer to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.

B. Normal construction activity shall take place in accordance with SECTION 01030, SPECIAL REQUIREMENTS. only between the hours of 7:00 a.m. to 5:00 p.m., excluding Saturdays, Sundays, and legal holidays. Work outside the above time periods will be permitted only on an emergency basis and only with the approval of the Owner.

3.02 - OCCUPYING PRIVATE LAND

A. The Contractor shall not (except after written consent from the proper parties) enter or occupy with men, tools, materials, or equipment any land outside the rights of way or property of the Owner.

B. A copy of the written consent shall be given to the Engineer.

3.03 - PIPE LOCATIONS

A. Exterior pipelines will be located substantially as indicated on the Drawings, but the right is reserved to the Owner, acting through the Engineer, to make such modifications in location as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings, etc., are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him from laying and jointing different or additional items where required.

B. Small interior piping is indicated diagrammatically on the Drawings, and the exact location is to be determined in the field. Piping shall be arranged in a neat, compact, and workmanlike manner, with a minimum of crossing and interlacing, so as not to interfere with equipment or access ways, and, in general, without diagonal runs.

3.04 - DIMENSION OF EXISTING STRUCTURES

A. Where the dimensions and locations of existing structures are of importance in the installation or connection of any part of the Work, the Contractor shall verify such dimensions and locations in the field before the fabrication of any material or equipment which is dependent on the correctness of such information.

3.05 - OPEN EXCAVATIONS

A. Excavation shall be made and mantained in accrodance wth all federal, state and locateal rules and regualtinos includign OSHA.

B. All open excavations shall be adequately safeguarded by providing temporary barricades, fencing, caution signs, lights, and other means to prevent accidents to persons and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access during construction shall be removed when no longer required. The length or size of excavation will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the Engineer. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Engineer may require special construction procedures such as limiting the length of the open trench, prohibiting stacking excavated material in the street, and requiring that the trench shall not remain open overnight.

C. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be well lighted at night.

3.06 - TEST PITS

A. Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor at the direction of the Engineer. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Engineer.

3.07 - INTERFERENCE WITH AND PROTECTION OF STREETS

A. The Contractor shall not close or obstruct any portion of a street, road, or private way without obtaining permits therefor from the proper authorities. If any street, road or private way shall be rendered unsafe by the Contractor's operations, he shall make such repairs or provide such temporary ways or guards as shall be acceptable to the proper authorities.

B. Streets, roads, private ways, and walks not closed shall be maintained passable and safe by the Contractor, who shall assume and have full responsibility for the adequacy and safety of provisions made therefor.

C. The Contractor shall, at least 24 hours in advance, notify the Police and Fire Departments in writing, with a copy to the Engineer, if the closure of a street or road is necessary. The Contracotr shall cooperate with the Police Department in the establishment of alternate routes and shall provide adequate detour signs, plainly marked and well lighted, in order to minimize confusion.

3.08 - CARE AND PROTECTION OF PROPERTY

A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or he shall make good the damage in other manner acceptable to the Engineer.

3.09 - PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

A. The Contractor shall assume full responsibility for the protection of all buildings, structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, drains, and electric and telephone cables, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind. Any damage resulting from the Contractor's operations shall be repaired by him at his expense.

B. Assistance will be given the Contractor in determining the location of existing services. The Contractor, however, shall bear full responsibility for obtaining all locations of underground structures and utilities (including existing water services, drain lines, and sewers). Services to buildings shall be maintained, and all costs or charges resulting from damage thereto shall be paid by the Contractor.

C. Protection and temporary removal and replacement of existing utilities and structures as described in this Section shall be a part of the work under the Contract and all costs in connection therewith shall be included in the Total Price Bid in the Bid Form.

D. If, in the opinion of the Engineer, permanent relocation of a Owner’s utility is required, he may direct the Contractor, in writing, to perform the work. Work so ordered will be paid at the Contract unit prices, if applicable, or as extra work. If relocation of a privately owned utility is required, the Owner will notify the Utility to perform the work as expeditiously as possible. The Contractor shall fully cooperate with the Owner and Utility, and shall have no claim for delay due to such relocation. The Contractor shall notify all utility companies in writing at least 72 hours (excluding Saturdays, Sundays, and Legal holidays) before excavating in any public way. The Contractor shall coordinate the removal and replacement of traffic loops and signals, if required for the performance of the work, at no additional cost to the Owner.

3.10 - INSPECTION OF WORK AWAY FROM THE SITE

A. If work to be done away from the construction site is to be inspected on behalf of the Owner during its fabrication, manufacture, or testing, or before shipment, the Contractor shall give notice to the Engineer of the place and time where such fabrication, manufacture, testing, or shipping is to be done. Such notice shall be in writing and delivered to the Engineer in ample time so that the necessary arrangements for the inspection can be made.

3.11- COOPERATION WITHIN THIS CONTRACT

A. All firms or persons authorized to perform any work under this Contract shall cooperate with General Contractor and his Subcontractors or trades, and shall assist in incorporating the work of other trades where necessary or required.

B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the Engineer.

3.12 - CLEANUP AND DISPOSAL OF EXCESS MATERIAL

A. During the course of the work, the Contractor shall keep the site of his operations in as clean and as neat a condition as is possible. He shall dispose of all residue resulting from the construction work and, at the conclusion of the work, he shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures, and any other refuse remaining from the construction operations, and shall leave the entire site of the work in a neat and orderly condition.

B. In order to prevent environmental pollution arising from the construction activities related to the performance of this Contract, the Contractor and his subcontractors shall comply with all applicable Federal, State, and local laws, and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and elsewhere in the Specifications.

C. The Contractor is advised that the disposal of excess excavated material in wetlands, stream corridors, and plains is strictly prohibited even if the permission of the property owner is obtained. Any violation of this restriction by the Contractor or any person employed by him, will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. Therefore, the Contractor will be required to remove the fill at his own expense and restore the area impacted.

3.13 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 01050

FIELD ENGINEERING

PART 1 – GENERAL 1
1.01 - SCOPE 1
1.02 – MEASUREMENT AND PAYMENT 1
1.03 - DEFINITIONS 1
1.04 - SUBMTTALS 2
1.05 – PROJECT/SITE CONDITIONS 2
PART 2 – PRODUCTS – Not Used 3
PART 3 – EXECUTION 3
3.01 - EXAMINATION 3
3.02 - APPLICATION 3
3.03 – CONTRACT CLOSEOUT 3

PART 1 – GENERAL

1.01 - SCOPE

A. This work of this Section includes all labor, materials, tools, and equipment required for the providing Field Engineering as specified herein and/or as shown on the Contract Drawings including the following:

1. Examination of site and conditions of construction;
2. Establishment of lines, grades, and easements;
3. Connections to existing facilities; and
4. Restoration and protection of public and private property.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 – MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMTTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. As-Built Drawings: The Contractor shall be responsible for maintaining two sets of redline "as-built locations and dimensions of work". The As-Built Drawings shall be submitted to the Owner at substantial completion of the project.

2. The Contractor shall submit copies of field records and record drawings each month with project invoices. Field data shall be updated each month as applicable.

1.05 – PROJECT/SITE CONDITIONS

A. Environmental Requirements

1. Unfavorable Construction Conditions

a. During unfavorable weather, wet ground, or other unsuitable construction conditions, confine operations to work which will not be affected adversely by such conditions.

b. No portion of Work shall be constructed under conditions which adversely affect quality or efficiency thereof, unless special means or precautions are taken to perform Work in manner acceptable to the Engineer.

B. Field Measurements

1. Lines and Grades

a. All Work shall be done to lines, grades, and elevations indicated on drawings or specified herein.

b. Basic vertical control points have been established or designated by the Engineer. Contractor shall be responsible for maintaining or subsequently replacing these controls to the satisfaction of the Engineer if these controls are disturbed. The Contractor shall be responsible for verifying all vertical control information that is used.

(1) Points shall be used as datum for work.

(2) Contractor shall be responsible for transferring all lines and grades from basic survey control points.

c. Contractor to perform all additional survey, layout, and measurement work.

(1) The Contractor shall provide survey work by a firm having successfully completed at least two projects of similar size and complexity within the last five years, and who shall employ experienced personnel and provide adequate supervision to satisfaction of the Engineer at all times when operations are in progress.

(2) Surveyor shall be a registered land surveyor in the location of the project.

d. Keep the Engineer informed, in writing, two weeks in advance, of times and places at which work is to be performed, so that horizontal and vertical control points may be established, and any checking deemed necessary by the Engineer may be performed.

e. Remove and reconstruct Work which is improperly located as determined by the Engineer and at no additional cost to the Owner.

2. Easements and Rights-of-Way

a. Easements and rights-of-way for utilities, if required, will be provided by the Owner.

b. Confine construction operations within limits indicated on drawings and/or within limits of easements or public ways.

c. Place construction tools, equipment, excavated materials, and pipeline materials and supplies, so as to cause least possible damage to property and interference with traffic.

PART 2 – PRODUCTS – Not Used

PART 3 – EXECUTION

3.01 - EXAMINATION

A. Examination of Site and Verification of Conditions

1. Before starting operations, examine site to become acquainted with conditions to be encountered.

2. Verify exact locations of sewers, water mains, gas mains, above or below ground electrical wires, other utilities, conduits and structures which may interfere with work.

3.02 - APPLICATION

A. Connections to Existing Facilities

1. Make connections to existing facilities as indicated on drawings or as specified.

2. Plan in advance all connections to existing facilities which are in service.

a. All equipment, materials, and labor shall be on hand at time of undertaking connections to existing facilities in service.

b. Work shall proceed continuously if necessary, to complete connections within the time designated by the Engineer.

3. Operation of valves or other appurtenances on existing utilities, when required, shall be performed by respective utility personnel unless otherwise noted. a. A tight shutdown of existing Owner's or Community valves is not guaranteed; Contractor shall control leakage past valves to satisfaction of the Owner and Engineer and at no additional cost to the Owner.

B. Restoration and Protection of Public and Private Property

1. Protect, shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by construction operations.

2. Restore all public and private property including pavement, surfacing, curbs, walks, utility poles, guy wires, fences, and other surface structures affected by construction operations, together with all sod and landscaping to their original condition or better, whether within or outside easements.

3.03 – CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT

END OF SECTION

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SECTION 01065

STRUCTURAL TESTS AND INSPECTIONS

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 2
1.03 - DEFINITIONS 2
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING – Not Used 2
1.06 - DESIGN CRITERIA – Not Used 2
1.07 - CONTRACTOR'S RESPONSIBILITIES 2
1.08 - CONTRACTOR FURNISHED TESTING LABORATORY SERVICES 3
1.09 - OWNER FURNISHED TESTING AND INSPECTION SERVICES 3
PART 2 – PRODUCTS – Not Used 3
PART 3 – EXECUTION – Not Used 3

PART 1 - GENERAL

1.01 - SCOPE

A. The Structural Engineer of Record (SER) is required to prepare a program describing the structural tests and inspections that will be performed for this project. The SER is the structural engineer (an individual) who is in responsible charge of the preparation of the structural drawings and structural specifications for this project and whose professional engineering seal appears on said structural drawings. The parties responsible for the performance of the structural tests and inspections are noted on the Program of Structural Tests and Inspections prepared by the SER.

B. The SER has prepared a Program of Structural Tests and Inspections (the "Program"), which has been or will be submitted to the building official who has jurisdiction over this project. A copy of this program is included in this specification as Attachment No 1 for reference.

C. The Program shall not relieve the Contractor or its subcontractors of their responsibilities and obligations for quality control of the Work, their other obligations for supervising the work, for any design work, which is included in their scope of services, and for full compliance with the requirements of the Contract Documents. The detection of, or failure to detect, deficiencies or defects in the Work during the testing and inspection conducted pursuant to the Program shall not relieve the Contractor or its subcontractors of their responsibility to correct all deficiencies or defects, whether detected or undetected, in all parts of the Work, and to otherwise comply with all requirements of the Contract Documents. Further, while the SER, and the Resident Engineer shall perform certain tasks in the Program requiring the review of certain construction activities, the SER and Resident Engineer shall only perform such tasks to ensure compliance with the SER approved submittals and the specifications. Neither the SER nor the Resident Engineer shall assume any responsibility or liability for the means, methods, procedures or techniques used by any construction contractor.

D. The program of structural tests and inspection does not apply to the Contractor's equipment, temporary structures used by the Contractor to construct the project, the Contractor's means, methods, and procedures, and job site safety.

E. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Testing Laboratory Qualifications
2. Testing and Inspection Schedule
3. Test Reports.

1.05 - PRODUCT HANDLING – Not Used

1.06 - DESIGN CRITERIA – Not Used

1.07 - CONTRACTOR’S RESPONSIBILITIES

A. Where the Program of Structural Tests and Inspections indicates that a structural component or system is subject to structural tests and inspections and that the SER for the project has not been retained to design said component or system or to prepare a performance specification for said component of system, the Contractor shall retain, or require others under his aegis to retain, a professional engineer registered in the jurisdiction where the project is located to design said component or system and to provide the required program of structural tests and inspections for said component or system.

B. The Contractor shall provide free and safe access to the Work for the SER and all other individuals who are observing the Work or performing structural tests or inspections. The Contractor shall provide all ladders, scaffolding, staging, and up-to-date safety equipment, all in good and safe working order, and qualified personnel to handle and erect them, as may be required for safe access.

1.08 - CONTRACTOR FURNISHED TESTING LABORATORY SERVICES

A. An independent commercial testing laboratory acceptable to the Engineer shall perform all tests that require the services of a laboratory to determine compliance with the Contract Documents. The laboratory shall be staffed with experienced technicians, properly equipped, and fully qualified to perform the tests in accordance with the specified standards.

B. Preliminary Testing Services: The Contractor shall be responsible for all testing laboratory services in connection with concrete materials and mix designs, the design of asphalt mixtures, gradation tests for structural and embankment fills, backfill materials, and all other tests and engineering data required for the Engineer's review of materials and equipment proposed to be used in the Work. The Contractor shall obtain the Engineer's acceptance of the testing laboratory before having services performed, and shall pay all costs for services.

C. The Contractor shall not retain any testing laboratory against which the Owner or the Engineer have reasonable objection, and if at any time during the construction process the services become unacceptable to the Owner, or the Engineer, either the Owner or the Engineer may direct in writing that such services be terminated. The request must be supported with evidence of improper testing or unreasonable delay. If the Engineer determines that sufficient cause exists, the Contractor shall terminate the services and engage a different testing laboratory.

D. Transmittal of Test Reports: Written reports of testing and engineering data furnished by the Contractor for the Engineer's review of materials and equipment proposed to be used in the Work shall be submitted as specified for Shop Drawings.

E. The Contractor’s testing laboratory shall furnish four copies of a written report of each test performed by laboratory personnel within three days after each test is completed. Distribution shall be two copies of each test report to the Engineer's Representative, one copy to the Owner, and one copy for the Contractor.

1.09 - OWNER FURNISHED TESTING AND INSPECTION SERVICES

A. The Owner will employ the services of an independent testing agency to conduct the Program of Structural Tests and Inspections as described herein and perform all quality control tests of materials of construction in the field or in the laboratory during and after their incorporation in the Work. Field sampling and testing shall be performed in the general manner indicated in the specifications, with minimum interference with construction operations.

B. The Contractor shall furnish a construction schedule and a minimum of 48 hour notice of readiness for testing and inspection of the work. The Engineer shall determine the exact time and location of field sampling and testing, and may require such additional sampling and testing as necessary to determine that materials and equipment conform with data previously furnished by Contractor and to the Contract Documents.

C. The Contractor shall schedule the work to permit adequate time for testing and re-testing should test results not conform to the contract documents. Lack of testing or inspection which is attributable to insufficient notice by the Contractor or failure of the Contractor to cooperate, will be cause for rejection of the work.

D. The Contractor shall deliver materials in sufficient quantities to the Owner’s testing agency as may be required. Laboratory testing shall be performed within a reasonable time, consistent with the specified standards.

E. The Contractor shall furnish material samples and cooperate in the field sampling and testing activities, interrupting the work when necessary. The Contractor shall furnish personnel, facilities and access to assist in the sampling and testing activities.

PART 2 – PRODUCTS – Not Used

PART 3 – EXECUTION – Not Used

END OF TEXT

SEE ATTACHMENT 1

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ATTACHMENT NO. 1

PROGRAM OF STRUCTURAL TESTS AND INSPECTIONS

Project: Downton Area Collection System and Pumping Stations

Location: Orleans, Massachusetts

Owner: Town of Orleans, Massachusetts

Owner's Address: 40 Giddiah Hill Road, Orleans, MA 02653

Engineer of Record: AECOM Technical Services, Inc.

Structural Engineer of Record (SER): Michael E. Malenfant, PE

This program of structural tests and inspections is submitted as a condition for issuance of the building permit in accordance with the International Building Code.

The following firms, agencies, or individuals (hereinafter referred to collectively as agents) will perform the tests and inspections under the direction of the SER:

Abbreviation	Agent
SER	Structural Engineer Of Record Listed Above
RES	The Resident Representative
ITA(C)	Independent Testing Agency Employed By Contractor
ITA	Independent Testing Agency Employed By Owner
RPE(C)	Registered Professional Engineer Employed By Contractor
GEO	The Project Geotechnical Engineer
IWI	Independent Welding Inspector

The above abbreviations will be used on the attached pages to identify which agent is performing the particular tests or inspections.

The following categories of structural tests and inspections, if checked, are included in the program for structural tests and inspections for this project. The specific tests and inspections required for each checked category are listed on the page noted opposite the category and further described in the various technical specification sections.

	Category	Page		Category	Page
☐	**Steel Construction**	**7**	☒	Controlled Structural Fill	**10**
☐	**Cast-in-Place Concrete**	**7**	☐	Pile Foundations	**11**
☒	**Precast Concrete Construction**	**8**	☐	Pier Foundations	**11**
☐	**Masonry Construction**	**9**	☐	Aluminum Construction	**12**
☐	**In-situ Bearing Strata**	**10**	☒	Special Cases	**12**

The following items of construction, if checked, are specified in the structural plans or specifications on a performance basis. The structural design of these items will be performed by the RPEC and reviewed by the SER. The construction of these items is included in the program for tests and inspections on the attached sheets.

	Category		Category
☐	Curtain Walls	☐	Metal Buildings
☒	Precast Concrete Components	☐	Metal Stairs
☐	Post-Tensioning Steel	☐	Metal Railings
☐	Structural Steel Connections	☐	Metal and Composite Gratings
☐	Structural Aluminum Connections	☐	Metal Plate Covers

The following items are excluded from this program of structural tests and inspections, since other structural engineers not under the aegis of the SER designed them and the SER has no duties or responsibilities with respect to such performance specifications or designs. The Owner shall assign other architects, or construction contractors, as applicable; to be special SER's for their respective designs and such architects and/or contractors shall be responsible for all such structural tests and inspections for their respective designs.

- Seismic design of mechanical or electrical components, systems and their anchorage to the structure.
- Excavation support systems.
- Temporary bracing, temporary platforms, scaffolding, temporary guards and railings.
- Anything related to jobsite safety or construction means and methods.

Structural Engineer of Record:

Name: Michael E. Malenfant, PE

Signature:_____

Firm: AECOM Technical Services, Inc.

Date: _____ Registration Seal

STEEL CONSTRUCTION

Item	Agent	Scope	Frequency
1. Fabricator Certification/ Quality Control Procedures.	SER	Review to ensure that quality control procedures have been adopted for each Fabricator.	Start of project
2. Fabricator Inspection	SER	Review to ensure that an Independent Inspection Agency has approved each Fabricator.	Start of project
3. Material Certification	SER	Review for conformance to the specifications.	Each product
4. Bolting	ITA	Test and inspect bolted connections in accordance with specifications. Verify bolt size and grade in accordance with AISC specifications A325/A490.	Periodic
5. Welding	IWI	Check welder qualifications. Verify filler material in accordance with AWS D1.1. Visually inspect fillet welds. Test complete and partial penetration groove welds full length by dye penetrant, ultrasonic, or radiographic testing in accordance with the contract documents.	Periodic
6. Shear Connectors	IWI	Inspect for size and placement. Test for proper weld attachment.	Periodic
7. Structural Framing, Details and Assemblies	RES	Review for conformance with specifications and shop drawings.	Continuous
8. Open Web Steel Joists	RES	Inspect for size, placement, bridging, bearing and connection to structure.	Continuous
9. Open Web Steel Joists	IWI	Visually inspect all welds of a minimum of 5 percent of the joists, randomly selected.	Periodic
10. Steel Decking	RES IWI	Verify gage, width, and type. Inspect placement, laps, welds, side lap attachment and screws or other mechanical fasteners (IWI). Check welder qualifications (RES).	Periodic

CAST-IN-PLACE CONCRETE CONSTRUCTION

Item	Agent	Scope	Frequency
1. Mix Design	ITA(C) SER	Design Concrete Mixes Review mix designs.	Each mix Each mix
2. Materials Certification	SER	Review for conformance to specifications.	Each product

Item	Agent	Scope	Frequency
3. Batching Plant	ITA SER	Review to ensure that Plant quality control procedures have been adopted.	Start of project
4. Reinforcement Installation	RES	Inspect reinforcing for size, quantity, condition and placement.	Prior to each placement
5. Formwork Geometry	RES	Inspect form sizes for compliance with specifications.	Prior to each placement
6. Concrete Placement	RES	Review for conformance with specifications.	Each placement
	ITA	Perform slump, density and air content tests at point of discharge.	Each truck
7. Curing and Protection	ITA RES	Observe procedures for conformance to the specifications.	Each placement
8. Evaluation of Concrete Strength	ITA	Test and evaluate in accordance with the specifications.	Every 50 cubic yards or part thereof
Note: The Contractor may elect to have the Contractor's independent testing agency (ITA(C)) perform additional tests in addition to the testing by the Owner's Independent Testing Agency (ITA) at no cost to the Owner.			

PRECAST CONCRETE CONSTRUCTION

Item	Agent	Scope	Frequency
1. Plant Certification/Quality Control Procedures	SER ITA	Review to ensure that Plant quality control procedures have been adopted (SER). Inspect plant storage and handling procedures (ITA). Confirm that approved submittals are being used for fabrication; review welder's certifications (SER). Monitor finished product for structural defects (cracks) (ITA).	Start of project
2. Material Certification	SER	Review for conformance to ACI 318.	Each product
3. Formwork Geometry	ITA	Inspect form sizes.	Selected placements
4. Reinforcement Installation	ITA	Inspect reinforcing and prestressing strands for size, quantity, condition and placement for conformance with Contract Documents, SER approved submittals, and ACI 318. Inspect welding.	Selected placements
5. Mix Design	ITA(C)	Design Concrete Mixes	Each mix
	SER	Review for conformance with specifications (SER).	Each mix

Item	Agent	Scope	Frequency
6. Concrete Placement	RES/ ITA	Inspect concrete placement procedures for conformance to ACI 318, Sections 5.9 and 5.10 (ITA), and for conformance with specifications (RES).	Selected placements
7. Curing and Protection	RES/ ITA	Inspect for maintenance of specified curing temperatures and techniques per ACI 318 (ITA), and for conformance with specifications (RES).	Each placement
8. Evaluation of Concrete Strength	ITA	Test for conformance to specifications in accordance with ACI 318.	Every 50 cubic yards or part thereof
9. Prestress Operation	ITA	Inspect application of prestressing forces per ACI 318. Inspect grouting of bonded, post-tensioned, prestressing tendons.	Selected placements
10. Assembled/Erected Precast Elements.	RES	Inspect for compliance with SER approved submittals and specifications. Review site storage and handling procedures for consistency with design of precast elements. Verify that SER approved erection drawings are on site and are being used for erection. Verify that SER approved erection procedures are being followed. Review welder's certifications.	Each unit
11. Connections/ Embedded Items	ITA	Inspect interface connections including end and edge doweling. Inspect embedment for proper location. Inspect shimming, bearing, bolting and welding of connections.	Each unit

MASONRY CONSTRUCTION

Item	Agent	Scope	Frequency
1. Material Certification	SER	Review for conformance to specifications.	Each product
2. Evaluation of Masonry Strength	ITA	Verify strength in accordance with the specifications.	Periodic
3. Proportioning, Mixing and Consistency of Mortar and Grout	ITA	Inspect field-mixing procedures for conformance to the specifications.	Continuous
4. Installation of Masonry	RES	Inspect placement for conformance to the specifications.	Continuous

Item	Agent	Scope	Frequency
5. Reinforcement Installation	RES IWI	Inspect reinforcing steel for conformance to SER approved submittals and specifications (RES) Inspect welding of reinforcement and review welder's certifications (IWI).	Periodic
6. Grouting Operations	RES	Review grouting procedures for conformance with the specifications.	Periodic
7. Weather Protection	RES	Review procedures for protection for cold and hot weather for conformance with the specifications.	Periodic
8. Anchorage	RES	Inspect anchorage of masonry to other construction for conformance with specifications.	Periodic

IN-SITU BEARING STRATA FOR FOUNDATIONS

Item	Agent	Scope	Frequency
1. Bearing strata for foundations	GEO RES	Review strata for conformance to the structural drawings, specifications, and/or geotechnical report.	Prior to foundation placement
2. Bearing surfaces of foundations	GEO RES	Review for conformance to the requirements of the structural drawings, specifications, and/or geotechnical report.	Prior to foundation placement

CONTROLLED STRUCTURAL FILL (PREPARED FILL)

Item	Agent	Scope	Frequency
1. Fill Material	ITA	Test material for conformance to specifications or geotechnical report. Perform laboratory compaction tests in accordance with the specifications to determine optimum water content and maximum dry density.	Each Material
2. Installation of Controlled Structural Fill	RES ITA	Provide review of the installation, in accordance with the specifications. Verify maximum lift placement thickness (ITA).	Each lift
3. Density of Fill	ITA	Perform field density tests of the in-place fill in accordance with the specifications.	Each lift
NOTE: Above testing is confirmatory testing by the Owner's independent testing agency (ITA). These tests are <u>in addition</u> to the testing required by the Contractor's independent testing agency (ITA(C)).			

PILE FOUNDATIONS

Item	Agent	Scope	Frequency
1. Pile Material	SER RES	Review for conformance with the specifications, and that the identification is maintained from the point of manufacture to the point of delivery to the site.	Each pile shipment
2. Pile Material Tests	ITA	If Item 1 is unsatisfactory, test material for conformance to the Contract Documents.	As required
3. Precast Concrete Piles.	---	Perform structural tests and inspections as listed under Precast Concrete Construction.	See precast concrete requirements
4. Steel Piles	---	Perform structural test and inspections as listed under Steel Construction.	See steel construction requirements
5. Pile Installation	RES GEO	Provide review for conformance with specifications. Maintain accurate records for each pile. Record final location of each pile in plan.	Continuous
6. Cast-in-Place Concrete Piles	---	Perform structural tests and inspections as listed under Cast-in-Place Concrete Construction.	See cast-in-place concrete construction
Note: Additional confirmatory observations and/or testing by the Owner's independent testing agency (ITA) in addition to the observations and testing required by the Contractor's independent testing agency (ITA(C)) and the Contractor's registered professional engineer (RPE(C)) may be performed at the Owner's discretion.			

PIER FOUNDATIONS

Item	Agent	Scope	Frequency
1. Load-bearing Steel Components	SER	Review documents identifying material and certifying grade of material for conformance to the specifications	Each component
2. Concrete and Reinforcing Steel Components	---	Perform structural tests and inspections as listed under Cast-in-Place Concrete Construction.	See concrete requirements
3. Pier installation	RES	Provide review of installation for conformance with specifications. Maintain accurate records for each pier, documenting observations.	Continuous

ALUMINUM CONSTRUCTION

Item	Agent	Scope	Frequency
1. Fabricator Certification/ Quality Control Procedures.	SER	Review to ensure that quality control procedures have been adopted for each Fabricator.	Start of project
2. Fabricator Inspection	SER	Review to ensure that an Independent Inspection Agency has approved each Fabricator.	Start of project
3. Material Certification	SER	Review for conformance to the specifications.	Each product
4. Bolting	ITA	Test and inspect bolted connections in accordance with specifications. Verify bolt size and grade in accordance with AISC specifications A325/A490.	Periodic
5. Welding	IWI	Check welder qualifications. Verify filler material in accordance with AWS D1.1. Visually inspect fillet welds. Test complete and partial penetration groove welds full length by dye penetrant, ultrasonic, or radiographic testing in accordance with the contract documents.	Periodic
6. Structural Framing, Details and Assemblies	RES	Review for conformance with specifications and shop drawings.	Periodic

SPECIAL CASES

Item	Agent	Scope	Frequency
1. Tank Leakage Testing	RES	Witness testing in accordance with contract documents.	Each tank
2. Concrete Anchor Installation	RES	Verify diameters, depth and cleaning of holes conforms to manufacturer's instructions.	Each anchor

END OF SECTION

SECTION 01090

REFERENCE STANDARDS

PART 1 - GENERAL 1
1.01 - QUALITY ASSURANCE 1
1.02 - SCHEDULE OF REFERENCES 1
PART 2 - PRODUCTS - Not Used 4
PART 3 - EXECUTION - Not Used 4

PART 1 - GENERAL

1.01 - QUALITY ASSURANCE

A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date for receiving bids unless otherwise specified in Product Sections.

C. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

D. Should specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

1.02 - SCHEDULE OF REFERENCES

Abbreviation	Name and Address	Abbreviation	Name and Address
AA	Aluminum Association 818 Connecticut Avenue, N.W. Washington, DC 20006	AABC	Associated Air Balance Council 1000 Vermont Avenue, N.W. Washington, DC 20005
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, N.W. Washington, DC 20001	ACI	American Concrete Institute Box 19150 Reford Station Detroit, MI 48219
ADC	Air Diffusion Council 230 North Michigan Avenue Chicago, IL 60601	AI	Asphalt Institute Asphalt Institute Building College Park, MD 20740
AISC	American Institute of Steel Construction 400 North Michigan Avenue Eighth Floor Chicago, IL 60611	AISI	American Iron and Steel Institute 1000 16th Street, N.W. Washington, DC 20036
AITC	American Institute of Timber Construction 333 W. Hampden Avenue Englewood, CO 80110	AMCA	Air Movement and Control Association 30 West University Drive Arlington Heights, IL 60004
ANSI	American National Standards	APA	American Plywood Association

Abbreviation	Name and Address	Abbreviation	Name and Address
	Institute 1430 Broadway New York, NY 10018		Box 11700 Tacoma, WA 98411
ARI	Air-Conditioning and Refrigeration Institute 1501 Wilson Boulevard Arlington, VA 22209	ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers 1791 Tullie Circle, N.E. Atlanta, GA 30329
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017	ASPA	American Sod Producers Association 4415 West Harrison Street Hillside, IL 60162
ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103	AWI	Architectural Woodwork Institute 2310 South Walter Reed Drive Arlington, VA 22206
AWPA	American Wood-Preservers' Association 7735 Old Georgetown Road Bethesda, MD 20014	AWS	American Welding Society 550 LeJeune Road, N.W. Miami, FL 33135
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235	BIA	Brick Institute of America 11490 Commerce Park Drive Reston, VA 22091
CDA	Copper Development Association 57th Floor, Chrysler Building 405 Lexington Avenue New York, NY 10174	CLFMI	Chain Link Fence Manufacturers Institute 1101 Connecticut Avenue, N.W. Washington, DC 20036
CRSI	Concrete Reinforcing Steel Institute 933 Plum Grove Road Schaumburg, IL 60195	DHI	Door and Hardware Institute 7711 Old Springhouse Road McLean, VA 22102
EJCDC	Engineers' Joint Contract Documents Committee American Consulting Engineers Council 1015 15th Street, N.W. Washington, DC 20005	EJMA	Expansion Joint Manufacturers Association 25 North Broadway Tarrytown, NY 10591
FGMA	Flat Glass Marketing Association 3310 Harrison White Lakes Professional Building Topeka, KS 66611	FM	Factory Mutual System 1151 Boston-Providence Turnpike P.O. Box 688 Norwood, MA 02062
FS	Federal Specification	GA	Gypsum Association

Abbreviation	Name and Address	Abbreviation	Name and Address
	General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Bldg. 197 Washington, DC 20407		1603 Orrington Avenue Evanston, IL 60201
ICBO	International Conference of Building Officials 5360 S. Workman Mill Road Whittier, CA 90601	IEEE	Institute of Electrical and Electronics Engineers 345 East 47th Street New York, NY 10017
IMIAC	International Masonry Industry All-Weather Council International Masonry Institute 815 15th Street, N.W. Washington, DC 20005	MBMA	Metal Building Manufacturer's Association 1230 Keith Building Cleveland, OH 44115
MFMA	Maple Flooring Manufacturers Association 60 Rivere Drive Northbrook, IL 60062	MIL	Military Specification Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
ML/SFA	Metal Lath/Steel Framing Association 221 North LaSalle Street Chicago, IL 60601	NAAMM	National Association of Architectural Metal Manufacturers 221 North LaSalle Street Chicago, IL 60601
NCMA	National Concrete Masonry Association P.O. Box 781 Herndon, VA 22070	NEBB	National Environmental Balancing Bureau 8224 Old Courthouse Road Vienna, VA 22180
NEMA	National Electrical Manufacturers' Association 2101 'L' Street, N.W. Washington, DC 20037	NFPA	National Fire Protection Association Battery March Park Quincy, MA 02269
NFPA	National Forest Products Association 1619 Massachusetts Avenue, N.W. Washington, DC 20036	NSWMA	National Solid Wastes Management Association 1730 Rhode Island Ave., N.W. Washington, DC 20036
NTMA	National Terrazzo and Mosaic Association 3166 Des Plaines Avenue Des Plaines, IL 60018	NWMA	National Woodwork Manufacturers Association 205 W. Touhy Avenue Park Ridge, IL 60068
OSHA	Occupational Safety and Health Administration	PCA	Portland Cement Association 5420 Old Orchard Road

Abbreviation	Name and Address	Abbreviation	Name and Address
			Skokie, IL 60077
PCI	Prestressed Concrete Institute 201 North Wells Street Chicago, IL 60606	PS	Product Standard U. S. Department of Commerce Washington, DC 20203
SDI	Steel Door Institute 712 Lakewood Center North 14600 Detroit Avenue Cleveland, OH 44107	SDI	Steel Deck Institute P.O. Box 9506 Canton, OH 44711
SIGMA	Sealed Insulating Glass Manufacturers Association 111 East Wacker Drive Chicago, IL 60601	SJI	Steel Joist Institute 1205 48th Avenue North Suite A Myrtle Beach, SC 29577
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association 8224 Old Court House Road Vienna, VA 22180	SSPC	Steel Structures Painting Council 4400 Fifth Avenue Pittsburgh, PA 15213
TCA	Tile Council of America, Inc. Box 326 Princeton, NJ 08540	UL	Underwriters' Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062
WWPA	Western Wood Products Association 1500 Yeon Building Portland, OR 97204		

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

SECTION 01110

ENVIRONMENTAL PROTECTION PROCEDURES

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PART 1 - GENERAL

1.01 - SCOPE

A. Provide and compact bank-run gravel as indicated and specified.

B. The work covered by this Section consists of furnishing all labor materials and equipment and performing all work required for the prevention of environmental pollution in conformance with applicable laws and regulations, during and as the result of construction operations under this Contract. For the purpose of this Specification, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic and/or recreational purposes.

C. The control of environmental pollution requires consideration of air, water, and land, and involves management of noise and solid waste, as well as other pollutants.

D. Schedule and conduct all work in a manner that will minimize the erosion of soils in the area of the work. Provide erosion control measures such as diversion channels, sedimentation or filtration systems, berms, staked hay bales, seeding, mulching, or other special surface treatments as are required to prevent silting and muddying of streams, rivers, impoundments, lakes, etc. All erosion control measures shall be in place in an area prior to any construction activity in that area. Specific requirements for erosion and sedimentation controls are specified in SECTION 01568, EROSION CONTROL, SEDIMENTATION AND CONTAINMENT OF CONSTRUCTION MATERIALS.

E. These Specifications are intended to ensure that construction is achieved with a minimum of disturbance to the existing ecological balance between a water resource and its surroundings. These are general guidelines. It is the Contractor's responsibility to determine the specific construction techniques to meet these guidelines.

F. All phases of sedimentation and erosion control shall comply with and be subject to the approval of the Massachusetts Department of Environmental Protection and local Conservation Commission.

G. Schedule and conduct all work in a manner that will minimize the level of noise escaping the site, especially at night and on weekends.

H. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 – SUBMITTALS – Not Used

1.05 - PRODUCT HANDLING – Not Used

1.06 - DESIGN CRITERIA

A. Comply with all applicable Federal, State, and local laws and regulations concerning environmental pollution control and abatement.

B. The Engineer will notify the Contractor in writing of any non-compliance with the foregoing provisions or of any environmentally objectional acts and corrective action to be taken. State or local agencies responsible for verification of certain aspects of the environmental protection requirements shall notify the Contractor in writing, through the Engineer, of any non-compliance with State or local requirements. The Contractor shall, after receipt of such notice from the Engineer or from the regulatory agency through the Engineer, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails or refuses to comply promptly, the Owner may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it is later determined that the Contractor was in compliance.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION

3.01 - IMPLEMENTATION

A. Prior to commencement of the work, meet with the Engineer to develop mutual understandings relative to compliance with this provision and administration of the environmental pollution control program.

B. Remove temporary environmental control features, when approved by the Engineer, and incorporate permanent control features into the project at the earliest practicable time.

3.02 - EROSION CONTROL

A. Provide positive means of erosion control such as shallow ditches around construction to carry off surface water. Erosion control measures such as siltation basins, hay check dams, mulching, jute netting, and other equivalent techniques shall be used as appropriate. Offsite surface water shall be diverted around the site to a downstream channel ahead of siltation barriers. Flow of surface water into excavated areas shall be prevented. Ditches around construction area shall also be used to carry away water resulting from dewatering of excavated areas. At the completion of the work, ditches shall be backfilled and the ground surface restored to original condition.

3.03 - PROTECTION OF STREAMS, WETLANDS, AND SURFACE WATER

A. Care shall be taken to prevent or reduce to a minimum any damage to any stream, drainage ditch, storm drain of sewer from pollution by debris, sediment, or other material, or from the manipulation of equipment and/or materials in or near such streams. Water that has been used for washing or processing, or that contains oils or sediments that will reduce the quality of the water in the stream, shall not be directly returned to the stream. Such water will be diverted through a settling basin or filter before being directed into the streams.

B. The Contractor shall not discharge water from dewatering operations directly into any live or intermittent stream, channel, wetlands, surface water, or any storm sewer. Water from dewatering operations shall be treated by filtration, settling basins, or other approved method to reduce the amount of sediment contained in the water to allowable levels.

C. All preventative measures shall be taken to avoid spillage of petroleum products and other pollutants. In the event of any spillage, prompt remedial action shall be taken in accordance with a contingency action drawing or plan approved by the Massachusetts Department of Environmental Protection. Contractor shall submit to copies of approved contingency drawings or plans to the Engineer.

D. Water being flushed from structures or pipelines after disinfection, with a Cl2 residue of 2 mg/l or greater, shall be treated with a dechlorination solution, in a method approved by the Engineer, prior to discharge.

3.04 - PROTECTION OF LAND RESOURCES

A. Land resources within the project boundaries and outside the limits of permanent work shall be restored to a condition, after completion of construction, that will appear to be natural and not detract from the appearance of the project. Confine all construction activities to areas shown on the Drawings.

B. Outside of areas requiring earthwork for the construction of the new facilities, the Contractor shall not deface, injure, or destroy trees or shrubs, nor remove or cut them without prior approval. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage unless specifically authorized by the Engineer. Where such special emergency use is permitted, first wrap the trunk with a sufficient thickness of burlap or rags over which softwood cleats shall be tied before any rope, cable, or wire is placed. The Contractor shall in any event be responsible for any damage resulting from such use.

C. Where trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment, dumping or other operations, protect such trees by placing boards, planks, or poles around them. Monuments and markers shall be protected similarly before beginning operations near them.

D. Any trees or other landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition. The Engineer will decide what method of restoration shall be used and whether damaged trees shall be treated and healed or removed and disposed of.

E. All scars made on trees by equipment, construction operations, or by the removal of limbs larger than 1-in. in diameter shall be coated as soon as possible with an approved tree wound dressing. All trimming or pruning shall be performed in an approved manner by experienced workmen with saws or pruning shears. Tree trimming with axes will not be permitted.

F. Climbing ropes shall be used where necessary for safety. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the Contractor and are beyond saving in the opinion of the Engineer, shall be immediately removed and replaced.

G. The locations of the Contractor's storage, and other construction building, required temporarily in the performance of the work, shall be cleared portions of the job site or areas to be cleared as shown on the Drawings and shall require written approval of the Engineer and shall not be within wetlands or floodplains. The preservation of the landscape shall be an imperative consideration in the selection of all sites and in the construction of buildings. Drawings showing storage facilities shall be submitted for approval of the Engineer.

H. Remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess of waste materials, or any other vestiges of construction as directed by the Engineer. It is anticipated that excavation, filling, and plowing of roadways will be required to restore the area to near natural conditions which will permit the growth of vegetation thereon. The disturbed areas shall be prepared and seeded as described in SECTION 01568, EROSION CONTROL, SEDIMENTATION AND CONTAINMENT OF CONSTRUCTION MATERIALS or as approved by the Engineer.

I. All debris and excess material will be disposed of outside wetland or floodplain areas in an environmentally sound manner.

3.05 - PROTECTION OF AIR QUALITY

A. Burning. The use of burning at the project site for the disposal of refuse and debris will not be permitted.

B. Dust Control. The Contractor will be required to maintain all excavations, embankments, stockpiles, access roads, plant sites, waste areas, borrow areas, and all other work areas within or without the project boundaries free from dust which could cause the standards for air pollution to be exceeded, and which would cause a hazard or nuisance to others.

C. An approved method of stabilization consisting of sprinkling or other similar methods will be permitted to control dust. The use of chlorides may be permitted with approval from the Engineer.

D. Sprinkling, to be approved, must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the Contractor must have sufficient competent equipment on the job to accomplish this if sprinkling is used. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs, as determined by the Engineer.

3.05 - MAINTENANCE OF POLLUTION CONTROL FACILITIES DURING CONSTRUCTION

A. During the life of this Contract, maintain all facilities constructed for pollution control as long as the operations creating the particular pollutant are being carried out or until the material concerned has become stabilized to the extent that pollution is no longer being created.

3.06 - NOISE CONTROL

A. The Contractor shall make every effort to minimize noises caused by his operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise in compliance with State and Federal (OSHA) regulations.

3.07 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 01171

ELECTRIC MOTORS

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PART 1 - GENERAL

1.00 - SUBBID REQUIREMENTS

A. This section is part of the filed sub-bid for DIVISION 16, ELECTRICAL. See SECTION 16050, ELECTRICAL WORK - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide Low Voltage Electric Motors and Accessories as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

C. Unless otherwise specified, all electric motors furnished and installed by the Contractor shall conform to the requirements specified herein.

1. Motors rated at 460 V which are powered from Variable Frequency Drives shall be inverter duty rated as per NEMA-MG-1.

2. Motors shall be NEMA Premium Efficient as per NEMA-MG-1.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Descriptive literature and motor characteristics, including thermal limit curves and speed vs. torque curves. Provide thermal limit curves for motors 75 Hp and greater and all motor data.
2. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance.
    a. Failure to include a copy of the marked-up specification sections will result in return of the entire submittal without further review and consideration until the marked-up specification are re-submitted with the entire package.
3. Submit motor data with the associated driven equipment submittals.
4. Shop drawings and descriptive data to include:
    a. Complete list of all motors to be furnished.
    b. Outlines, dimensions, weights, and wiring diagrams.
    c. Location of main and accessories boxes with size of conduit entrance.
    d. Efficiency and power factor at 1/2, 3/4 and full load.

e. Bearing life data and grease requirements.

f. Nameplate data.

g. Prototype test data.

h. Ground pad locations.

i. Strip heaters KW and voltage ratings.

j. Statement certifying that motor insulation system is compatible with output of VFD system provided under SECTION 16260, VARIABLE FREQUENCY DRIVES.

k. Full load current

l. Locked rotor current

m. Full load torque in lb.-ft.

n. Starting and breakdown torque in percent of full-load torque

o. Number and frequency of permissible starts under specified conditions

p. Horsepower versus current curves

q. Moment of inertia of rotor

r. The zero load, rated speed (with no load connected) kW and kvar input

s. The locked rotor KVA and power factor at rated voltage

t. Service factor

u. Descriptive bulletins or catalog cuts with full description of the insulation system

v. Manufacturer, type, size and rating of bearings

w. Motor thermal limit or damage curves

5. Submit certified copies of all factory shop test results.

6. Submit list of recommended spare parts and maintenance tools for each type of motor.

7. Provide manufacturer's printed installation instructions including anchoring details to meet earthquake requirements as specified and indicated on the structural drawings.

8. Performance Test Reports: Upon completion of installed system, submit in booklet form all field tests performed.

1.05 - PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

B. The design conditions and other pertinent requirements for the equipment are listed on the Contract Drawings.

1.07 - QUALITY ASSURANCE

A. Motors shall comply with the latest reference standards specified.

B. Routine tests shall be performed on representative motors less than 100 Hp in size and shall include the information described on NEMA MG1-12.54 Report of Test Form for Routine Tests on Induction Motors. Efficiency shall be determined in accordance with IEEE Publication No. 112, Method B. Power factor shall be measured on representative motors.

C. The Contractor shall obtain the pumps, motors, and appurtenances from the pump manufacturer, as a complete and integrated package to insure proper coordination and compatibility and operation of the system.

1. Where motors are driven by variable frequency drives (VFDs) the Contractor shall coordinate the variable frequency motor controllers with the pump and motor manufacturer and submit as part of the shop drawings a written statement signed by the Contractor, pump manufacturer, motor manufacturer and variable frequency motor controller manufacturer that the variable frequency motor controller manufacturer has received the required information from the pump and motor manufacturers and that all parties have reviewed the system and coordinated the equipment selection. Also include all motor data and information that has been used for the coordination.

2. Variable frequency drives shall be provided in accordance with Specification SECTION 16260, VARIABLE FREQUENCY DRIVES.

D. Provide equipment rated in accordance with the Area Classification Schedule on Contract Electrical drawing 00 E-601.

1.08 - REFERENCES

A. National Electrical Code (NEC)

B. Massachusetts Electrical Code

C. Underwriters Laboratories, Inc. (UL)

D. National Electrical Manufacturers Assoc. (NEMA)

1. NEMA Standard MG-1 – Motors and Generators

2. NEMA WP-1 – Enclosed Electric Motor

E. American Bearing Manufacturers Association (ABMA)

F. American National Standard Institute (ANSI)

G. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE Standard 112 – Test Procedures for Polyphase Induction Motor and Generators
2. IEEE Standard 85 – Airborne Sound Measurements on Rotating Electric Machinery, Test Procedure for
3. IEEE Standard 429 – Evaluation of Sealed Insulation Systems for AC Electric Machinery Employing Form – Wound Stator Coils
4. IEEE Standard 841 – Service Duty Totally Enclosed Fan Cooled (TEFC) Squirrel Cage Induction Motors

PART 2 - PRODUCTS

2.01 - ACCEPTABLE MOTOR MANUFACTURERS

A. Reliance Electric

B. Toshiba

C. U.S. Electric Motors

D. Or equal

2.02 - ELECTRIC MOTOR RATINGS

A. Voltage Ratings:

1. Unless otherwise specified, motors with ratings of 1/2 to 500 Hp shall be rated 460-volt (nameplate rating), three-phase, 60-Hertz; motors of 1/3 Hp or less to be rated 115-volt, single-phase, 60 Hertz.

B. The following specific motor requirements shall be identified in each equipment specification:

1. RPM.
2. Motor enclosure type.

2.03 - MOTOR REQUIREMENTS

A. Motor heaters shall be supplied on all motors located outdoors. Heaters shall be of the cartridge or flexible wrap around type installed within the motor enclosure adjacent to core iron. Heaters shall be rated for 120 volt, single phase with wattage. The heater wattage and voltage shall be embossed on the motor nameplate.

B. Every motor shall be of capacity to operate the driven equipment under all load and operating conditions without exceeding its rated nameplate current or power or its specified temperature limit at rated voltage. Each motor shall develop the necessary torque for its required service throughout its acceleration range at a voltage 10 percent below nameplate rating. Where indicated on the electrical drawings to be operated on a reduced voltage starter, the motor shall develop the necessary torque under the conditions imposed by the reduced voltage starting method.

C. The motor shall have capacity to operate the driven equipment as given in the equipment detail specifications. The motor shall not be required to deliver more than its rated nameplate horsepower, at unity (1.0) service factor, under any condition of mechanical or hydraulic loading.

D. Type of Motors

1. All motors shall be NEMA Design B or of a type having starting characteristics and ruggedness as may be necessary under the actual conditions of operation and, unless otherwise specified, shall be for full-voltage starting.

E. Insulation

1. All motors shall have Class B (fractional horse power only) and Class F insulation for all other size motors.

2. Insulation systems shall be manufacturer's premium grade, resistant to attack by moisture, acids, alkalies and mechanical or thermal shock for 480 Volt motors. Provide a Class F insulation system for an ambient temperature motor operation of 0 to 40 degrees C at no more than 3300 feet above sea level for inverter duty motors. This temperature rise shall be met when motors are operated and controlled with the VFD(s). The motor insulation system shall have full capability to handle the common mode voltage conditions imposed by the VFD.

3. Motors shall have vacuum/pressure impregnated epoxy insulation for moisture resistance.

4. Insulation for inverter duty motor windings shall meet or exceed the Pulse Endurance Index for magnetic wire and shall not be injured when exposed to repeated pulse type waveforms, repetitive high voltage transients, switching frequency and rate of rise of the pulse. Class H insulation shall be used.

F. Enclosures

1. Motors shall have a steel or cast-iron frame and a cast iron or stamped steel conduit box, as specified below. Conduit box shall be split from top to bottom and shall be capable of being rotated to four positions. Synthetic rubber-like gaskets shall be provided between the frame and the conduit box and between the conduit box and its cover. Motor leads shall be sealed with a non-wicking, non-hygroscopic insulating material. A frame mounted pad with drilled and tapped hole, not less than 1/4-in. diameter, shall be provided inside the conduit box for motor frame grounding.

a. Totally enclosed fan cooled: TEFC motors shall have a steel or cast-iron frame, cast iron end brackets, cast iron conduit box, 1.15 service factor at 40 degrees C, tapped drain holes (corrosion resistant plugs for frames 286T and smaller and automatic breather/drain devices for frames 324T and larger) and upgraded insulation by additional dips and bakes to increase moisture resistance.

b. Totally enclosed non-ventilated: TENV motors shall include the same rating and accessories as specified for TEFC motors.

c. Explosion proof motors shall comply with all requirements of Class I, Division 1, Group D, hazardous locations as defined by the National Electrical Code and with all other safety codes pertaining thereto.

d. Motors in NEMA 4, NEMA 4X and classified areas shall be provided with severe duty rating. Motors shall be of the corrosion resistant type conforming to motors designated by the manufacturer as "Corro-Duty", "Mill and Chemical", "Custom Severe Duty", or similar quality designation. Severe duty motors shall have a cast iron frame, cast iron end brackets, cast iron conduit box and 1.15 service factor at 40 degrees C and tapped drain holes (corrosion resistant plug for frames 286T and smaller and automatic breather/drain devices for frames 324T and larger).

G. Special Purpose Motors

1. Hermetically sealed air conditioning units, hoists, cranes and other devices complying with special safety codes shall be furnished with motors, control equipment, accessories and safety devices, in accordance with the manufacturer's standards and to be rated for the duty cycle as specified for the driven equipment. Service factor 1.15 above 3 hp.

2. Submersible motors shall be equipped with three thermal switches (one in each phase winding) connected to stop motor operation if the temperature exceeds 125 deg. C (255 deg. F). Also a leakage sensor for sensing water intrusion into the stator housing shall be provided.

3. Inverter duty rated: Motors for operation on variable frequency drives shall meet current power quality levels published in NEMA MG1, Part 31.

    a. Enclosures shall be equal to those furnished for severe duty or explosion proof motors. Motor shaft and bearings shall be insulated.

    b. Motors nameplate service factor shall be 1.0. Internal service factor shall be 1.15 that of the nameplate.

    c. Stator laminations shall be stagger-stacked and stamped from high grade electrical steel to minimize eddy-current losses and heat build-up caused by inverter induced harmonics. Rotors shall be configured to minimize skin-effect heating.

    d. Provide each variable frequency drive motor with an internal normally closed motor thermostat per phase wired in series

    e. Provide VFD driven motor shafts with grounding rings.

H. Auxiliary Devices

1. Single-phase motors requiring switching devices and auxiliary starting resistors, capacitors, or reactors shall be furnished as combination units with such auxiliaries either incorporated within the motor housings or housed in enclosures mounted upon the motor frames. Each combination unit shall be mounted upon a single base and to be provided with a single conduit box.

I. General Design of Motors

1. Motors shall comply with the latest NEMA Standards Publication No. MG1 for Motors and Generators, unless otherwise specified.

2. All polyphase non-explosion proof motors shall be provided with energy efficient operation and meet the requirements of MG1-12.53 a and b.

3. Motor windings shall be braced to withstand successfully the stresses resulting from the method of starting. The windings shall be treated thoroughly with an insulating compound that protects against moisture and slightly acid or alkaline conditions.

4. Bearings shall be of the self-lubricating type, provided so that there is proper alignment of rotor and shaft and to prevent leakage of lubricant.

    a. Bearings for open motors shall be of the sleeve or ball type, as specified under the respective items of mechanical equipment.

    b. Bearings for totally enclosed and explosion proof motors shall be of the ball type.

    c. Bearing L-10 fatigue life in hours at 100 percent load shall be 50,000.

    d. Bearing grease shall be of the 120 deg. C thermal capability type.

    e. Bearings for 50 HP and larger VFD driven motors shall be isolated type bearings.

5. Vertical motors shall be provided with thrust bearings for all thrusts to which they can be subjected in operation.

6. All three phase two speed motors shall be of the two-winding design.

7. All non-VFD driven three phase motors shall be provided with a 1.15 service factor.

8. Three phase motors shall be of cast iron construction including frame and end brackets.

9. Motor nameplates shall be Type 316 stainless steel.

10. Motor Terminal Boxes and Leads:

    a. Motors shall be furnished with oversize conduit terminal boxes to provide for making and housing the connections, and with flexible leads of sufficient length to extend for a distance of not less than 4 in. beyond the face of the box. Solderless lugs shall be furnished. Totally enclosed and explosion proof motors to have cast-iron terminal boxes.

    b. Leads for space heaters shall be brought out into an auxiliary, cast, conduit box on the motor side opposite to the main terminal box. Auxiliary box to have 1" threaded conduit openings and shall be so constructed that conduit entrance may be placed at top, bottom, or either side.

    c. A grounding terminal shall be provided in the main terminal box and a bronze grounding bolt to be furnished at the conduit side of the motor frame.

    d. For inverter rated motors, provide oversized terminal boxes with oversize conduit opening and oversized cable lugs for cables as indicated.

J. Motor Efficiencies

1. Three phase motors rated 1 Hp and larger shall be of the premium efficiency, “Design E”, type per Table 12.1 of NEMA MG1 Part 12. Efficiency values shall be based on tests performed in accordance with IEEE Publication No. 112, Method B. Motors with horsepower or rpms not listed shall conform to comparable standards of construction and materials as those for listed motors.

K. Shop Painting

1. Unless otherwise specified, motors shall be given a shop application of paint filler or enamel sealer, a flat coat of undercoater for enamel, and two coats of enamel or, in lieu of this treatment, other corrosion-resistant treatment customary with the manufacturer.

L. Motor Data

1. The Contractor shall furnish five certified copies of characteristic curves of each motor furnished, except 115-volt motors. Curves shall be supplied as a part of the driven equipment submittal.

M. Motor Shop Tests

1. Motor shop tests shall be made in accordance with the IEEE Test Codes as specified in the NEMA MG1 Standards for Motors and Generators. NEMA report-of-test forms to be used in submitting test data.

2. Motor efficiency shall be determined by use of IEEE Standard 112 Test Method B, and by use of MGI-12.53 a and b.

3. For motors rated 100 hp and larger, complete tests of each motor furnished to be made and certified test data sheets to be submitted. Each motor shall be tested at rated voltage for: efficiency and power factor at 25, 50, 75, and 100 percent of it rated horsepower; for temperature rise, torque, no-load current, starting current, full load current, and dielectric strength; and for compliance with all specified performance requirements.

4. For induction motors 5 hp, up to 100 hp, copies of routine test reports of electrically duplicate motors shall be furnished.

5. For motors 3 hp or less, no test data need be furnished.

6. Where required by the load equipment specifications, provide testing support for shop testing at the equipment manufacturer’s facility.

PART 3 - EXECUTION

3.01 - INSTALLATION

A. Verify heaters are energized when supplied on motors.

B. After motor installation but before connection to power wiring, test motor winding insulation.

C. After connection to power wiring, check for operating temperature, correct rotation, vibration, alignment and operating current drawn under load.

D. Submit all motor test results for review and record.

3.02 - TESTING

A. Inspect physical and mechanical condition.

B. Inspect for correct anchorage, mounting, grounding, connection, and lubrication.

C. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturers published data.

D. Verify the absence of unusual mechanical or electrical noise or signs of overheating during initial test run.

E. Megger test motor winding insulation.

F. Provide testing in accordance with SECTION 16998, FIELD INSPECTION AND ACCEPTANCE TESTS.

3.03 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 01300

SUBMITTALS

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PART 1 - GENERAL

1.01 - SCOPE

A. The work of this section specifies the general methods and requirements of submissions applicable to the following Work-related submittals:

1. Shop Drawings, Product Data and Samples.
2. Mock Ups.
3. Construction Photographs.
4. Contractor's Responsibilities.
5. Submission Requirements.
6. Review of Shop Drawings, Product Data, Working Drawings and Samples.
7. Distribution.
8. General Procedures for Submittals.
9. Certificate of Design.
10. Certificates of Compliance.
11. Schedules.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.
10. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
11. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
12. Submittals: written and graphic information and physical samples that require Engineer’s responsive action. Action submittals are those submittals indicated in individual Specification sections as "action submittals."
13. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
14. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.
15. Shop drawings, as defined in the General Conditions, and as specified in individual Work Sections include, but are not necessarily limited to: custom-prepared data such as fabrication and erection/installation (working) drawings of concrete reinforcement, structural details and piping layout, scheduled information, setting diagrams, actual shop work manufacturing instructions, custom templates, special wiring diagrams, coordination drawings, individual system or equipment inspection and test reports including performance curves and certifications as applicable to the Work

1.04 - SUBMITTALS

A. Shop drawings and brochures shall be submitted for all items to be furnished in accordance with the provisions of DOCUMENT 00700, GENERAL CONDITIONS and this Section.

B. Detailed submittal requirements are specified in the Technical Specifications sections.

C. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of Subcontractors, the schedule of values, and Contractor's construction schedule.

2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

a. Scheduled date for first submittal.

b. Specification section number and title.

c. Submittal category: Action; informational.

d. Name of Subcontractor.

e. Description of the Work covered.

f. Scheduled date for Engineer's final release or acceptance.

g. Scheduled date of fabrication.

1.05 - SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Engineer's Digital Data Files: Electronic digital data files of the Drawings will be provided by Engineer for Contractor's use in preparing Project Record Drawings.

1. Engineer will furnish Contractor one set of digital data drawing files of the Drawings for use in preparing Project record drawings.

2. Engineer makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.

3. Digital Drawing Software Program: The Contract Drawings are available in AutoCad Civil 3D 2017 format.

4. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to the Engineer.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Submit all submittal items required for each Specification section concurrently unless partial submittals for portions of the Work are indicated on accepted submittal schedule.

3. Submit action submittals and informational submittals required by the same Specification section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. All shop drawings shall be submitted using the transmittal form furnished by the Engineer.

D. All shop drawings submitted by Subcontractors for approval shall be sent directly to the Contractor for checking. The Contractor shall be responsible for their submission at the proper time so as to prevent delays in delivery of materials.

E. Processing Time. Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review. Allow 15 working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review. If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review. Allow 15 working days for review of each resubmittal.
4. Sequential Review. Where sequential review of submittals by Engineer's consultants, Owner, or other parties is indicated, allow 20 working days for initial review of each submittal.

F. Paper Submittals. Place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6-inches by 8-inches on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.
3. Number of submittals required:
    a. Shop Drawings: Unless otherwise stated in the respective Specifications sections, submit six (6) copies.
    b. Product Data: Unless otherwise stated in the respective Specifications submit six (6) copies.
    c. Samples: Submit the number stated in the respective Specification Sections.
4. Include the following information for processing and recording action taken:
    a. Project name.
    b. Date.
    c. Name of Engineer.
    d. Name of Contractor.
    e. Name of Subcontractor.
    f. Name of supplier.
    g. Name of manufacturer.

h. Submittal number or other unique identifier, including revision identifier. Engineer's Shop Drawing Transmittal Form includes spaces for the submittal number (e.g. 12) and the Specification section number (e.g., SECTION 09940, SHOP PAINTING). Submittal numbering shall be sequential. Resubmittals shall include an alphabetic suffix after the original submittal number (e.g. 12A).

i. Number and title of appropriate Specification section.

j. Drawing number and detail references, as appropriate.

5. Additional Paper Copies. Unless additional copies are required for final submittal, and unless Engineer observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

6. Transmittal for Paper Submittals. Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form to be supplied by the Engineer. Engineer will discard submittals received from sources other than Contractor.

G. Options. Identify options requiring selection by Engineer.

H. Deviations and Additional Information. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

I. Resubmittals. Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.

2. Note date and content of revision in label or title block and clearly indicate extent of revision.

3. Resubmit submittals until they are marked with acceptance notation from Engineer's action stamp.

J. Distribution. Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities.

K. Use for Construction. Retain complete copies of submittals on the Project Site. Use only final action submittals that are marked with acceptance notation from Engineer's action stamp.

1.06 - CONSTRUCTION PHOTOGRAPHS

A. The Contractor shall provide construction photographs in accordance with requirements specified in SECTION 01030, SPECIAL REQUIREMENTS.

PART 2 - PRODUCTS

2.01 - SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements. Prepare and submit submittals required by individual Specification sections. Types of submittals are indicated in individual Specification sections.

B. Product Data. Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each copy of each submittal to show which products and options are applicable.

3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.

b. Manufacturer's product specifications.

c. Standard color charts.

d. Statement of compliance with specified referenced standards.

e. Testing by recognized testing agency.

f. Application of testing agency labels and seals.

g. Notation of coordination requirements.

h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring.

b. Printed performance curves.

c. Operational range diagrams.

d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.

6. Submit Product Data in the following format. Six (6) paper copies of Product Data unless otherwise indicated. Engineer will return three (3) copies.

C. Shop Drawings. Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Engineer's digital data drawing files is otherwise permitted.

1. Contractor shall submit certified shop and erection drawings of the proposed equipment in the capacity, size, and arrangement as indicated and specified.

a. Drawings shall include plan views, sectional views, title block, Tag Numbers, serial numbers, Parts List (identifying each component), dimensions, connection sizes and types and all details of all related items. In cases where certain information is proprietary and is omitted, provided a statement indicating that the information is proprietary and is being omitted.

b. Drawings shall be in conformance with all other requirements as specified in this Specification.

2. Preparation. Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.

b. Schedules.

c. Compliance with specified standards.

d. Notation of coordination requirements.

e. Notation of dimensions established by field measurement.

f. Relationship and attachment to adjoining construction clearly indicated.

g. Seal and signature of professional engineer if specified.

3. Sheet Size. Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8 ½ inches by 11 inches, but no larger than 24 inches by 36 inches.

4. Submit Shop Drawings in the following format. Submit Product Data in the following format. Six (6)paper copies of Product Data unless otherwise indicated. Engineer will return three (3) copies.

D. Samples. Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one (1) submittal package.

2. Identification: Attach label on unexposed side of Samples that includes the following:

   a. Generic description of Sample.

   b. Product name and name of manufacturer.

   c. Sample source.

   d. Number and title of applicable Specification Section.

   e. Specification paragraph number and generic name of each item.

3. Disposition: Maintain sets of accepted Samples at Project Site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

   a. Number of Samples: Submit two (2) sets of Samples. Engineer will retain one (1) sample set; remainder will be returned.

   b. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

   c. If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three (3) sets of paired units that show approximate limits of variations.

E. Test and Inspection Report Submittal. Comply with requirements specified in SECTION 01400, QUALITY ASSURANCE.

F. Welding Certificates. Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

G. Installer Certificates. Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

H. Manufacturer Certificates. Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

I. Product Certificates. Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

J. Material Certificates. Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

K. Field Test Reports. Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

2.02 - DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Engineer.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit three (3) paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.01 - CONTRACTOR'S REVIEW

A. Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Mark with approval stamp before submitting to Engineer.

B. Contractor review shall verify the following:

1. Field measurements
2. Field construction criteria
3. Catalog numbers and similar data
4. Conformance with the Specifications

C. If a shop drawing shows any deviation from the requirements of the Contract Documents, the Contractor shall make specific mention of the deviations in the Transmittal Form furnished by the Engineer and provide a description of the deviations in a letter attached to the submittal.

D. The review and approval of shop drawings, samples or product data by the Engineer shall not relieve the Contractor from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error and omission are assumed by the Contractor and the Engineer will not have responsibility therefor.

E. No portion of the Work requiring a shop drawing, sample, or product data shall be started nor shall any materials be fabricated or installed prior to the approval or qualified approval of such item. Fabrication performed, materials purchased or on-site construction accomplished which does not conform to accepted shop drawings and data shall be at the Contractor's risk. The Owner and Engineer will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.

F. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 - ENGINEER’S ACTION

A. The Engineer's review is for general conformance with the design concept and contract documents. Markings or comments shall not be construed as relieving the Contractor from compliance with the Contract Drawings and Specifications or from departures therefrom. The Contractor remains responsible for details and accuracy, for coordinating the Work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.

B. The review of shop drawings, data, and samples will be general. They shall not be construed:

1. As permitting any departure from the Contract requirements;

2. As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials; or

3. As approving departures from details furnished by the Engineer, except as otherwise provided herein.

C. If the shop drawings, data or samples as submitted describe variations and show a departure from the Contract requirements which the Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in Contract Price or time for performance, the Engineer may return the reviewed drawings without noting an exception.

D. Three (3) (maximum) copies of shop drawings or product data will be returned to the Contractor via First Class United States Postal Service. Samples will not be returned.

E. Submittals will be returned to the Contractor under one of the action codes indicated below and defined on the transmittal form furnished by the Engineer.

1. Marking: No Exception Taken.

a. When submittals are marked as “No Exception Taken,” Work covered by submittal may proceed provided it complies with Contract Documents. Acceptance of Work depends on that compliance.

2. Marking: Make Corrections Noted.

a. When submittals are marked as “Make Corrections Noted,” Work covered by submittal may proceed provided it complies with Engineer’s notations or corrections on submittal and with Contract Documents. Acceptance of Work depends on that compliance. Resubmittal not required.

3. Marking: Amend and Resubmit.

a. When submittals are marked as “Amend and Resubmit,” do not proceed with Work covered by submittal. Do not permit Work covered by submittals to be used at Project Site or elsewhere where Work is in progress.

b. Revise submittal or prepare new submittal in accordance with Engineer's notations in accordance with resubmittal requirements of this section. Resubmit without delay. Repeat if required to obtain different action marking.

4. Marking: Rejected; See Remarks.

a. When submittals are marked as “Rejected; See Remarks,” do not proceed with Work covered by submittal. Work covered by submittal does not comply with Contract Documents.

b. Prepare new submittal for different material or equipment supplier or different product line or material of same supplier complying with Contract Documents.

5. Marking: For Information Only.

a. When submittals are marked as “For Information Only,” the Engineer will review the submittal but take no action.

b. It will be recorded as “For Information Only”. Work covered by this submittal may proceed provided it complies with the Contract Documents.

6. Marking: Not Required for Review.

a. When submittals are marked as “Not Required for Review,” the Engineer has not reviewed the submittal and it is being returned.

b. Work covered by this submittal may proceed provided it complies with the Contract Documents.

F. Resubmittals will be handled in the same manner as first submittals. On resubmittals the Contractor shall direct specific attention, in writing, on the letter of transmittal and on resubmitted shop drawings by use of revision triangles or other similar methods, to revisions other than the corrections requested by the Engineer, on previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the Contractor. The Contractor shall make corrections to any Work done because of this type revision that is not in accordance to the Contract Documents as may be required by the Engineer.

G. Partial submittals may not be reviewed. The Engineer will be the only judge as to the completeness of a submittal. Submittals not complete will be returned to the Contractor, and will be considered "Rejected" until resubmitted. The Engineer may at his option provide a list or mark the submittal directing the Contractor to the areas that are incomplete.

H. If the Contractor considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, the Contractor shall give written notice thereof to the Engineer within five working days after the date of the Engineer's review of the shop drawing and prior to the release for manufacture.

I. When the shop drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

3.03 - DISTRIBUTION

A. Distribute reproductions of accepted shop drawings and copies of accepted product data and samples, where required, to the Project Site file and elsewhere as directed by the Engineer. Number of copies shall be as directed by the Engineer but shall not exceed six (6).

3.04 - CERTIFICATE OF DESIGN

A. If specifically specified in other sections of these Specifications, the Contractor shall submit the applicable Certificate of Design for each item required, and in the form attached to this Section, completely filled in and signed and sealed by a registered professional engineer.

3.05 - CERTIFICATES OF COMPLIANCE

A. Certificates of Compliance as specified in the specifications shall include and mean certificates, manufacturer's certificates, certifications, certified copies, letters of certification and certificate of materials.

B. The Contractor shall be responsible for providing Certificates of Compliance as specified in the technical specifications. Certificates are required for demonstrating proof of compliance with specification requirements and shall be executed in six (6) copies unless otherwise specified. Each certificate shall be signed by an official authorized to certify on behalf of the manufacturing company and shall contain the name and address of the Supplier, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Supplier from furnishing satisfactory material, if after tests are performed on selected samples, the material is found not to meet the specific requirements.

3.06 - SCHEDULES

A. Provide all schedules as specified.

B. Progress Payments shall be subject to meeting the Schedule Requirements of this section (Refer to Table 01300-1). No progress payment identified in Table 01300-1 over the limits identified will be made until the milestones set in this table are satisfied.

Table 01300-1

Section Number	Section Name	Submittal	Schedule Requirement/ Payment Milestone
01311	Construction Progress Schedule	Project schedule is submitted and reaches no exceptions taken status.	Prior to Mobilization to the Project Site
01300	Submittals	Shop drawings are submitted and reach no exceptions taken status.	Prior to 75% payment of Mobilization/Demobilization.
01030	Special Requirements	Record documentation is submitted and reaches no exceptions taken status.	Prior to 95% payment.
01311	Construction Progress Schedule	Punch list is completed and corrected.	Prior to 95% payment.

END OF SECTION

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SECTION 01310

MISCELLANEOUS TESTING AND SOIL DATA

PART - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 1
1.03 - DEFINITIONS 1
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING – Not Used 2
1.06 - DESIGN CRITERIA 2
PART 2 - PRODUCTS - Not Used 2
PART 3 - EXECUTION - Not Used 2

PART - GENERAL

1.01 - SCOPE

A. The Work of this section includes the furnishing of all labor, materials, tools and equipment required to perform miscellaneous testing as required in the Contract Documents and/or as directed by the Engineer.

B. Existing testing and subsurface soil data, if available, is included in this section.

C. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. In addition to the above, measurement and payment shall be in accordance to the following:

1. Payment for testing shall be as specified under the applicable Payment Items included under SECTION 01025, MEASUREMENT AND PAYMENT.

2. Pay all up front costs associated with additional testing. If the testing proves the Work is defective or materials are unsatisfactory then correct all defective Work at no cost to the Owner. If the testing proves the Work and/or materials are satisfactory, then the Owner will pay for costs associated with additional testing.

3. Where the technical section of the Specifications required that a piece of equipment be tested at the manufacturer's facility or at the site, the cost of such tests shall be included in the price of the equipment.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals shall include shop drawings including at least the following:

1. Additional Testing.

1.05 - PRODUCT HANDLING – Not Used

1.06 - DESIGN CRITERIA

A. Subsurface soil data, if included in the Contract Documents, is for general information only. The information pertains to the subsoil conditions in the vicinity of the Work and is given to assist in properly evaluating the amount and character of the Work required hereunder. Such data is represented as being the best factual information available.

1. The Owner and Engineer assume no responsibility for the accuracy thereof or for any conclusions that might draw therefrom.
2. It is understood and agreed that, by careful examination, you have satisfied yourself as to the nature and location of the Work, have examined such logs of test borings and/or records made of underground exploration as may be available, understand the character of equipment and facilities needed for the prosecution of the Work, the general and local conditions, and all other matters which could in any way affect the Work under this Contract.
3. Jar samples, if available, may be examined during normal business hours, at the Owner’s office.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF TEXT

SEE ATTACHMENT - GEOTECHNICAL DATA REPORT

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SECTION 01311

CONSTRUCTION PROGRESS SCHEDULES

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PART 1 - GENERAL

1.01 - SCOPE

A. The work covered by this section of the specifications includes furnishing all labor, equipment, tools, and materials, and in performing all operations in connection with developing and updating construction progress schedules.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. No payment shall be made for any work on this project unless these requirements have been met.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

C. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

D. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise accepted by Engineer.

E. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

F. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

G. Event: The starting or ending point of an activity.

H. Float: The measure of leeway in starting and completing an activity.
   1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
   2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
   3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

I. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Construction Progress Schedules includes administrative and procedural requirements for documenting the progress of construction during performance of the Work and shall include at least the following:

1. Startup construction schedule. Within 15 days after execution of the Agreement, submit preliminary schedule indicating planned operations during first 60 days. Include cost of activities expected to be completed before submission and acceptance of the complete schedule.

2. Contractor's construction schedule. Initial schedule, of size required to display entire schedule for entire construction period.

3. Monthly construction schedule updating reports. Submit with Applications for Payment.

4. Daily construction reports. Submit weekly.

5. Material location reports.

6. Site condition reports. Submit at time of discovery of differing conditions

7. Special reports. Submit at time of unusual event

1.05 – PRODUCT HANDLING – Not Used

1.06 – DESIGN CRITERIA – Not Used

1.07 - QUALITY ASSURANCE

A. Comply with the requirements specified in SECTION 01400, QUALITY ASSURANCE.

1.08 - COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.01 - CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 working days, unless specifically allowed by Engineer.

2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, acceptance, purchasing, fabrication, and delivery.

3. Submittal Review Time: Include review and resubmittal times indicated in DIVISION 1 - GENERAL REQUIREMENTS, SECTION 01300, SUBMITTALS in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.

4. Startup and Testing Time: Include no fewer than 45 days for startup and testing.

5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Engineer's administrative procedures necessary for certification of Substantial Completion.

6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.

1. Work Restrictions: Show the effect of the following items on the schedule:

a. Limitations of continued occupancies.

b. Uninterruptible services.

c. Partial occupancy before Substantial Completion.

d. Use of premises restrictions.

e. Seasonal variations.

2. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

a. Structural completion.

b. Completion of mechanical installation.

c. Completion of electrical installation.

d. Substantial Completion.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.

2. Unanswered Requests for Information.

3. Rejected or unreturned submittals.

4. Notations on returned submittals.

5. Pending modifications affecting the Work and Contract Time.

F. Recovery Schedule: When periodic update indicates the Work is 10 or more working days behind the current accepted schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, as well as the date by which recovery will be accomplished.

G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.02 - STARTUP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within 15days of date of execution.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.03 - CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.04 - REPORTS

A. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.05 - SPECIAL REPORTS

A. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable. Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Weekly Look Ahead Schedule – The Contractor shall prepare and submit a Weekly Look Ahead Schedule for all crews on the Thursday prior to the next week. Failure to comply with this requirement will result in no payment for work performed.

PART 3 - EXECUTION

3.01 - CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.

3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of accepted schedule to Engineer, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.

2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

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SECTION 01400

QUALITY ASSURANCE

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PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes preparation and implementation of the Quality Assurance Program.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Within 20 days after receipt of the Notice to Proceed, the Contractor shall submit to the Owner, for review and comment, a draft of the Contractor's CQC program.
2. Prior to commencement of the work but not later than 60 days after the Notice to Proceed, the Contractor shall submit to the Owner for review the following:
    a. The CQC program.
    b. An inspection and test index identifying all required inspections and tests to be performed under the Contract Documents and the CQC program.
    c. Those implementing procedures required for quality control of Work scheduled to be performed within 180 days after receipt of the Notice to Proceed together with a schedule of Contractor procedures for the balance of Work activities.
    d. A list of all quality records that are to be developed and turned over to the Owner as a result of implementing the quality control program and procedures.

3. The Contractor shall submit any revisions or changes to the CQC program or implementing procedures previously submitted to and reviewed by the Owner.
4. Resumes of the QC Manager and Resident inspection personnel shall be submitted and reviewed prior to their commencement of work.
5. Prior to Subcontractors' and suppliers' commencement of work for which their own quality control (SQC) program will be implemented, the Contractor shall review, approve and submit to the Owner for review the SQC program and the resumes of the SQC Manager and Resident inspection personnel to be used.
6. During performance of Contract Work, the Contractor shall submit the following to the Owner for information and as a condition of payment:
    a. Monthly quality control reports as specified herein.
    b. Copies of inspection and test results.
    c. Manufacturer representative reports (in duplicate) within 10 days of each field visit as specified herein including final reports which certify that equipment or systems have been satisfactorily installed and are functioning correctly. If the duration of field visits are greater than one week, the Contractor shall submit weekly reports.

1.05 - PRODUCT HANDLING – Not Used

1.06 - DESIGN CRITERIA – Not Used

1.07 - REFERENCED STANDARDS

A. The Contractor shall indicate any instance where specified reference standards conflict with Contract Documents and request clarification from Owner before proceeding.

B. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.08 - QUALITY CONTROL AND CONTROL OF WORK

A. The Contractor shall control the quality of Work including work of its Subcontractors and suppliers. The Contractor shall develop and maintain a quality control program which complies with the requirements of this Section. The Contractor Quality Control (CQC) program shall explain the Contractor's approach to on-site quality control, off-site quality control, the CQC organization, documentation of quality control activities, and provide all other information necessary to demonstrate to the Owner that the Contractor and its Subcontractors and suppliers will provide quality control services that comply with the Contract Documents. The CQC program shall identify the Contractor's individuals responsible for the execution of the program and identify those Subcontractors/suppliers working to the CQC program and those working to their own Subcontractor/Supplier Quality Control (SQC) program. The Quality Control programs shall apply to the control of quality throughout all areas of contract performance including the procurement, identification, stocking, and issue of material; the entire process of construction; and the installation and testing of equipment.

B. Overall administration of the CQC program shall be vested in an element of the Contractor's organization, hereinafter referred to as the QC Organization, under a QC Manager who has clear access to senior level offsite home office management and to Subcontractors' officers responsible for the execution of the SQC Program. The QC Manager shall manage and administer the CQC program. The QC Manager shall be assigned full time to the Project for the duration of the Contract, shall be on-site at all times and shall have no other duties in the company. The Contractor shall perform the work covered by this Section with a QC Manager having five (5) years of experience, all in the last ten (10) years, in quality control management of resident inspection personnel performing quality control inspection on construction Projects, and with a staff of resident inspection personnel each having three (3) years of experience, all in the last ten (10) years, in quality control inspection on construction Projects. The staff of resident inspection personnel shall inspect the Work in process for completeness and acceptance including multi shift Work and multi operations occurring concurrently. The size and composition of the resident inspection staff may vary as the job progresses but at all times it shall be compatible with the level of effort and capability required by the Contract and construction schedule.

C. The QC Organization shall consistently maintain quality requirements and shall be independent from that portion of the Contractor's organization responsible for production.

D. Written quality control inspection and test procedures shall be used for all operations. These procedures shall contain instructions for performing the required inspection or test, contain the accept/reject criteria for each inspection or test activity (i.e., applicable drawing, specification section, industry code or standard), shall establish the frequency for performing the inspection or test, and shall provide for recording the results of inspections and tests on checklists. These procedures shall be available at all locations where inspections and tests are to be performed. Payment will not be processed until these procedures are submitted to and reviewed by the Owner.

E. The Contractor's procurement documents shall require subcontractors and supplies to implement their own (SQC) program or require them to implement the CQC Program. Copies of the Contractor's procurement documents shall be provided to the Owner in accordance with the requirements specified herein. The Contractor shall comply fully with manufacturers' instructions, including completing each step-in sequence. Should manufacturers' instructions conflict with Contract Documents, the Contractor shall request clarification from the Owner before proceeding.

F. Work to be done away from the construction site is subject to inspection by the Owner during its fabrication, manufacture, testing, or before shipment. The Contractor shall give notice to the Owner of the place and time where such fabrication, manufacture, testing, or shipping is to be done. Such notice shall be in writing and delivered to the Owner in accordance with SECTION 01680, PHYSICAL CHECKOUT, SHOP, FIELD AND FUNCTIONAL TESTING so that the necessary arrangements for inspections and witnessing of shop tests can be made. The Owner has the right but not the responsibility to perform inspection or to witness tests. The Owner's right to perform inspection or to witness tests does not relieve the Contractor of its obligation to comply with the requirements of the Contract Documents.

G. The Owner has the right to perform inspections, witness tests, or otherwise monitor or assess the Work and activities. The Owner's right to perform inspections, witness tests, or monitor or assess the Work and activities does not relieve the Contractor of its obligation to comply with the requirements of the Contract Documents nor does it imply completion of the work.

H. Procedures shall be established for controlling the identification, inspection status, handling, and storage of raw and fabricated material. These controls shall be maintained from the time of receipt of the material until delivery to the Owner, in order to protect the material from damage, deterioration, loss or substitution.
The Contractor shall maintain control over construction and installation processes to assure compliance with specified requirements. In-process and final inspection and testing of construction shall be performed in accordance with written implementing quality control inspection and test procedures to assure that contract requirements have been met. The results of in-process and final inspections shall be recorded on inspection checklists developed by the Contractor and reviewed by the Owner.

I. The CQC and SQC programs are subject to periodic audit by the Owner to assure compliance with the Contract Documents. However, audit by the Owner does not relieve the Contractor of the requirements for the CQC and SQC programs.

J. Monthly quality control reports shall be submitted as specified herein and shall address: status of the Contractor quality control program including procedure development, status of Subcontractor/supplier quality control programs and procedures, number of inspections and tests performed during the month, unsatisfactory and nonconforming items identified as well as those that remain open or were closed during the month, and any other quality problems experienced.

1.09 - QUALITY ASSURANCE/CONTROL OF SUBCONTRACTORS/SUPPLIERS

A. The Contractor shall be responsible for controlling the quality of Work performed by its Subcontractors and suppliers. Unless Subcontractors and suppliers implement their own quality control (SQC) program, approved by the Contractor and reviewed by the Owner, the Contractor shall instruct the Subcontractor or supplier to implement the CQC program on all Work performed and the Contractor shall perform the Quality Control inspections of the Subcontractor's or supplier's Work and activities at their facilities. The CQC program shall list all Subcontractors and suppliers and identify which quality program, CQC or SQC, they are to implement.

1.10 - OWNER FURNISHED TESTING AND INSPECTION SERVICES

A. The Contractor shall furnish a construction schedule and a minimum of 48-hour notice of readiness for testing and inspection of the work. The Owner shall determine the exact time and location of field sampling and testing, and may require such additional sampling and testing as necessary to determine that materials and equipment conform with data previously furnished by Contractor and with the Contract Documents.

B. The Contractor shall schedule the work to permit adequate time for testing and re-testing should test results not conform to the contract documents. Lack of testing or inspection which is attributable to insufficient notice by the Contractor or failure of the Contractor to cooperate, will be cause for rejection of the work.

C. The Contractor shall deliver materials in sufficient quantities to the Owner testing agency as may be required. Laboratory testing shall be performed within a reasonable time, consistent with the specified standards.

D. The Contractor shall furnish material samples and cooperate in the field sampling and testing activities. The Contractor shall furnish personnel, facilities and access to assist in the sampling and testing activities.

1.11 - CONTRACTOR'S ON-SITE QUALITY CONTROL TESTING AND INSPECTION

A. The Contractor shall perform inspections, tests, and other services required by the Contract Documents, the CQC programs, and in accordance with all applicable laws, codes, rules, and regulations and document the results on checklists as specified herein.

B. The Contractor shall provide 48 hour notice to the Owner so that the Owner may witness Contractor’s on-site inspections and tests. The Owner's witnessing of inspections and tests does not relieve the Contractor of its obligation to comply with the requirements of the Contract Documents.

C. The Contractor shall develop an inspection and test index identifying all required inspections and tests as indicated in the Contract Documents and the CQC program. This index shall be submitted to the Owner for review and be included as part of the CQC program. The Contractor shall provide the original inspection and test results upon completion to the Owner witnessing the inspection or test.

1.12 - OWNER QUALITY CONTROL ACTION ITEMS

A. The Contractor shall promptly undertake appropriate action, at no additional cost to the Owner, to respond and correct any unsatisfactory, nonconforming, or otherwise deficient conditions reported to the Contractor by the Owner. These conditions may be identified as a result of Owner inspections, audits or surveillances.

1.13 - MANUFACTURERS' FIELD INSTALLATION SERVICES AND REPORTS

A. When specified in the Contract Documents, the Contractor shall require material or product suppliers and manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, (test, adjust, and balance of equipment) and to provide instructions for installation.

B. The Contractor shall report to the Owner in writing any observations and site decisions or instructions given by the manufacturer’s representatives to the Contractor that are supplemental or contrary to manufacturers' written instructions.

C. The Contractor shall submit manufacturer representative reports (in duplicate) within 10 days of each field visit, to the Owner for review. If the durations of field visits are greater than one week, the Contractor shall submit weekly reports. Final report shall certify that the equipment or systems have been satisfactorily installed and are functioning correctly.

PART 2 - PRODUCTS AND SERVICES – Not Used

PART 3 - EXECUTION

3.01 - GENERAL

A. Inspections and tests shall be made by the Contractor and the appropriate documentation produced as each element of Work is executed.

3.02 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF TEXT

SEE ATTACHMENT A – ELEMENTS OF A QUALITY CONTROL PROGRAM

ATTACHMENT A - ELEMENTS OF A QUALITY CONTROL PROGRAM

A-1 - INTRODUCTION

A. The Quality Control Program is the basic quality document for the construction of a Project, and it identifies quality program commitments. The Quality Control Program assigns responsibilities, authority levels, and interface requirements for activities, which affect quality. Activities which affect quality are those activities which affect the features and characteristics important to the equality of an item, such as soil compaction, concrete curing, etc. The Quality Control Program serves as the basis for Quality Control Procedures, which contain the administrative and implementation requirements for quality control activities.

B. A Quality Control Program must address the following program topics/elements as they relate to the equipment, material or service being furnished:

1. Organization
2. Quality Assurance Program
3. Design Control
4. Control of Procurement Documents
5. Instruction and Procedures
6. Control of Documents
7. Control of Material, Equipment, and Services
8. Survey/Field Coordination
9. Control of Special Processes
10. Inspection and Tests
11. Unsatisfactory/Nonconformance Control
12. Quality Control Records
13. Surveillance and Audits
14. Attachments:
    a. Inspection Report
    b. Nonconformance Report
    c. List of Procedures
    d. List of Subcontractors and Suppliers and applicable QC program
    e. List of inspections and tests
    f. List of QA Records

A-2 - ORGANIZATION

A. This section the QC program must:

1. Specify that the responsibility for the program is retained and exercised by the Contractor.
2. Describe how responsibility is exercised for the overall program including oversight, and how the Contractor evaluates the performance of work by the delegated organization.
3. Describe lines of communication between the contractor/suppliers to assure quality control program direction.

4. Contain organization charts clearly identifying all on-site and off-site organizations which function under the cognizance of the quality control program (such as design, engineering, procurement construction, subcontractors, suppliers, etc.), lines of responsibility and a description of the size of the quality control organization including the inspection staff.
5. Describe the delegation of contract work and the quality control responsibility for the quality control program and which:
    a. Is at the same or higher organizational level as the highest line manager responsible for contract activities affecting quality.
    b. Has communications with other senior management positions.
    c. Has responsibility for approval of QC Manual(s).
    d. Has no other duties or responsibilities.
    e. Has access to senior level management to identify quality problems; initiate, recommend or provide solutions to problems; and verify implementation of solutions.
6. Require that verification of conformance to established requirements is accomplished by individuals or groups within the QC organization who do not have direct responsibility for performance of the work being verified and are independent from that portion of the contractor's organization responsible for production.
7. Assure that QC personnel are sufficiently free from direct pressures due to cost/schedule, and have the responsibility delineated in writing to stop unsatisfactory work and control further processing, delivery, or installation of nonconforming material.
8. Document and make mandatory the corporate level policies regarding the implementation of the QC program.

A-3 - QUALITY CONTROL PROGRAM

A. This element of the program must:
1. Describe the scope of the QC program applicability.
2. Establish provisions to assure that quality-affecting procedures required to implement the QC program are consistent with QC program commitments and corporate policy and are properly documented, controlled, and made mandatory through signature of the responsible official.
3. Provide for the submittal of quality affecting procedures to the Authority for review with documented agreement of acceptance prior to initiation of activities affected by the program and procedure.
4. Address how management regularly assesses the scope, status, adequacy and compliance of the QC program to the contract requirements.
5. Establish requirements for training such that:
    a. Personnel performing quality-affecting activities are instructed as to the purpose, scope and implementation of the quality control program and procedures.
    b. Personnel verifying activities affecting quality are trained and qualified in the principals, techniques, and requirements of the activity being performed.
    c. Documentation of training and qualification including the subject, content of the training, attendees, and date of attendance is maintained.

A-4 - CONTRACTOR DESIGN CONTROL

A. This element of the program must:

1. Describe the scope of design control, if any, including Contractor's design activities associated with the preparation and review of design documents including the correct translation from the contract documents.

2. Define the organizational responsibilities for preparing, reviewing, approving and verifying design documents.

3. Establish internal and external design interface controls, procedures, and lines of communication among participating design organizations and across technical disciplines.

A-5 - PROCUREMENT DOCUMENT CONTROL

A. This element of the program must:

1. Require that procurement documents are reviewed to determine that quality requirements are correctly stated, inspective and controllable; and there are adequate acceptance and rejection criteria.

2. Require that procurement documents, to the extent necessary, require suppliers and subcontractors to provide an acceptable quality control program.

3. Assure that procurement documents identify applicable technical, administrative and reporting requirements; drawings, specifications; codes and industrial standards; test and inspection requirements; and special process instructions that must be complied with by suppliers.

4. Require procurement documents to indicate that the work is subject to inspection by the Contractor and others on behalf of the Authority during its fabrication, manufacture, testing, or before shipment.

A-6 - INSTRUCTION AND PROCEDURES

A. This element of the program must:

1. Describe organizational responsibilities for assuring that activities affecting quality are prescribed by documented instructions and procedures and that the activities are accomplished through implementation of these documents.

2. Require that instructions and procedures be developed that include quantitative (such as dimensions, tolerances, and operating limits) and qualitative (such as workmanship samples) acceptance criteria for determining that important activities have been satisfactorily accomplished.

3. List, as an attachment, all quality administrative and quality-affecting procedures developed or to be developed to implement the program.

A-7 - DOCUMENT CONTROL

A. This element of the program must:

1. Describe the scope of the document control program and identify the types of documents to be controlled. Controlled documents shall include:

a. Design documents (e.g., calculations, drawings, specifications, analyses).

b. Instructions and procedures for such activities as fabrication, construction, modification, installation, test and inspections.

c. As-built documents.

d. Quality control manuals and quality-affecting procedures.

2. Establish procedures for:

   a. Assurance that changes to documents are reviewed and approved by the same organizations that performed the initial review and approval.

   b. Assurance that the documents are available at the location where the activity will be performed and obsolete documents are removed.

A-8 - CONTROL OF MATERIAL, EQUIPMENT AND SERVICES:

A. This element of the program must:

1. Describe the organizational responsibilities for the procurement of material, equipment and services including the interface between the design, procurement and QC organizations.

2. Describe requirements for verification of subcontractors' and suppliers' activities during fabrication, inspection, testing and shipment of materials, equipment and components by the QC organization in accordance with written procedures to assure conformance to the procurement document.

3. List, as an attachment, all subcontractors and suppliers to be utilized on the project and indicate whose QC program will be implemented on the work.

4. Require receiving inspection by the QC organization to assure:

   a. Material, equipment and components are identified and conform to the procurement document requirements.

   b. That the supplier furnished the documentation required by the Contract and procurement documents and that the documentation identifies the purchased item and the specific procurement requirements (e.g., codes, standards, and specifications) met the item.

5. Describe the measures for the control and identification of materials, equipment, parts, and components to preclude the use of incorrect or defective items. When Contract Documents require to be traceable in order to show locations, heat numbers, chemical analysis, physical properties or other inspection/test results for materials used, the Program must:

   a. Establish procedures to assure that identification is maintained either on the material item or on records traceable to the material/item.

   b. Require that correct identification of material items is verified and documented prior to release for fabrication, assembly, shipment and installation.

   c. Require identification to be traceable to the appropriate drawings; specifications; purchase/manufacturing/inspection documents; and physical/chemical test reports.

6. Describe the control of the handling and storage of material, equipment, and components to assure that they are protected from damage, deterioration, loss or substitution and installed in accordance with the design drawings.

A-9 - SURVEY/FIELD COORDINATION

A. This element of the Program must:

1. Describe the organizational responsibilities for the control of survey accuracy and integrity.

2. Establish a procedure for surveying which addresses:

   a. Verification of the continuing accuracy and integrity of both horizontal and vertical surveys.

   b. Establish control traverse, baseline and benchmarks.

   c. Performance of survey checks of detailed layout of the work and accuracy of preparations for field installations as work progresses.

   d. Verify dimensional location and tolerances of completed work.

3. Require preparation of as-built plans.

A-10 - CONTROL OF SPECIAL PROCESSES

A. This element of the Program must:

1. Contain a listing of those processes that are controlled as special processes.
2. Describe the organizational responsibilities including those of the QC organization for qualification of the special process, equipment, and personnel, in accordance with the applicable codes, standards, QC procedures and specifications.
3. Establish requirements for performance of the special process using qualified procedures, equipment and personnel, including documentation of the results.
4. Establish requirements for retention of qualification records of procedures, equipment and personnel associated with special processes.

A-11 - INSPECTION AND TESTS

A. This element of the Program must:

1. Describe the scope of the inspection and test program and the organizational responsibilities for performing inspection and tests.
2. Require that individuals performing inspections and tests be independent of those who performed or directly supervised the activity being inspected.
3. Establish and document the qualification requirements for inspectors, including Non-Destructive Testing (NDT) personnel, and test personnel.
4. Establish procedures for calibration (technique and frequency), maintenance, and control of measuring and test equipment (instruments, tools, gages, fixtures, etc.) used in acceptance measurement, inspection and testing. The Program/Procedures must:
    a. Require the identification and be able to trace Measuring and Test equipment to the calibration test data.
    b. Specify intervals of calibration based on the required accuracy, purpose, usage or other conditions affecting the measurement.
    c. Require calibration against standards that have a higher degree of accuracy then the Equipment being calibrated to assure that the Equipment being calibrated will be within required tolerance.
    d. Require reference and calibration standards to be traceable to nationally recognized Standards.
5. Require preparation of inspection and test procedures, instructions, or checklists which require:
    a. Identification of characteristics and activities to be inspected or tested.
    b. Describe the method for performing tests or inspections.
    c. Acceptance and rejection criteria.
    d. Prerequisites such as calibrated measuring and test equipment and instrumentation.
    e. Method of recording or documenting inspection and test results and data.
6. Determine acceptability of inspection results or test data and results.

A-12 - UNSATISFACTORY/NONCONFORMANCE CONTROL

A. This element of the Program must:

1. Establish procedures for identification, documentation, segregation, review, disposition and notification to affected organizations of unsatisfactory and nonconforming materials, parts, components, and services, if disposition is other than to scrap.

2. Require re-inspection of items reworked, repaired or replaced to determine compliance with contract documents or approved engineering dispositions.

3. Require nonconformances or unsatisfactory conditions to be corrected or resolved prior to the initiation of pre-operational tests on the item.

A-13 - QUALITY CONTROL RECORDS

A. This element of the Program must:

1. Describe the scope of the QC Records including a list of the record types, which will be generated as a result of implementing the program. QC records include results of reviews, assessments, inspections, tests, audits and surveillances; material analysis; monitoring of work performance; qualification of personnel, procedures and equipment; and other documentation such as drawings, specifications, procurement documents, calibrations procedures and reports, nonconformance reports and corrective action reports.

2. Identify the organizational responsibilities for the implementation and retention activities related to QC records including turnover to the Authority.

A-14 - SURVEILLANCE AND AUDITS

A. This element of the Program must:

1. Require an audit of the QC program on an annual basis by personnel having no direct responsibilities for the area being audited.

2. Establish requirements and procedures describing the audit and surveillance programs which includes:

a. Performance of audits and surveillances to pre-established written procedures or checklists by trained personnel having no direct responsibilities in the areas being evaluated.

b. Analysis of data.

c. Issuance of reports to appropriate management for action, review and assessment.

d. Tracking of deficient areas until satisfactory resolution.

e. Re-audit of deficient areas to verify correction and closure.

A-15 – SUBMITTALS

A. Submit the following:

1. Inspection Report

2. Nonconformance Report

3. List of Procedures

4. List of Subcontractors and Suppliers and applicable QC program

5. List of QA Records

END OF ATTACHMENT

SECTION 01500

TEMPORARY FACILITIES

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PART 1 - GENERAL

1.01 - SCOPE

A. The work of this section includes the furnishing of all labor, tools, equipment and materials, performing all operations necessary to provide temporary facilities as specified herein and as directed by the Engineer.

B. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS – Not Used

1.05 - PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer’s written recommendations.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

PART 2 - PRODUCTS

2.01 - TEMPORARY BUILDINGS

A. Furnish temporary offices, storage and fabrication facilities as required and obtain all necessary applicable permits and/or approvals required for their use. Such buildings shall be located as required and as to not interfere with the work of the project and shall be completely removed at the completion of the work.

B. Engineer's Field Office

1. Provide at the start of the work and for the duration of the project, unless otherwise directed, a field office for the use of the Engineer. The office shall be of approximately 500 square feet divided into three rooms plus a lavatory with hot and cold running water and a closet. Legally dispose of sanitary wastes. The office and rooms shall be constructed in a manner, and of materials, satisfactory to the Engineer. Office shall be weathertight with a minimum of six windows and two exterior doors. The office shall be adequately lighted for detailed working conditions, heated and air conditioned during the appropriate seasons (each room to be individually controlled). Thoroughly clean and mop the trailer on a weekly basis and shall restock all paper products such as but not limited to cups, towels, toilet paper, office copy paper, printer paper and plastic liners for waste baskets.

   a. The rooms shall be designated Room "A", Room "B" and Room “C” and of the approximate sizes: Room "A" - 100 square feet, Room "B" - 300 square feet and Room “C” – 100 square feet. Separate entrances shall be provided to each Room.

   b. Furniture, furnishings and equipment subject to approval of the Engineer, shall be provided in the designated rooms as follows:

      (1) Room "A"

      1 - Executive desk

      2 - Executive chairs

      1 - Bookcase (6' high x 3' wide)

      1 - 4 drawer steel files (locking, legal size)

      1 - Waste basket

      1 - Cordless telephone (with hands free speaker and speed dialing)

      1 - Telephone answering machine with recorder

      1 - Dell All-In-One Printer 962 or equal.

      (2) Room "B"

      3 - Tables (2'-6 x 6'-0)

      1 - Plan table (3’-0” x 4’-0”)

      1 - Plan rack (mobile stand and handling clamps by rack manufacture)

      2 - 4 drawer steel files (locking, legal size)

      12 - Folding metal chairs

      1 - Water Cooler/Heater with up to ten 5-gallon supply containers furnished per month for the duration of the contract

      1 - 2.5 cubic foot refrigerator

      1 - Small microwave oven

      1 – Black and White and Color copy machine, self-feeding, with 8-1/2" x 11" and 11" x 17" printing capability, enlargement/reduction capability and scanning capability; provide cartridges, toner, paper, etc., for the project duration

      1 – Wi-Fi service

      1 - Push broom and dust pan

      1 - First aid kit

      1 - Fire extinguisher

      1 - Waste basket

1 - Canon Power Shot ELPH 180 - digital camera or equal

(3) Room "C"

1 - Executive desk

2 - Executive chairs

1 - Bookcase (6' high x 3' wide)

1 - 4 drawer steel files (locking, legal size)

1 - Waste basket

1 - Cordless telephone (with hands free speaker and speed dialing)

3. The Engineer's Field Office shall be located at the work site where it will not interfere with the construction work. Space shall be provided with crushed stone base for at least three vehicles adjacent to the office for the exclusive use of the Engineer and visitors. Remove snow, mud, and control dust in the parking area adjacent to the office.

2.02 - TEMPORARY OPERATIONS

A. General

1. The Contractor shall conduct operations in such a manner and sequence that shall neither result in a disruption of the amenities, nor interfere with the functional organization and workings of existing infrastructure.

2. The Contractor is required to provide all temporary facilities required to maintain the operation of the existing infrastructure.

3. The Contractor shall prepare a carefully planned and detailed construction schedule showing the proposed sequences of operation and the methods to be used for maintaining continued operations of existing infrastructure. No payment will be made until the carefully planned and detailed construction schedule has been developed by the Contractor and approved by the Owner and the Engineer. The following provides the minimum requirements to be addressed by the Contractor while preparing the construction schedule. It should be noted that the following is not intended to be all inclusive.

B. In order to maintain continuous operations during construction (if applicable), the Contractor is required to furnish, install, maintain and remove all necessary temporary by-pass systems. The Contractor shall fully maintain the temporary by-pass systems at all times. The temporary by-pass systems shall include, but is not limited to, piping, valves, flow control devices, electrical connections, and power supply, if necessary. The temporary by-pass equipment shall remain in operation and be fully maintained by the Contractor until the applicable equipment or system has been approved by the Engineer and approved by the Owner.

PART 3 - EXECUTION

3.01 - TELEPHONE SERVICES

A. Provide separate temporary telephone services in the field offices for use by the Contractor, subcontractors and the Engineer up to the time of final acceptance of the project.

B. The Engineer's Field Office shall be provided with one telephone line.

3.02 - WATER

A. Make connections to the nearest municipal water supply and use this supply for construction purposes. Any portions, which are to become a part of the permanent system, shall conform to the applicable sections of these specifications.

B. Furnish, maintain and subsequently provide the water meters and backflow preventers at each location. Furnish all extensions required. Provide drinking water, satisfactorily cooled.

3.03 - ELECTRICITY

A. Arrange for, furnish and maintain all expenses for all electricity required for proper lighting, the use of power tools, for temporary heat for construction operations and for field offices up to the time of final acceptance of the project.

B. Furnish all wiring, fixtures, lamps and other accessories required for his or his subcontractors' work, and for proper lighting, the use of power tools and for temporary heat for construction operations up to the time of final acceptance. Power shall be obtained directly from power company lines or from portable, gasoline driven generator sets.

3.04 - SANITARY CONVENIENCES

A. Provide sanitary conveniences for the duration of the project for the use of all persons employed on the project, including all other contractors and subcontractors.

B. Sanitary conveniences shall be properly screened from public observation, provided in sufficient numbers, and in such manner and at such points as shall be approved by the Engineer and/or Owner. The contents shall be removed and legally disposed of at a frequency acceptable to the public health agency having jurisdiction or as required.

3.05 - PROJECT SIGNS

A. Contractor shall provide Project Sign(s) in accordance with SECTION 00902, PROJECT SIGN.

3.06 - BARRICADES AND GUARD LIGHTS

A. Barricades, signs, fences and similar safety and warning devices shall be provided as required, in order to insure the protection of employees and others concerned with their duties and presence on the premises at the project site.

B. Provide and maintain guard lights at all barricades, obstructions in plant ways, and at all trenches and pits adjacent to traveled ways.

3.07 - TEMPORARY HEAT

A. During the months of October through April, provide heat, fuel and services necessary to protect all of the work and materials against injury from dampness and cold and to maintain temperature above 55 degrees F in all enclosed portions of the project. Provide temporary heating devices, electrical power, adequate and proper fuel, fire enclosures, and the like, as required for the work of all trades, and shall have watchmen constantly in attendance when fires are burning. Only Underwriters' Laboratory approved equipment shall be used. Open salamanders will not be allowed.

B. The permanent heating system may be used for temporary heat prior to the occupancy of the buildings by the Owner, or as otherwise approved by the Engineer, however, the use of permanent equipment for temporary heat purposes shall not affect the guarantee period stated elsewhere in these specifications. Operate and maintain the heating system (including fuel) and the equipment used for temporary heat until final completion of the project, and repair and replace all items damaged during temporary use. Clean all of the permanent heating equipment if it is used for temporary heat before turning the system over to the Owner.

3.08 - TEMPORARY CLOSURES

A. Temporary doors and closures for all openings shall be furnished and installed to keep out inclement weather and intruders until the permanent units are installed. Any loss or damage caused by failure to comply with the above provisions shall be replaced and/or repaired at no additional cost to the Owner.

3.09 - SCAFFOLDING

A. Furnish, erect, maintain in a safe condition and remove all scaffolding required for the execution of the work not specified as being furnished under other sections herein.

B. Neither the Engineer nor the Owner will act as an arbitrator on questions of whether the Contractor or any of his subcontractors shall furnish or remove scaffolding required for any portion of the work.

3.10 - SHELTER AND PROTECTION OF MATERIALS

A. Provide adequate storage facilities for all materials required for the work. The facilities shall be enclosed, heated and provided with moisture control, as required to provide adequate protection and shall be satisfactory to the Engineer.

3.11 - BRACING, SHORING AND SHEETING

A. Provide all bracing, shoring and sheeting as required for safety and for the proper execution of work. Unless otherwise ordered by the Engineer, all bracing, shoring, and sheeting shall be removed when work is completed.

END OF SECTION

SECTION 01570

TRAFFIC MANAGEMENT AND MAINTENANCE

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PART 1 - GENERAL

1.01 - SCOPE

A. The work under this section includes furnishing all engineering, materials, labor, and equipment required for traffic management and maintenance on state highways and/or municipal roadways within the limits of construction under this contract.

B. All practices and traffic control devices shall conform to the relevant provisions of the Manual on Uniform Traffic Control Devices, latest edition and State of Massachusetts Department of Transportation (hereinafter called State) Standard Specifications for Road and Bridge Construction.

C. Develop a traffic management plan to be reviewed and approved by the Owner, state, local, and/or jurisdictional agencies as appropriate. The traffic management plan shall meet with standard practices of the above references, requirements of this specification, and special requirements required by the project.

D. Furnish adequate notice to police and fire departments, public transportation authorities, and school departments/districts of the proposed traffic maintenance plan including, but not limited to, detours, lane closures, and alternate routes.

E. Furnish, erect and maintain traffic control devices, as required by the traffic maintenance plan. Provide traffic control devices including lights, markings, barricades, warning signs, and all other safety precautions necessary to protect streets, sidewalks, access to adjoining property, and the traveling public within the area of the construction. Reference is made to the drawings for general guidelines for typical traffic control devices and their placements. These are intended as a guide only, and do not necessarily include all possible warning devices, control devices, or police details, which may be required by the project.

F. Remove, replace and/or reposition all traffic control devices, as necessary.

G. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT and as follows:

1. Any traffic control devices provided under this section which are lost, stolen, destroyed or deemed unacceptable while in use on the project, shall be immediately replaced at no additional cost to the Owner.

2. Uniformed Police Officers shall be paid for in accordance with SECTION 01025, MEASUREMENT AND PAYMENT.

3. Payment for work under this Item shall include, but not be limited to, supplying drums, signs, Type III barricades, arrow boards, message boards, removing and replacing damaged traffic control devices, moving and removing drums during non-work hours, providing steel plates as required, and moving traffic control devices to provide uninterrupted abutter access.

4. No payment shall be made for any work on this project until a Traffic Management Plan has been developed, submitted and approved by the Owner and/or Engineer.

B. The Contractor is responsible to obtain and provide two surety bonds. A $2,500,000 surety bond to cover the work located within the MassDOT Roadways identified as Cranberry Highway (Route 6A) and South Orleans Road (Route 28), and a second $500,000 surety bond to cover the Crossing work located within the MassDOT Roadway identified as Mid Cape Highway (Route 6).

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Traffic Management Plan.
2. Written Approval of the Traffic Management Plan from the Owner’s Safety Officer/Municipalities’ Safety Officer.

1.05 - SPECIAL REQUIREMENTS

A. Notify the Owner, state, local, and/or jurisdictional agencies well in advance of commencing construction. Arrange all detours, partial road closures, and alternate traffic patterns. Inform emergency departments on the daily status of project roadways.

B. Arrange for the services of uniformed police officers, as required to protect and facilitate the flow of vehicular and pedestrian traffic through the construction work zone.

C. During winter months, remove snow and prevent ice conditions within active construction work zones, and assist local or state agencies in clearing roads used as detour routes to facilitate uninterrupted movement of traffic.

D. No Work shall be started on the Project until a detailed Project Schedule and Engineered Traffic Management Plan has been submitted to and approved by the Engineer and MassDOT. In addition, during the construction of the Project update the Project Schedule weekly and inform the Engineer, Owner, MassDOT for work in the State Highway Layout, and all other applicable utilities or other entities affected by the Work in writing of changes to the approved Project Schedule.

PART 2 - PRODUCTS

2.01 - SAFETY CONTROLS AND SIGNING FOR CONSTRUCTION OPERATIONS

A. All signs, barricades and drums shall have reflective sheeting, in accordance with the Manual on Uniform Traffic Control Devices, latest edition and State of Massachusetts Department of Transportation Standard Specifications for Road and Bridge Construction.

B. The Contractor shall use sandbags or provide other suitable means to weigh down Portable Breakaway Barricades to minimize the disturbance of barricades by vandals.

C. Furnish, erect and maintain throughout the construction period warning and directional signs.

D. All traffic control devices not conforming in type, composition, and size to the standards specified herein shall not be used under this contract.

E. Each day, remove or cover all erected signs not consistent with the use of the roadway.

2.02 - FLAGS FOR ADVANCE WARNING SIGNS

A. Standard orange or red-orange flags (16 inch by 16-inch minimum) shall be mounted on all advance work area signs. Flags shall not interfere with a clear view of the sign face.

2.03 - TEMPORARY PRECAST CONCRETE BARRIER

A. Temporary Precast Concrete Barriers shall conform the State Standard Specifications.

B. Furnish, set up, move, maintain, and remove Temporary Precast Concrete Barriers, when positive traffic barriers are needed for traffic control and safety in construction zones.

C. Each run or bay of Temporary Precast Concrete Barrier units shall be installed and fastened together to form a continuous chain, in accordance with the requirements of the state or local agencies having jurisdiction.

2.04 - PORTABLE BREAKAWAY BARRICADE TYPE III

A. Portable Breakaway Barricades shall be a 4-foot unit and conform to the latest edition of the State Construction Standards, as shown on the drawings and any additional requirements of this specification.

B. Reflectorized sheeting shall conform to the State Standard Specifications. Alternating 6-inch-wide stripes shall be orange and white and shall slope downward at 45 degrees toward the end by which traffic is to pass. Pipe shall be Polyvinyl Chloride (PVC) pressure rated SDR 26 conforming to ASTM D2241. Fittings may be PVC conforming to ASTM D2665 or Acrylonitrile Butadiene Styrene (ABS) conforming to ASTM D2661 (Drainage Waste and Vent).

C. Furnish, set up, move, maintain (in good and serviceable condition), and remove Portable Breakaway Barricades as required by the performance of this work or as may be required by jurisdictional authorities, at no additional cost to the Owner.

2.05 - PORTABLE BARRIER FENCE

A. Construction of Portable Barrier Fences shall be as shown on the drawings. Include the necessary signs, reflectors, and all incidental equipment in order to provide the portable barrier fence, complete in place.

2.06 - REFLECTORIZED DRUMS

A. Reflectorized drums shall conform to the State Standard Specification and shall be as shown on the drawings. Other drum-type products providing equivalent target value and stability, and accepted by the State, may be used.

B. Drums shall be used in the protection of driveways, utility structures, and pedestrian control and safety throughout the construction period.

C. Warning lights shall conform to the State Standard Specifications. Drums shall be maintained in a satisfactory manner including the removal of dirt or road film that may cause a reduction in reflective efficiency.

D. The Contractor shall furnish, set up, move, maintain (in good and serviceable condition), and remove reflectorized drums with or without warning lights as required by the performance of his work or as directed by jurisdictional authorities, at no additional cost to the Owner.

2.07 - ADVANCED WARNING ARROW PANELS

A. Advance Warning Arrow Panels shall consist of a black background panel meeting the requirements of the State Standard Specifications. Each Special Lighting Unit shall automatically provide for a minimum of 50 percent dimming from their rated lamp voltage at night. The flashing rate of the lamps shall not be less than 25 nor more than 40 flashes per minute. The arrow panels shall have the capability of the following mode selections: (1) left or right flashing or sequential arrows; and (2) double flashing arrows.

B. Minimum height should be seven feet above the roadway to the bottom of the panel.

2.08 - PORTABLE CHANGEABLE MESSAGE SIGNS

A. The Contractor shall provide portable changeable message signs to provide advance warning to motorists prior to entering the construction area. The portable changeable message signs shall be available for immediate use throughout the duration of the project and be positioned in accordance with the Temporary Traffic Control Plan and/or at the direction of the Engineer. If the unit is found to be defective in any way it shall be replaced immediately at the Contractor's expense.

B. The portable changeable message signs display shall be full matrix LED signs utilizing 18-inch high characters on a display of 3 rows of characters with a minimum of 8 characters per line. The variable message signs shall have an encryption feature that provides data security.

C. Portable changeable message signs shall be Sunray 480 as manufactured by National Sign Incorporated, or equal.

2.09 - TEMPORARY PAVEMENT MARKINGS AND RAISED PAVEMENT MARKERS

A. Paints, tapes, and glass beads used for temporary pavement markings shall conform to the State Standard Specifications. The colors of the marking materials shall be white, yellow or black.

B. Raised pavement markers shall conform to the State Standard Specifications.

2.10 - PEDESTRIAN BARRICADE

A. Pedestrian Barricade shall be ADA Compliant, no trip hazard for pedestrians that meets or exceeds ADA Guidelines and Manual on Uniform Traffic Control Devices Standards.

B. Pedestrian Barricade shall be:

1. Approximately 38-inches high, 43-inches long and 16-inch wide.
2. Modular system can be shaped to any layout.
3. Stable in windy conditions.
4. Quick and easy to install without the use of supporting devices such as sandbags or water barrels.
5. Orange with retroreflective sheeting.
6. Anti-tamper linking system difficult for unauthorized personnel to dismantle when linked.

C. Pedestrian Barricade shall be Plasticade, Des Plaines, IL or approved equal.

D. Contractor shall provide 100 sections of Pedestrian Barricade to be used during construction.

PART 3 - EXECUTION

3.01 - PERFORMANCE

A. Furnish, erect and maintain suitable barriers, barricades, signs, markings, drums and all other traffic control devices necessary to protect all roadways, which are partially obstructed or closed to vehicular or pedestrian traffic, as a result of this project.

B. The Owner reserves the right to suspend work, if inadequate traffic control devices are provided to control and protect both vehicular and pedestrian traffic.

C. Completely backfill all trenches at the end of each workday and/or when work is suspended for indefinite periods. In addition, install temporary trench patch each and every Friday or the last day of the work week, whichever comes first.

D. All damage to the work, pedestrians and/or public/private property due to failure to place or maintain adequate warning or directional signs or other traffic control devices shall be corrected and/or replaced at no additional cost to the Owner.

E. Furnish, supply, maintain and remove temporary white and/or yellow reflectorized and/or black non-reflectorized pavement markings, as required by the performance of his work or as directed by jurisdictional authorities, at no additional cost to the Owner. For the purpose of this specification, temporary markings shall mean markings with an effective marking period of 90-days.

F. Remove existing pavement markings as required by the performance of his work or as directed by jurisdictional authorities, at no additional cost to the Owner. Pavement marking removal methods shall not cause damage to the pavement or cause significant change in its texture. Any damage to the pavement or surfacing caused by pavement marking removal shall be satisfactorily repaired, at no additional cost to the Owner.

G. Provide all necessary temporary pavement markings, and/or temporary raised pavement markers following the completion of each week's operation, change in detour routing or prior to opening the roadway to traffic. Make all necessary arrangements for this work, as required. Continually replace the temporary pavement markings until the final pavement markings have been provided on the final pavement.

H. Transport and relocate any or all signs, barriers, barricades, or other safety devices as specified herein, as required or directed during the project. No additional payment will be provided for relocating and removing traffic control devices.

3.02 - TRAFFIC MANAGEMENT PLAN

A. The hours of operation shall be limited as required by permitting agencies and/or as required by the municipality.

B. $L = S \times W$ for speeds of 45 mph or more and/or $L = W \times S / 60$ for speeds of 40 or less where:

1. L = minimum length of taper
2. S = numerical value of posted speed limit prior to work or 85th percentile speed
3. W = width of offset

C. The maximum spacing between channelizing devices in a taper should be approximately equal in feet to the speed limit.

D. The maximum spacing between channelizing devices should be approximately equal in feet to two times the speed limit.

E. Channelizing devices are to be extended to a point where they are visible to approaching traffic.

F. Warning lights (steady burn Type C) should be used to mark channelizing devices at night as needed.

G. Pavement markings no longer applicable which could create confusion shall be removed. Temporary pavement markings shall be used as necessary and shall be in place prior to work completed each night.

H. Signs and sign supports shall meet criteria in NCHRP 350. No signs shall be attached to drums or cones. All signs shall be attached to independent supports.

I. Exact location of signs shall be approved by the engineer. Distances may be adjusted slightly to meet with field conditions.

J. All traffic control signs shall be completely covered or removed at the end of each work day or when otherwise not in effect.

K. Advisory speed at site to be determined by the municipality prior to the start of construction.

L. As required by the local safety officer, police details shall be used to direct traffic around a work area if traffic must be temporarily stopped or rerouted to allow for movement of work vehicles or other equipment.

M. As required by the local safety officer, in low volume traffic roadways, if the entire work area is visible from one station, a single police officer may be used. A single officer shall be stationed on the shoulder opposite the obstruction or work place or in a position where good visibility and traffic control can be maintained at all times.

N. As required by the local safety officer, in areas of heavy traffic volume or critical work areas, 2 or more police officers shall be used. Where 2 or more police officers are required, all police officers must be in communication with each other and should be clearly visible to the traffic which is being controlled.

O. Flood lights should be provided to mark police detail stations at night as needed.

P. Operation of traffic signal controls at intersections should be coordinated with local authorities.

Q. The contractor shall square off full width of roadway (10:1 slope) at the end of each work day, where applicable.

R. At the end of the work day the contractor shall ensure that safe access/egress of all driveways, entrances and exits are maintained during night time and on weekends.

S. If detour plans which use local roadways are required, they must be approved by engineer in writing prior to commencing work.

3.03 - PORTABLE CHANGEABLE MESSAGE SIGNS

A. Portable changeable message signs shall be positioned in accordance with the traffic control plan and/or at the direction of the Engineer. The portable changeable message signs shall be visible from a minimum distance of 900 feet with a viewing angle of no less than 30 degrees. The Contractor shall take appropriate measures as needed within the roadway layout to provide the required minimum sight distance. The Contractor shall be responsible for the maintenance of each device and appurtenance.

B. The Contractor shall be responsible for all maintenance associated with all portable changeable message signs. This includes, but is not limited to knockdowns, power outages, equipment malfunctions, temporary modifications to support the traffic control plan during construction and any other incidents within the project limits.

3.04 - PEDESTRIAN BARRICADE

A. Pedestrian barricades shall be installed to protect pedestrians at locations within the Project areas.

B. Pedestrian barricades shall be unassembled and reassembled, as necessary, throughout the duration of construction.

C. The Pedestrian Barricades shall remain the property of the OWNER upon completion of the Project. Following construction activities, the Contractor shall clean the Pedestrian Barricade and replace sections damaged during construction.

3.05 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 01600

CONTROL OF MATERIALS

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PART 1 - GENERAL

1.01 - SCOPE

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products including:

1. Definitions.
2. Submittals.
3. Spare parts.
4. Quality assurance.
5. Delivery, storage and handling.
6. Warranty.
7. Products.
8. Substitution and “Or Equal” items.
9. Reuse of existing material.
10. Owner Furnished Products.
11. Manufacturer’s instructions.
12. Special tools.
13. Lubrication.
14. Nameplates.
15. Loads and seismic forces.
16. General material and equipment requirements.
17. Materials and Equipment.
18. Field Quality Control; Installation, and Instructional.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

C. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and accepted through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT C-700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Engineer’s Action: If necessary, Engineer will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Engineer will notify Contractor of acceptance or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later. Use product specified if Engineer does not issue a decision on use of a comparable product request within time allocated.

1.05 - PRODUCT HANDLING

A. Comply with the requirements of SECTION 01610, DELIVERY, STORAGE AND HANDLING.

B. Contractor shall arrange deliveries of materials and equipment in accordance with construction Progress Schedule, coordinate to avoid conflict with Work and conditions at Project site.

C. Provide equipment and personnel to handle materials and equipment by methods recommended by manufacturer to prevent soiling or damage to materials or equipment, or their packaging.

D. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

E. Owner assumes no responsibility for damage or loss due to storage of materials and equipment.

F. Interior Storage:

1. Store with seals and labels intact and legible.
2. Store materials and equipment subject to damage by elements in weathertight enclosures.
3. Maintain temperature and humidity within ranges required by manufacturer’s instructions.

G. Exterior Storage:

1. Store fabricated materials and equipment above ground, on blocking or skids, to prevent soiling or staining. Cover materials and equipment subject to deterioration with impervious sheet coverings. Provide ventilation to avoid condensation.

2. Store loose granular materials in well drained area on solid surfaces to prevent mixing with foreign matter.

3. Store materials such as pipe, reinforcing steel, structural steel, and equipment on pallets or racks, off ground.

H. Inspection and Maintenance:

1. Arrange storage to provide easy access for inspection, maintenance, and inventory.

2. Make periodic inspections of stored materials and equipment to ensure materials and equipment maintained under specified conditions are free from damage or deterioration, and coverings are in-place and in condition to provide required protection.

3. Perform maintenance on stored material and equipment in accordance with manufacturer's written instructions and in presence of Owner or Engineer.

a. Notify Engineer 24 hrs before performance of maintenance.

b. Submit report of completed maintenance and condition of coverings to Engineer with each Application for Payment.

c. Failure to perform maintenance, to notify Engineer of intent to perform maintenance or to submit maintenance report may result in rejection of material or equipment.

I. Contractor shall assume responsibility for protection of completed construction and repair and restore damage to completed Work equal to original condition.

J. Wheeling of loads over finished floors, with or without plank protection, is not permitted in anything except rubber tired wheelbarrows, buggies, trucks or dollies. This applies to finished floors and exposed concrete floors, as well as those covered with composition tile or other applied surfacing.

K. Where structural concrete is also finished surface, avoid marking or damaging surface.

1.06 - DESIGN CRITERIA – Not Used

1.07 - QUALITY ASSURANCE

A. Comply with the requirements specified in SECTION 01400, QUALITY ASSURANCE.

B. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.08 - REFERENCED STANDARDS

A. American Society of Mechanical Engineers (ASME):

1. B1.1: Unified Inch Screw Threads (UN and UNR Thread Form)

B. American Society for Testing and Materials International (ASTM):

1. A123/A123M: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

2. A325/A325M: Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

C. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.09 - SPARE PARTS

A. Provide spare parts for Products as specified in the individual technical Specification sections.

B. Pack spare parts to protect them during storage. Tag spare parts and containers to clearly identify them in accordance with Contractor's parts numbering system as reviewed by Engineer. All parts shall be cross-referenced to their applicable the Specification section.

1.10 - WARRANTY

A. Warranties specified in other Specification sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.

3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in SECTION 01700, CONTRACT CLOSEOUT

1.11 - PRODUCTS

A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.

C. Furnish interchangeable components from same manufacturer for components being replaced.

1.12 - ACCEPTANCE OF MATERIALS

A. Unless otherwise specified, only new materials and equipment shall be incorporated in the Work. All materials and equipment furnished by Contractor shall be subject to the inspection and acceptance of Engineer. No material shall be delivered to the Project site without prior acceptance of the Engineer.

B. As specified in SECTION 01300, SUBMITTALS, Contractor shall submit to Engineer, data relating to materials and equipment he proposes to furnish for the work. Such data shall be in sufficient detail to enable the Engineer to identify the particular product and to form an opinion as to its conformity to the specifications.

C. Facilities and labor for handling and inspection of all materials and equipment shall be furnished by Contractor. If the Engineer requires, either prior to beginning or during the progress of the Work, Contractor shall submit additional samples or materials for such special tests as may be necessary to demonstrate that they conform to the Specifications. Such samples shall be furnished, stored, packed, and shipped at Contractor's expense. Except as otherwise noted, Owner will make arrangements for and pay for the tests.

D. Any delay of acceptance resulting from Contractor's failure to submit samples or data promptly shall not be used as a basis of a claim against Owner or Engineer.

E. In order to demonstrate the proficiency of workmen or to facilitate the choice among several textures, types, finishes, and surfaces, Contractor shall provide such samples of workmanship or finish as may be required.

F. The materials and equipment used on the Work shall correspond to the accepted samples or other data.

1.13 - REUSE OF EXISTING MATERIAL

A. Except as specifically indicated or specified, do not use materials and equipment removed from existing structure(s) in new Work.

B. For material and equipment specifically indicated or specified to be reused in Work:

1. Use special care in removal, handling, storage, and reinstallation to ensure proper function in completed Work.

2. Contractor shall arrange and pay for transportation, storage, and handling of products which require off-site storage, restoration or renovation.

3. Off-site storage areas and buildings shall conform to requirements of this Specification section.

1.14 - OWNER-FURNISHED PRODUCTS – Not Used

1.15 - MANUFACTURER'S INSTRUCTIONS

A. Installation of equipment and materials shall comply with manufacturer's instructions. Obtain and distribute printed copies of such instructions to parties involved in installation, including two (2) copies to Engineer.

1. Maintain one (1) set of complete instructions at the Project site during installation and until completion of Work.

B. Handle, store, install, connect, clean, condition, and adjust materials and equipment in accordance with manufacturer's written instructions and in conformance with the Specifications.

1. If Project site conditions or specified requirements conflict with manufacturer's instructions, consult Engineer for further instructions. Do not proceed with Work without written instructions.

1.16 - SPECIAL TOOLS

A. For each type of equipment furnished, Contractor shall provide a complete set of all special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation, maintenance, and disassembly of such equipment. Tools shall be high-grade, smooth, forged, alloy, tool steel. Grease guns shall be lever type.

B. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment.

C. Pack items to protect them during storage. Tag items and containers to clearly identify them in accordance with Contractor's part system, as reviewed by Engineer. Cross reference all items to their applicable Specification section.

D. Special tools shall be delivered at the same time as the equipment to which they pertain. Contractor shall properly store and safeguard such special tools until completion of the Work, at which time they shall be delivered to Owner.

E. Contractor shall furnish and erect one (1) or more steel wall cases with flat key locks and clips or hooks to hold each tool in arrangement.

1.17 - LUBRICATION

A. Where lubrication is required for proper operation of equipment, incorporate necessary and proper provisions in equipment in accordance with manufacturer's requirements. Where possible, lubrication shall be automated and positive.

B. Where oil is used, reservoir shall be of sufficient capacity to supply unit for 24 hr period.

C. Provide adequate and, as far as practicable, automatic means of lubrication for working parts. Arrange lubrication grease nipples, grease boxes and other lubrication devices so that they are readily accessible for routing greasing using grease nipples and Type 316 stainless steel or copper tubing extensions where required. Secure nipples and tubing to the equipment at appropriate locations. Indicate on the working drawings submitted, the types of lubricants to be used. Use grease nipples of a consistent type, Alemite button head type or equivalent. Provide grease gun(s) of the appropriate size(s) and pressure(s).

D. Provide a one (1) year supply of all lubricants necessary for the routine, daily operation of the equipment. All lubricants to be readily available to the Owner. Provide a complete schedule of all the lubricant including the manufacturer name, type, name and local address and phone number of where each lubricant can be purchased for each piece of equipment.

1.18 - NAMEPLATES

A. With the exceptions mentioned below, each piece of equipment shall be provided with a nameplate of non-corrodible metal, securely fastened in place and clearly and permanently inscribed with the manufacturer's name, model or type designation, serial number, principal rated capacities, electrical or other power characteristics, and similar information.

B. This requirement shall not apply to standard, manually operated hydrants or to gate, globe, check and plug valves.

1.19 - LOADS AND SEISMIC FORCES

A. Provide anchorage and supports for products, including equipment, assemblies, and pipe, designed to resist the following loads and seismic forces.

1. Horizontal forces: 100 percent of dead and live loads acting in any direction in the horizontal plane applied to the center of gravity of the load.

2. Vertical forces: 50 percent of the dead and live load, acting either upward or downward applied at the center of gravity of the load.

3. Cantilevered anchorages/supports: 100 percent of the dead and live loads acting in any direction applied at the center of gravity of the load.

B. Seismic force determination: Maximum dead and live loads conditions while operating.

C. Products, including equipment and assemblies, in normal submerged condition operation: analysis of seismic forces in both submerged/dry condition.

D. Above ground tanks, their supports and anchorages: Design fabricate and install to comply with the seismic requirements of applicable codes.

E. Analysis of loads and seismic force: Performed by a registered structural professional Engineer in the Commonwealth of Massachusetts with experience in this type of work.

F. Furnish copies of all analyses with the submittals for equipment, assemblies, and pipe.

1.20 - GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

A. The requirements of this Paragraph shall constitute the standards for the material and equipment specified herein. Should these requirements conflict with the Supplier’s recommendations or in any way be less stringent than the Supplier’s requirements, they shall be superseded by the Supplier’s requirements.

B. Bolts, Anchor Rods and Nuts:

1. All necessary bolts, anchor rods, nuts, washers, plates and bolt sleeves shall be furnished by the contractor in accordance herewith. Anchor rods shall have suitable washers and hexagonal nuts.

2. All anchor rods, nuts, washers, plates, and bolt sleeves shall be galvanized unless otherwise indicated or specified.

3. Unless otherwise specified, stud, tap, and machine bolts, and nuts shall conform to the requirements of ASTM Standard Specification for Carbon Steel Externally and Internally Threaded Standard Fasteners, Designation A325. Hexagonal nuts of the same quality of metal as the bolts shall be used. All threads shall be clean cut and shall conform to ANSI Standard B1.1 for Unified Inch Screw Threads (UN and UNR Thread Form).

4. Bolts, anchor rods, nuts, and washers, specified to be galvanized, shall be zinc coated, after being threaded, by the hot-dip process in conformity with the ASTM Standard Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip, Designation A123, or the ASTM Standard Specifications for Zinc Coating (Hot Dip) on Iron and Steel Hardware, Designation A153, as is appropriate.

5. Bolts, anchor rods, nuts, and washers specified to be stainless steel shall be Type 316 stainless steel.

6. Anchor rods shall be set accurately. They shall be carefully held in suitable templates of acceptable design. Where indicated on the Drawings, specified, or required, anchor bolts shall be provided with square plates at least 4 in. by 4 in. by 3/8 in. or shall have square heads and washers and set in the concrete forms with suitable pipe sleeves, or both. If anchor are set after the concrete has been placed, all necessary drilling and grouting or caulking shall be done by Contractor and care shall be taken not to damage the structure or finish by cracking, chipping, spalling, or otherwise during the drilling and caulking.

C. Grease Fittings:

1. Provide extension fittings and tubing on all grease fittings that are installed in an inaccessible location. The extension is to be located so that equipment can be lubricated from the operating level without the use of ladders, staging or shutting down the equipment. Tubing: 316 stainless steel.

D. Concrete Inserts For Hangers:

1. Concrete inserts for hangers shall be designed to support safely, in the concrete that is used, the maximum load that can be imposed by the hangers used in the inserts. Inserts for hangers shall be of a type which will permit adjustment of the hangers both horizontally (in one plane) and vertically and locking of the hanger head or nut. All inserts shall be galvanized by the hot-dip process in conformity with the ASTM Standard Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip, Designation A123, or the ASTM Standard Specifications for Zinc Coating (Hot Dip) on Iron and Steel Hardware, Designation A153, as is appropriate.

E. Equipment Foundations, Installation and Grouting:

1. Contractor shall furnish the necessary materials and construct suitable concrete foundations for all equipment installed by him, even though such foundations may not be indicated on the Drawings. The tops of foundations shall be at such elevations as will permit grouting as specified below.

2. All such equipment shall be installed by skilled mechanics and in accordance with the instructions of the manufacturer.

3. In setting pumps, motors, and other items of equipment customarily grouted, Contractor shall make an allowance of at least 1-inch for grout under the equipment bases. Shims used to level and adjust the bases shall be steel. Shims may be left embedded in the grout, in which case they shall be installed neatly and so as to be as inconspicuous as possible in the completed work. Unless otherwise permitted, all grout shall be a suitable non-metallic, non-shrink grout.

4. Grout shall be mixed and placed in accordance with the recommendations of the manufacturer. Where practicable, the grout shall be placed through the grout holes in the base and worked outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a suitable chamfer around the top edge of the finished foundation.

5. Where such procedure is impracticable, the method of placing grout shall be as accepted byEngineer. After the grout has hardened sufficiently, all forms, hoppers, and excess grout shall be removed, and all exposed grout surfaces shall be patched in an accepted manner and given a burlap-rubbed finish.

F. Equipment Drive Guards:

1. All equipment driven by open shafts, belts, chains, or gears shall be provided with acceptable all-metal guards enclosing the drive mechanism. Guards shall be constructed of galvanized sheet steel (12 gage minimum) or galvanized woven wire or expanded metal set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps which will permit easy removal for servicing the equipment. Guards shall conform in all respects to all applicable safety codes and regulations.

2. Provide pivoting access covers for shaft speed measurements.

G. Sleeves:

1. Unless otherwise indicated on the Drawings, or specified, form openings for the passage of pipes, conduits, and circular ducts through floors and walls using sleeves of standard weight, galvanized-steel pipe. Provide sleeves of ample diameter to pass the pipe and its insulation, if any, and to permit expansion as may occur. Provide sleeves that are flush at the walls and at the bottom of slabs and project 4-inches above the finish floor surface. Threaded nipples shall not be used as sleeves.

2. Sleeves in exterior walls below ground or in walls that have liquids on one or both sides, shall have a 2-inch annular fin of 1/8-inch plated welded with a continuous weld completely around the sleeve at mid-length. Galvanize sleeves after the fins are attached.

3. Sleeves shall be set accurately before the concrete is placed or shall be built in accurately as the masonry is being built.

H. Protection Against Electrolysis:

1. Where dissimilar metals are used in conjuction with each other, provide insulation between adjoining surfaces to eliminate direct contact and any resultant electrolysis. Provide bituminous insulation, heavy bituminous coatings, nonmettalic separators or washers, impregnated felt, or other means to provide insulation.

PART 2 - PRODUCTS AND SERVICES

2.01 - MATERIALS AND EQUIPMENT

A. Material and Equipment Incorporated into Work:

1. Conform to applicable specifications and standards.

2. Comply with size, make, type, and quality specified or as accepted by Submittal.

B. Manufactured and Fabricated Materials and Equipment:

1. Design, fabricate, and assemble in accordance with engineering and shop practices standard with industry.

2. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.

3. Two (2) or more items of same kind shall be identical, by same manufacturer.

4. Material and equipment shall be suitable for service conditions.

5. Equipment capabilities, sizes, and dimensions shown or specified shall be adhered to, unless variations are specifically accepted, in writing.

6. Equipment shall be adapted to best economy in power consumption and maintenance. Parts and components shall be proportioned for stresses occurring during continuous or intermittent operation, and for additional stresses occurring during fabrication or installation.

7. Design so working parts are readily accessible for inspection and repair, easily duplicated, and replaced.

8. Design structural members of equipment for anticipated shock and vibratory loads.

9. Design machinery such that working parts are readily accessible for inspection and repair, and that each part is suitable for the service required.

C. Do not use material or equipment for purpose other than for which it is designed or specified.

PART 3 - EXECUTION

3.01 – FIELD QUALITY CONTROL; INSTALLATION, AND INSTRUCTIONAL SERVICES

A. General

1. Provide on-site services of Supplier's representatives for equipment provided by Contractor during construction, installation, equipment startup, and training of Owner's personnel for equipment or plant operation as specifically required in Specification sections for equipment or systems.
2. Include and pay costs for Supplier's services.
3. Work day is defined as 8 hr period during Owner's or Contractor's typical calendar day. Work day for purposes of this section does not include travel to or from the Project Site.
4. Specification sections include minimum mandays to provide basis for bidding. If additional time is required to perform services Contractor shall include that time in the Contract Price.

B. Installation Services

1. Where installation services are called for in the Specifications, provide competent and experienced technical representatives of manufacturers of material or equipment and systems to resolve assembly or installation procedures attributable to, or associated with, equipment furnished.
2. After equipment is installed, representatives shall perform initial equipment and system adjustment and calibration to conform to the Specifications and manufacturer's requirements and instructions.
3. Provide "Certificate of Installation Services" stating proper adjustments have been made to equipment or system and equipment or system is ready for startup and system demonstration.

C. Training

1. Do not start training until Installation Services have been completed.
2. Where training is called for in the Specifications, provide competent and experienced technical representative of Supplier to provide detailed instructions to Owner's personnel for operation of equipment. Training services shall include operation and maintenance of instrumentation and equipment in classroom and on-site. Training shall include electrical, mechanical, and safety aspects of equipment.
3. Submit documentation identifying name of specific representative, factory authorization, and background of named individual(s) to conduct training. Submit information 30 days before scheduled training period for review and acceptance by Engineer.
4. Coordinate training periods with Engineer, Owner and Supplier's representatives.
    a. No training shall be conducted unless instructor has been accepted by Engineer.
    b. Notify Engineer at least 48 hrs before training sessions are to begin so Engineer can make arrangements with Owner's operating personnel.
    c. Reschedule canceled training sessions 48 hrs in advance.
    d. Failure of Supplier's or manufacturer's representative to appear for scheduled training, failure to notify Engineer 24 hrs in advance of need to cancel scheduled training or failure to arrive within 30 minutes of start of scheduled training shall result in reimbursement to Owner for time lost by Owner's personnel in waiting for arrival of manufacturer's representative. Except in case of failure to arrive on time, time will not exceed 1 hr for each employee scheduled to receive training. Failure to arrive on time will be reimbursed by actual time late, up to 1 hr, after 1 hr training will be rescheduled.
    e. Failure of Supplier's or manufacturer's representative to appear for scheduled training, failure to notify Engineer 24 hrs in advance of need to cancel scheduled training or failure to arrive within 30 min of start of scheduled training shall result in reimbursement to Owner for expenses and time incurred by Engineer in traveling and time spent on-site. Minimum time billed shall be 8 hrs.

5. Similar types of equipment differing in model, size or manufacturer shall require equal service time as stated in specific Specification section.
6. O&M data shall constitute basis of instruction. Review data contents with personnel in full detail to explain aspects of operations and maintenance.
7. Instructional Services shall be completed before start of performance testing required in SECTION 01650, FACILITY START-UP AND TESTING REQUIREMENTS.
8. Provide “Certificate of Instructional Services”, cosigned by Owner and Supplier’s representative, verifying training has been accomplished to satisfaction of each party.

3.02 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 01610

DELIVERY, STORAGE AND HANDLING

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 1
1.03 - DEFINITIONS 1
1.04 - SUBMITTALS – Not Used 2
1.05 - PRODUCT HANDLING 2
1.06 - DESIGN CRITERIA – Not Used 3
PART 2 – PRODUCTS – Not Used 3
PART 3 – EXECUTION – Not Used 3

PART 1 - GENERAL

1.01 - SCOPE

A. This Section specifies the general requirements for the delivery handling, storage and protection for all items required in the construction of the work. Specific requirements, if any, are specified with the related item.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS – Not Used

1.05 - PRODUCT HANDLING

B. Transportation and Delivery

1. Transport and handle items in accordance with manufacturer's printed instructions.
2. Schedule delivery to reduce long term on-site storage prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Engineer.
3. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged or sensitive to deterioration.
4. Deliver products to the site in manufacturer's original sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, protecting and installing.
5. All items delivered to the site shall be unloaded by the Contractor and placed in a manner which will not hamper the Contractor's normal construction operation or those of subcontractors and other contractors and will not interfere with the flow of necessary traffic. The Owner shall not offload any materials or equipment at the site.
6. Provide equipment and personnel to unload all items delivered to the site.
7. Promptly inspect shipment to assure that products comply with requirements, quantities are correct, and items are undamaged. For items furnished by others (i.e. Owner, other Contractors), perform inspection in the presence of the Engineer. Notify Engineer verbally, and in writing, of any problems.

C. Storage and Protection

1. Store and protect products and equipment in accordance with the manufacturer's instructions, with seals and labels intact and legible. Storage instruction shall be studied by the Contractor and reviewed with the Engineer by him. Instructions shall be carefully followed and a written record of this kept by the Contractor for each product and pieces of equipment.
2. Arrange storage of products and equipment to permit access for inspection. Periodically inspect to make sure products and equipment are undamaged and are maintained under specified conditions.
3. Provide protective maintenance during storage consisting of manually exercising equipment, inspecting mechanical surfaces for signs or corrosion or other damage, lubricating, applying any coatings as recommended by the equipment manufacturer necessary for its protection and all other precautions to assure proper protection of all equipment stored and for compliance with manufacturers' requirements related to warranties.
4. Store loose granular materials on solid flat surface in a well-drained area. Prevent mixing with foreign matter.
5. Cement and lime shall be stored under a roof and off the ground and shall be kept completely dry at all times. All structural, miscellaneous and reinforcing steel shall be stored off the ground or otherwise to prevent accumulation of dirt or grease, and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored with the webs vertical. Precast concrete shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping or cracking. Brick, block and similar masonry products shall be handled and stored in manner to reduce breakage, cracking and spalling to a minimum.

6. All mechanical and electrical equipment and instruments shall be covered with canvas and stored in a weathertight building to prevent injury. The building may be a temporary structure on the site or elsewhere, but it shall be satisfactory to the Engineer. Building shall be provided with adequate ventilation to prevent condensation. Maintain temperature and humidity within range required by manufacturer and to prevent condensation on the equipment being stored.

    a. All equipment shall be stored fully lubricated with oil, grease and other lubricants unless otherwise instructed by the manufacturer.

    b. Moving parts shall be rotated a minimum of once weekly to insure proper lubrication and to avoid metal-to-metal "welding".

    c. Upon installation of the equipment, the Contractor shall start the equipment, at least half load, once weekly for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.

    d. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants shall be put into the equipment at the time of acceptance.

    e. For electrical equipment (including switchgear, switchboards, motor control centers, and variable frequency drives) installed in areas where temperature and humidity are not controlled for, provide temporary heaters in accordance with manufacturer’s recommendations to prevent condensation prior to energization of equipment.

    f. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.

1.06 - DESIGN CRITERIA – Not Used

PART 2 – PRODUCTS – Not Used

PART 3 – EXECUTION – Not Used

END OF SECTION

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SECTION 01650

FACILITY START-UP AND TESTING REQUIREMENTS

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1.01 - SCOPE 1
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1.03 - DEFINITIONS 2
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PART 1 - GENERAL

1.01 - SCOPE

A. The Contractor shall be responsible for furnishing of all labor, equipment, appliances and materials and performing all operations in connection with the facility testing and inspection and startup and performance testing prior to final acceptance of all process systems, including the coordination of all performance tests and the furnishing of operating instructions for all equipment.

B. Start-up and Testing Requirements for individual equipment systems shall be as indicated for all equipment as specified in individual sections in DIVISIONS 11, EQUIPMENT, 15, MECHANICAL and 16, ELECTRICAL.

C. HVAC systems shall be tested and balanced in accordance with DIVISION 15, MECHANICAL. Fire Protection Systems shall be commissioned in accordance with DIVISIONS 10, SPECIALTIES and 15, MECHANICAL.

D. Electrical and Fire Alarm tests shall be performed as specified in DIVISION 16, ELECTRICAL.

E. The Instrumentation and Control System tests shall be performed as specified in DIVISION 13, SPECIAL CONSTRUCTION.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

10. Shop Testing is defined as testing that is done by the manufacturer either at the place of manufacture, the place of assembly, or at another location where the required testing apparatus is located, for the purpose of proving that the equipment meets the requirements of the pertinent technical specification(s).

11. Physical Checkout, Inspection and Certification is defined as the process of physically inspecting products after they have been installed in the work, and then certifying that the products have been properly and completely installed, and are ready for field and/or start-up.

12. Field Testing or Functional Testing is defined as testing that is performed by the Contractor with supplier assistance on products they have been installed in the work and after the performance of physical checkout, for the purpose of proving that the tested products meet the requirements of the pertinent technical specifications.

13. Start-up is defined as the initial operation of a sufficiently completed facility and/or plant process by the Owner, utilizing wastewater and related substances (sludge, wastewater, scum), or other media which the facility has been designed to process.

14. Full System Testing is defined as testing performed on a "system" normally comprised of two or more pieces of equipment, after the equipment has been installed in the work, and after physical checkout and field testing has been completed, for the purpose of providing that the system meets requirements as specified and as indicated.

15. Performance Testing is defined as testing performed to verify performance of the individual components under actual and simulated operating conditions. The tests shall indicate compliance with the performance requirements in the individual specification sections.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Submit data and certificates in accordance with SECTION 01300, SUBMITTALS and as specified herein.

2. Submit detailed specific start-up plans for each significant mechanical or process system.

1.05 - RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1, GENERAL REQUIREMENTS, Specification Sections, apply to this section.

1.06 - SHOP TESTING

A. When required by the technical specifications, perform shop testing prior to delivery of the equipment or material. Provide thirty days written notice indicating the time and place of testing. Submit the following for approval thirty days prior to this notice.

1. Description of the Test - Specifically outlining how tests will conform to the requirements in the technical specifications.

2. Testing Devices That Will be used In the Tests - Description must state what portion of the tests that the devices will perform or measure, and device accuracy. Submit sample measurement results and catalog cuts.

3. Personnel Used to Perform the Tests - Resumes, qualifications, and experience shall be submitted. As a minimum, personnel shall have three years' experience with the manufacturer and operation of the equipment to be tested and will have participated in 5 similar tests during this period of experience.

4. Schedule for Testing - Schedule shall include frequency of measurements, personnel present and contingency plans for equipment and/or test failure.

5. Test Forms - Submit all forms used to record and report on shop test data, for approval, prior to the test. Forms shall include description of test, equipment used, personnel present, equipment tag ID numbers, and measurements made. Forms shall conform to the Engineer's format for heading and check off sections. Forms shall have a place for signature by the chief testing person, and an officer of the company that the tests performed are true, accurate, have me the required criteria, and that the equipment will operate as indicated and as specified.

B. Shop test procedures will be reviewed and returned by the Engineer. Incorporate minor comments on the procedures, equipment, or personnel prior to testing. Major comments by the Engineer will require a resubmission of the shop test procedure and proposed test date. The Contractor will be notified, in writing by the Engineer, if a formal resubmission is required with the transmittal of the review comments.

C. Submit the following within one week after completion of the tests for approval:

1. Completed test forms, for each device tested, on forms as approved prior to the test.

2. Completed certification, the content of which was approved prior to the tests.

3. A written summary of testing, reporting on the results and summarizing the entire procedure.

4. A schedule for retesting, if necessary. Perform any retesting required to fulfill the intent of the technical specification test requirements at no additional cost to the Owner.

1.07 - FIELD/FUNCTIONAL TESTING OF EQUIPMENT

A. When required by the technical specifications, perform field or functional testing on installed equipment. If none are required by the technical specifications, complete field / functional testing as detailed below. Field / functional -esting shall be in addition to and not in lieu of, any shop testing either required or otherwise performed. Perform testing as a part of the overall testing process defined herein. However, the following specific instructions shall also apply. Provide thirty days written notice indicating the date and time for testing one piece of equipment, or a series of equipment pieces. Submit with this notice the following for approval by the Engineer:

1. Description of the Tests - specifically outlining how the test will conform to the requirements in the technical specifications.
2. Testing Devices That Will Be Used in the Tests - Description shall state what portion of the tests that the devices will perform or measure, and device accuracy. Submit sample measurement results and catalog cuts.
3. Personnel Used to Perform the Tests - Submit resumes, qualifications, and experience. As a minimum, personnel must have three years' experience with the manufacturer and operation of the equipment to be tested and will have participated in five similar tests during this period of experience.
4. Schedule of Testing - Schedule shall include frequency of measurements, personnel present and contingency plans for equipment and/or test failure.
5. Test Forms - Review and comment on all forms provided by the Engineer for recording reporting on the field test data, prior to the test.
6. Material and Equipment Required for the Test - This material and equipment shall be supplied by the Contractor or his/her subcontractors at no additional cost to the Owner.
7. Water and Power Requirements - Water and power requirements shall be identified in the plan by the Contractor and will be supplied by the Contractor for field testing purposes only. The Contractor shall provide all temporary piping and wiring required for field testing; and equipment and labor for the reuse of the test water.
8. Disposal of Waste – The Contractor is responsible for the proper disposal of all wastes generated from the testing at no additional cost to the Owner.

B. Field test procedures will be reviewed and returned by the Engineer. Incorporate minor comments on the procedures, equipment, or personnel prior to testing. Major comments by the Engineer will require a resubmission of the field test procedure and proposed test date. The Contractor will be notified, in writing, by the Engineer if a formal resubmission is required with the transmittal of the review comments.

C. Submit within one week after completion of the tests, the following to the Engineer for approval.

1. Completed test forms for each device tested on forms provided prior to the tests.
2. Completed certification documentation, the content of which was approved prior to the tests.
3. A written summary of testing, reporting on the results and summarizing the entire procedure.
4. A schedule for retesting, if necessary. Perform any retesting required to fulfill the intent of the technical specification test requirements at no additional cost to the Owner.

D. Minimum field test requirements include

1. Calibrate equipment as required. For pumps, use water as a calibration liquid.
2. Test equipment and systems through a normal start, normal stop, and all emergency shutdown sequences.
3. Complete a four-hour running test. For variable speed units, the test shall include running for three complete cycles of one-hour duration at the maximum and minimum speeds for one half of each of those cycles. Operate each system through its normal automatic sequence of operation. During the four-hour test, observe and record all level indications, flow indicators, and pressure indicators.

4. If the equipment utilizes a local programmable logic controller (PLC), verify that the PLC is capable of operating and controlling the system as specified in the individual specification sections. Also verify all communications with distributed control system (DCS) are as specified.
5. For equipment not supplied with a PLC, verify that the instrumentation and control system is capable of operating and controlling the system.
6. Check safety devices, and interlocks for satisfactory operation. Check instrumentation and control systems for conformance with the Specifications.
7. Check for system leaks and proper valve operation.
8. Demonstrate to the Owner's Representative that all temporary jumpers and/or bypass have been removed and that all of the components are operating under their own controls as designated.
9. Coordinate start-up activities with the Owner's representative and with the Engineer prior to commencing system start-up.

E. Motor Testing

1. Visually inspect the motor for any physical damage.
2. Before energizing any machine, visually inspect for serviceability. Verify that proper alignment has been performed. Check nameplate for electrical power requirements.
3. Test run all motors before placing into regular service. A check on the motor for rotation, speed, current and temperature rise shall be made and the results recorded. Maintain the proper color codes for phase identifications. A motor phase rotation meter should be used prior to connection at motor to prevent later swaps of phase wires.

F. Engine Generator Test

1. Visual and Mechanical Inspection.
    a. Compare equipment nameplate data with drawings and specifications.
    b. Inspect physical and mechanical condition.
    c. Inspect correct anchorage and grouting.
2. Electrical and Mechanical Tests.
    a. Perform an insulation-resistance test on generator winding with respect to ground in accordance with ANSI/IEEE Standard 43. Calculate polarization index.
    b. Test protective relay per applicable NETA standards.
    c. Perform phase-rotation test to determine compatibility with load requirements.
    d. Functionally test engine shutdown for low oil pressure, over temperature overspeed, and other features as applicable.
    e. Conduct performance test in accordance with ANSI/NFPA Standard 110, (Installation Acceptance).
    f. Verify correct function of governor and regulator.
    g. Test circuit breakers per applicable NETA standards.

1.08 - INSPECTION AND CERTIFICATION OF EQUIPMENT

A. Upon completion of installation of all permanent equipment and related shop and field testing, the manufacturer's technical service representative shall inspect and, as necessary, adjust and/or calibrate the equipment. The inspection shall consider the completeness and integrity of the installation, the alignment and clearances of the equipment parts with respect to each other, and the sufficiency of any required sealing, lubricants or packing.

B. The technical service representative shall submit the results of the inspection including certification that the equipment was properly installed and is operating as specified and as installed. The report should verify that the equipment is ready for sustained operation and free from defects that would render the guarantee null and void.

1.09 - GENERAL REQUIREMENTS FOR START-UP

A. Fourteen (14) days' notice of scheduled start-up of individual equipment items or mechanical systems, dates shall be given to the Engineer. The following representatives, as appropriate, shall be present simultaneously for the start-up.

1. General Contractor
2. Electrical Subcontractor
3. Equipment Manufacturer's Technical Service Representative
4. Instrumentation and Control Equipment Representative
5. System Integrator
6. Owner and Owner's Representative

B. The following must be completed prior to start-up and testing:

1. Controls and alarm systems shall be tested to show it is capable of transmitting and annunciating all specified control points to the plant-wide SCADA system.
2. All safety equipment shall be installed and operating properly.
3. Initial training of facility personnel by manufacturer's technical service representatives shall be completed.
4. All spare parts, tools, lubricants shall be delivered to the Owner.
5. Installation drawings delivered to the Owner.

C. The Contractor shall, upon orders by the Engineer, startup, adjust and place in satisfactory operation all plant equipment constructed under this contract. At the discretion of the Engineer, individual startups may be required for various phases of the work or individual systems. The Engineer may order the start-ups prior to the completion of non-essential items of work.

D. As soon as practical after the initial start-up, the Contractor shall arrange for the manufacturer's representatives to perform all field tests and complete all additional training.

1.10 - GENERAL REQUIREMENTS FOR SYSTEM AND PERFORMANCE TESTING

A. Full System Tests: Full System tests on all items and systems shall be made at the wastewater treatment facility after all equipment has been installed for a given unit process and a final testing and inspection and all startup activities have been satisfactorily conducted by the Contractor, and the Contractor is satisfied that the equipment is operating as specified. The successful performance of all systems, equipment and components for each unit process shall be demonstrated to the satisfaction of the Engineer by completing a full system demonstration test. Unless especially required in technical specifications, the demonstration test will consist of operating the system, for an uninterrupted seven (7) day period for 24 hours per day or as otherwise specified. Failure of equipment to operate as specified will require the test to be reperformed for the full period. At no time during the startup of the facilities shall any equipment or system be operated under a more severe condition than the maximum design condition for which the equipment is rated.

B. Performance Tests and Performance Criteria: Specific performance testing criteria are listed for specific equipment and systems in the Divisions 11 through 16 specifications. Compliance with these performance test requirements shall be demonstrated during the full system testing or otherwise demonstrated prior to substantial completion.

C. In the event of a failure to demonstrate satisfactory facility performance on the first or any subsequent attempt, it shall be the responsibility of the Contractor to make all the necessary and required changes, replacements, and tests to make the units meet the specified operating and efficiency requirements.

D. If equipment is unable to operate, initial calibration and/or additional adjustments are required, or representatives are absent, the start-up or tests shall be canceled at that time and full rescheduling will be required. Damages shall be assessed to the Contractor for Owner's, Owner's Representative, and Manufacturer's Representative time and expenses wasted on scheduling, coordinating and attending the failed performance test.

E. The Contractor shall be fully responsible for the operation and maintenance of the new equipment and systems until the full system and performance tests have been completed and substantial completion and facility acceptance has been issued.

F. Once the complete facility system is fully tested, operational, calibrated and capable of performing, the Owner shall take occupancy of the equipment and the warranty period shall begin. It should be noted that the final performance test is meant to check complete performance of the equipment and is not a time for contractors' or manufacturers' representatives to begin major calibrating, testing, and adjusting of their equipment to insure it works or performs as required.

G. Substantial completion and facility acceptance will not be issued until the full system tests are completed successfully for all unit processes.

1.11 - ROLES AND RESPONSIBILITIES DURING START-UP AND TESTING

A. The Contractor shall not operate any of the existing facilities at any time. This shall include the starting and stopping of equipment or opening and closing of valves. Whenever the Contractor believe their work will affect or be impacted by the existing facilities operation, they shall so notify the Engineer in writing three (3) working days prior to the intended start of the work. This notification shall clearly detail the work to be completed, the method by which the existing facilities operation may be impacted, and the assistance requested of the Owner.

B. Contractor's Responsibilities: The Contractor shall be responsible for furnishing and installing all of the several kinds and types of equipment required in the treatment facilities, and for testing each individual piece of equipment, all combinations of equipment as they may operate one in conjunction with another, and the complete system, such that each component and the total unit may operate in an acceptable fashion to the Engineer, the Owner, and to any other municipal, State or Federal authorities within whose jurisdiction the operation of the facility may be a concern, at no additional costs to the Owner:

1. Develop specific start-up plans and schedule.

2. Provide specific start-up material and operating supplies until substantial completion. Supplies include lubricants, chemicals, gases, specialized fluids, electric power, water and all other required appurtenances.

3. Provide all specified third-party testing and laboratory costs at no additional costs to the Owner.

4. Provide manufacturer's representative to provide guidance during performance testing.

5. Provide to the Engineer a list of 24 hour, "on call" representative supervisory persons who will monitor the start-up and performance testing.

6. Provide the necessary craft or labor assistance, in the event of an emergency equipment failure requiring immediate attention, (emergency is defined as a failure of function which precludes the further operation of a critical segment of; or the whole of the work) with a response time of not less than four hours from the time of notification. The time of notification is defined as the time of contact between the Engineer's representative and the Contractor's representative.

7. Correct all failures or equipment problems identified during start-up when notified by the Engineer. Resolve and correct all equipment or system failures during the performance testing.

8. Provide manufacturer's representatives and operating supplies for retesting of systems that fail to pass the initial performance tests due to deficiencies in products or workmanship at no additional cost to the Owner.

9. Provide training as specified.

10. Prior to starting the start-up and testing, the Contractor shall provide and field calibrate certified flow meters (by using volumetric calibration), flow recorders, all electrical meters, and electrical recorders. The Contractor shall provide a test procedure, wiring diagram of field test recorders and instrumentation, and a field calibration report on the installed meter.

11. Review procedures for performance testing.

12. Attend meetings related to the review of start-up plan(s).

13. Clarify submittals, testing requirements, schedules, or other items related to the start-up of the equipment and facilities specified and indicated in the Contract Documents.

C. The Owner's Responsibilities:

1. Assist in the start-up testing activities. The Owner will endeavor to be cooperative with the Contractor when required. However, it is emphasized that the existing facilities operations and treatment take precedence and only requests that do not adversely affect the flow or treatment will be considered. Additionally, any assistance given to the Contractor must be completed when the Owner's schedule and manpower permit. There may be instances when the Owner cannot provide assistance at the time of the Contractor's request and this shall not be the basis for a claim by the Contractor.

2. Provide staff to operate and maintain equipment, systems, and facilities requiring start-up.

1.12 - TREATMENT EQUIPMENT USAGE

A. Any partial or full usage of the proposed equipment by the Owner, and/or his employees or agents, prior to acceptance shall be the responsibility of the Contractor.

1.13 - OPERATIONAL EXPENSES

A. During the construction stage and start-up period, before the facilities are turned over to the Owner, the Contractor shall bear all expenditures and operational expenses of all systems included in the project, including electrical power, chemicals, maintenance, and fuel.

B. The Contractor shall be responsible for the proper handling, sampling, and lab testing and analysis from the testing and start-up of facility processes.

1.14 - GUARANTEE

A. The Contractor shall guarantee the materials and equipment furnished and the performance thereof to be in accordance with the requirements of the Contract Documents and agrees upon written notice to make promptly and without charge, all necessary changes, corrections, and replacements (including installation of replacement parts) required to make good all defects developing in the material or equipment, under ordinary use and proper care, within a period of twelve months after final acceptance or substantial completion of the treatment facilities.

PART 2 - PRODUCTS

2.01 - TEST EQUIPMENT

A. The Contractor shall provide all test equipment, including kWh demand meters and recorders, instruments, analyzers, handling equipment, etc., required to sample and test the various systems. All test equipment must have been tested and calibrated within 6 months of their use on this contract.

PART 3 - EXECUTION – Not Used

END OF SECTION

SECTION 01680

PHYSICAL CHECKOUT; SHOP, FIELD AND FUNCTIONAL TESTING

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 2
1.03 - DEFINITIONS 2
1.04 - SUBMITTALS 3
1.05 - PRODUCT HANDLING – Not Used 3
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1.07 - ROLES AND RESPONSIBILITIES 3
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1.10 - WITNESSING OF TESTS 4
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1.15 - CORRECTIONS TO THE WORK 7
1.12 - SAFETY 7
PART 2 - PRODUCTS - Not Used 8
PART 3 - EXECUTION – Not Used 8

PART 1 - GENERAL

1.01 - SCOPE

A. The physical inspection and testing requirements in this Section are in addition to those requirements defined in the individual technical specification sections. This testing shall be performed during Contract Closeout.

B. Provide the following checkout and testing activities:

1. Physical checkout and inspection of equipment and materials to verify conformance of the installed equipment and materials as indicated and as specified.

2. Shop Testing of equipment as specified in the sections of Division 2 through 16 and as specified herein.

3. Field Testing of equipment as specified in the sections of Divisions 2 through 16 and as specified herein.

4. Functional Testing of equipment as specified in the sections of Divisions 2 through 16 and as specified herein.

5. Provide a Checkout Plan covering the entire checkout and testing process as specified herein.

C. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.
10. Shop Testing: Is defined as testing that is done by the Supplier or Manufacturer, either at the place of manufacture, the place of assembly, or at another location where the required testing apparatus is located, for the purpose of proving that the equipment supplied under the Contract meets the requirements of the pertinent technical specification(s).
11. Field Testing: Is defined as testing that is performed by the Contractor, on equipment supplied under the Contract after its been installed in the Work, and after the performance of physical checkout, for the purpose of proving that the tested equipment meets the requirements of the pertinent technical specifications.
12. Physical Checkout: Is defined as the process of physically inspecting equipment after it has been installed in the Work to determine if the equipment has been properly and completely installed and is ready for Field and/or Functional Testing.
13. Functional Testing: Is defined as testing performed on a "system" normally comprised of two or more pieces of equipment, after the equipment has been installed in the Work, and after Physical Checkout and Field Testing has been completed, for the purpose of proving that the system meets requirements as specified and as indicated.
14. Supplier's Representative: Sometimes referred to in the technical specifications as a Factory-Trained Service Representative, is defined as a person, or persons provided by the Supplier, who is qualified by having the training and experience, to provide technical and/or process related advice, and/or assistance, relating to the installation or utilization of the Products provided by that same Supplier, for installation and utilization in the Work.
15. The Testing and Checkout Coordinator: Is defined as the person provided by the Contractor to coordinate and oversee the total spectrum of testing and inspection activities required by the Contract Documents. The Testing and Checkout Coordinator shall have been in responsible charge of two similar Projects in the last four years.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

1.05 - PRODUCT HANDLING – Not Used

1.06 - DESIGN CRITERIA – Not Used

1.07 - ROLES AND RESPONSIBILITIES

A. Provide all outside services, materials, labor, supplies, test equipment and other items necessary to perform the testing specified herein. In addition, arrange for and provide the participation or assistance of survey crews, quality control technicians, Supplier's representative(s), and required governmental agency representatives.

B. Provide the services of the Supplier’s representative(s) for the following activities:

1. Assistance during installation.
2. Shop Testing
3. Field Testing
4. Functional Testing

C. The Supplier's representatives activities required by this Section are in addition to the requirements for vendor training and other services specified elsewhere in the Contract Documents. Timing for the performance of these services are to be defined in the Contractors Checkout Plan, specified herein.

D. The Owner will review and comment on the Contractor’s deliverables, participate in the physical inspection activities, witness the shop and field testing, and witness functional testing. The Owner’s right to perform inspections, witness tests or monitor or assess the Work and activities does not relieve the Contractor of its obligation to comply with the requirements of the Contract Documents nor does it imply completion of the Work.

1.08 - CHECKOUT PLAN

A. Submit a Checkout Plan based upon the requirements defined herein to the Owner. Six copies of the Checkout Plan (preliminary) shall be submitted for review 90 days prior to the proposed date of the first test. The plan shall define:

1. The performance of physical inspections, shop, field and functional tests including:
    a. A chronological schedule of all testing and inspection activities.
    b. A checklist of all inspection and testing activities broken down by location, discipline, system, and device or item.
    c. All blank forms proposed by the Contractor for verification or recording of the shop testing.
    d. An index which cross references the forms to their intended application(s).
    e. A list of all shop tests, and supplier certifications, including those required by the applicable technical specifications. Provisions shall also be included for retesting, in the event it is required.
2. Participants in the testing.
3. Special test equipment.
4. Sources of the test media (water, power, air.)
5. The proposed method of delivery of the media to the equipment to be tested.
6. Temporary or interim connections for the sequencing of multiple units.
   Ultimate disposal of the test media.

B. The plan shall be reviewed by the Owner, modified or revised as necessary by the Contractor, then re-reviewed by the Owner. The Contractor shall continue to update the checkout plan, working in conjunction with the Owner prior to the start of the scheduled equipment checkout and functional testing activities as specified herein. Each specific element of the plan must receive review or comment by the Owner two weeks prior to the actual commencement of testing as defined herein.

C. The Contractor shall designate, in the checkout plan, a Testing and Checkout Coordinator, to coordinate and manage the activities defined in the checkout plan.

1.09 - SHOP AND FIELD TESTING REQUIREMENTS

A. In the event no reference to procedures are made, or no procedures for shop and field testing are contained in a technical specification for the following test parameters, the following shall be the checkout requirements. Should these requirements conflict with the Supplier's recommendations or in any way be less stringent than the Supplier's requirements, they shall be superseded by the Supplier's requirements for checkout testing.

B. Hydrostatic Testing:

1. AWWA C600 standards latest edition are the standards for all hydrostatic testing.

2. Visually inspect all welds prior to testing, for cracks, undercut on surface greater than 1/32-in. deep, lack of fusion on surface, reinforcement greater than Table 127.4.2 located in ANSI B31.1 Power Piping, and incomplete penetration (when accessible). Repair or rework as directed by the Owner, at no additional cost to the Owner.

3. At no time during hydrostatic testing shall any part of the piping system be subjected to a stress greater than 90 percent of its yield strength at test temperature.

4. After 10 minutes of full hydrostatic test pressures, make an examination for leakage of all joints, connections, and all regions of high stress, such as around openings and thickness transition sections.

5. Unless otherwise specified, the minimum required hydrostatic test pressure shall be 1.5 times the design pressure as specified and as indicated.

6. Pressure holding time shall be 10 minutes plus the time required to inspect for leakage.

7. Maximum pressure shall not exceed the maximum rated pressure for any component in the system being tested.

1.10 - WITNESSING OF TESTS

A. Provide 30 days written notice to the Owner so that the Owner, may witness the Contractor's Shop, Field, and Functional tests. The Owner may witness the performance of any or all tests, at their option.

1.11 - SHOP TESTING

A. When required by the technical specifications, perform shop testing prior to delivery of the equipment or material. Provide thirty (30) days written notice indicating the time and place of testing. Submit the following for review thirty days prior to this notice:

1. Description of the test: Specifically outlining how tests will conform to the requirements in the technical specifications.

2. Testing devices that will be used in the tests: Description must state what portion of the tests that the devices will perform or measure, and device accuracy. Submit sample measurement results and catalog cuts.

3. Personnel used to perform the tests: Resumes, qualifications, and experience shall be submitted. Personnel shall have three (3) years' experience with the manufacture and operation of the equipment to be tested and will have participated in 5 similar tests during this period of experience.

4. Schedule for testing: Schedule shall include frequency of measurements, personnel present, and contingency plans for equipment and/or test failure.

5. Test forms: Submit all forms used to record and report on Shop Test data, for review, prior to the test. Forms shall include description of test, equipment used, personnel present, equipment tag ID numbers, and measurements made. Forms shall have a place for signature by the chief testing person, and an officer of the company that the tests performed are true, accurate, have met the required criteria, and that the equipment will operate as indicated and specified.

B. Shop test procedures will be reviewed and returned by the Owner within 30 days of receipt. Incorporate comments on the procedures, equipment, or personnel prior to testing. Comments by the Owner will require a resubmission of the shop test procedure and proposed test date.

C. Submit the following within one week after completion of the tests for review:

1. Complete test forms, for each device tested, on forms as reviewed prior to the test.

2. Completed certification, the content of which was reviewed prior to the tests.

3. A written summary of testing, reporting on the results and summarizing the entire procedure.

4. A schedule for retesting, if more testing is required. Perform any retesting required to fulfill the technical specification test requirements at no additional cost to the Owner. Additional travel required by the Owner to witness retesting shall be provided by the Contractor, at no additional cost to the Owner. Reimbursement for travel expenses required for retesting will be applied as a debit against the Contractor's subsequent Application for Payment.

1.12 - FIELD TESTING OF EQUIPMENT

A. When required by the technical specifications, perform field testing on installed equipment. Field testing shall be in addition to, and not in lieu of, any shop testing either required or otherwise performed. Perform field testing as a part of the overall physical and functional testing process defined herein and in accordance with the reviewed checkout plan. However, the following specific instructions shall also apply. Provide ninety (90) days written notice indicating the date and time for testing one piece of equipment, or a series of equipment pieces. Submit with this notice the following for review by the Owner:

1. Description of the tests: Specifically outlining how the test will conform to the requirements in the technical specifications.

2. Testing devices that will be used in the tests: Description shall state what portion of the tests that the devices will perform or measure, and device accuracy. Submit sample measurement results and catalog cuts.

3. Personnel used to perform the tests: Submit resumes, qualifications, and experience. Personnel must have three years experience with the manufacture and operation of the equipment to be tested and will have participated in five similar tests during this period of experience which shall have occurred over the last five years.

4. Schedule of Testing: Schedule shall include frequency of measurements, personnel present, and contingency plans for equipment and/or test failure.

5. Test forms: Submit Contractor provided test forms to the Owner for recording and reporting on the Field Test data, prior to the test.

6. Material and equipment required for the test: This material and equipment shall be supplied at no additional cost to the Owner.

7. Water and Power For Field Testing: Water and power for field testing shall be provided by the Contractor at no additional cost to the Owner. The Contractor shall provide all temporary piping and wiring required for field testing; and equipment and labor for the reuse of the test water. When testing is performed with water during freezing conditions the Contractor shall take measures to prevent damage to the Work caused by freezing of the water.

8. Provide seven days written notice to the Owner prior to the actual start of any testing. This will include a statement by the Contractor that the equipment and facilities to be tested have been thoroughly inspected and cleaned of construction debris or other extraneous materials and all lubrication, materials, and preparations are completed.

B. Field test procedures will be reviewed and returned by the Owner within 30 days of receipt. Incorporate minor comments on the procedures, equipment, or personnel prior to testing. Major comments by the Owner will require a resubmission of the field test procedure and proposed test date. The Contractor will be notified, in writing, by the Owner if a formal resubmission is required with the transmittal of the review comments.

C. Submit within one week after completion of the tests, the following to the Owner for review:

1. Completed test forms, for each device tested, on forms provided prior to the tests.

2. Completed certification documentation, the content of which was reviewed prior to the tests.

3. A written summary of testing, reporting on the results and summarizing the entire procedure.

4. A schedule for retesting, if more testing is required. Perform any retesting required to fulfill the intent of the technical specification test requirements at no additional cost to the Owner.

1.13 - PHYSICAL CHECKOUT AND INSPECTIONS

A. Physical Checkout and inspections provide verification of conformance to the requirements of the technical specifications and contract drawings for physical presence; dimensions; and location, for proper materials, parts, and items; and for integrity of materials, equipment and systems to determine their condition and readiness for field and/or functional testing, and for Substantial Completion. Inspection includes the following elements, where applicable:

1. Exterior areas for backfill, grading, surfacing, drainage, landscaping, roadways, fencing, gates, and signage.

2. Building structural integrity, masonry, architectural, mechanical systems, electrical/lighting, communications, and HVAC systems.

3. Concrete structures for structural integrity, finish, tolerance, durability, appearance, embedded and inserted items, painting and surface applications.

4. Steel structures for member alignment, connection bolts torque, connection welds integrity, painting, fire proofing and surface applications.

5. Mechanical systems and items for installation, alignment and securing, adjustments of packing and seals, lubrication, drive connection and alignment, motor rotation, belt/chain tension, painting or surface applications, and tagging for identification.
Piping systems for material, size, components, direction, alignment of joints and bolting/welding, valves, packing and seals, screens, filters and strainers, painting, identification labeling and color coding, hangers, anchors, supports, and expansion provisions.

6. Electrical and control/instrumentation systems for conduit and tray installation, wire/cable material and size, circuit identification, terminal installation and identification, major switches, circuit breakers and components, and labeling for system identification.

7. Communication systems including telephone, fire/smoke alarm, security, page/party; similar to electrical above.

8. Computer systems by station, function, and network interface.

B. Tanks, pipes, conduits, vessels, equipment, systems, buildings, areas and other items provided under the contract must be clean and free from debris or materials which will interfere with subsequent testing requirements or routine operations.

C. Upon completion of the inspection, submit to the Owner six copies of each completed inspection form, developed by the Contractor and reviewed by the Owner prior to the inspection, signed by an authorized representative of the Contractor who participated in the inspection. The Owner will review and comment on the contents of the forms. A copy of each reviewed inspection form will be provided to the Owner. Should a re-inspection be required, it shall be performed at no additional cost to the Owner

1.14 - FUNCTIONAL TESTING

A. When listed in Part 4, Appendix A of this section, specific functional tests shall be performed in addition to the requirement for shop, field, and other tests called for in the technical specifications. Functional tests will be performed with fluid or gaseous substances that are generally non-septic, non-corrosive, non-toxic, and non-inflammable.

B. Provide thirty (30) days written notice indicating the date and time during which the specific functional test is proposed. Submit with this notice, the following to the Owner for review:

1. Changes to the test procedures (if any) outlined in the technical specifications.

2. Testing devices that will be used in the tests: Description must state what portion of the tests that the devices will perform or measure and device accuracy. Submit sample measurement results and catalog cuts.

3. Personnel used to perform the tests: Submit resumes, and qualifications. Personnel must have three years experience with the operation of the equipment and/or system to be tested and have participated in five similar tests during this period of experience.

4. Schedule for Testing: Schedule shall include frequency of measurements, personnel present, and contingency plans for equipment and/or system test failure.

5. Test forms: Submit test forms for review by the Owner for recording and reporting on the test data prior to the test.

6. List of material and equipment required for the test. This material and equipment will be in addition to that specified in SECTION 01600, CONTROL OF MATERIALS.

C. Operational requirements: Include valve positions, set-ups, and gate positions that are required to run the tests in the written request so that the Owner can anticipate and plan for the testing. Provide all temporary piping, connections or other temporary requirements related to performance of the functional tests including water and power.

D. The Owner may witness these tests, at their option. Provide seven (7) days written notice to the Owner prior to the actual start of any testing. This will include a statement by the Contractor that the equipment and facilities to be tested have been thoroughly inspected and cleaned of construction debris or other extraneous materials and all lubrication, materials, and preparations are completed.

E. Review of the functional test plan and requirements as provided in Part B above by the Owner will be made within two weeks of the test date. Incorporate comments on the procedures, equipment, and personnel prior to testing.

F. Submit within one week after completion of the tests, the following to the Owner for review:

1. Completed test forms, for each device, or system tested, on forms reviewed prior to the test.

2. Completed certification, the content of which was reviewed prior to the tests.

3. A written summary of testing, reporting on the results and summarizing the entire procedure.

4. A schedule for retesting, if more testing is required, including changes to procedures, testing devices, or personnel. Any retesting required to fulfill the intent of the test requirements, due to negligence, poor workmanship, or Products that fail to meet the Contract requirements, shall be at no additional cost to the Owner.

1.15 - CORRECTIONS TO THE WORK

A. Correct any items of Work failing to meet the specified requirements, at no additional cost to the Owner. Correct the nonconforming items by re-work, modification, or if the equipment fails to pass the specified requirements after three testing attempts, replace the items. This includes the provision of all required labor, materials, and requirements for retesting as specified herein, to verify that the items conform with Contract Documents.

1.12 - SAFETY

A. Conduct all specified test procedures in compliance with all applicable safety standards and regulations.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL 1
1.01 SCOPE 1
1.02 MEASUREMENT AND PAYMENT 1
1.03 DEFINITIONS 1
1.04 SUBMITTALS – Not Used 2
1.05 SPECIAL REQUIREMENTS – Not Used 2
PART 2 - PRODUCTS – Not Used 2
PART 3 - EXECUTION 2
3.01 CLOSEOUT PROCEDURES 2
3.02 FINAL CLEANING 2
3.03 ADJUSTING 2

PART 1 - GENERAL

1.01 - SCOPE

A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to: Closeout procedures; Final Cleaning; and Adjusting.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS – Not Used

1.05 - SPECIAL REQUIREMENTS – Not Used

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION

3.01 - CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection.

B. Provide submittals to Engineer that are required by governing or other authorities.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payment and sum remaining due.

3.02 - FINAL CLEANING

A. Complete the following cleaning operations, as applicable, before requesting inspection for Certification of Substantial Completion.

1. Remove labels that are not permanent labels.
2. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean.
3. The installing Subcontractor shall wipe surface of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
4. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

3.03 - ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

END OF SECTION

SECTION 01710

CLEANING UP

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 2
1.03 - DEFINITIONS 2
1.04 - SUBMITTALS – Not Used 2
1.05 - PRODUCT HANDLING – Not Used 2
1.06 - DESIGN CRITERIA – Not Used 2
1.07 - SPECIAL REQUIREMENTS – Not Used 2
PART 2 - PRODUCTS – Not Used 2
PART 3 - EXECUTION 2
3.01 – CONTRACT CLOSEOUT 2

PART 1 - GENERAL

1.01 - SCOPE

A. The work of this section includes all labor, equipment, tools, and materials necessary for the performance of all cleaning up the project sites, as specified herein, and as shown on the drawings.

1. During its progress, the work and the adjacent areas affected thereby shall be cleaned up and all rubbish, surplus materials, and unneeded construction equipment shall be removed and all damage repaired so that the public and property owners will be inconvenienced as little as possible.

2. Where material or debris has washed or flowed into or been placed in existing watercourses, ditches, gutters, drains, pipes structures, work done under this contract, or elsewhere during the course of the Contractor's operations, such material or debris shall be entirely removed and satisfactorily disposed of during the progress of the work, and the ditches, channels, drains, pipes, structures, and work, etc., shall, upon completion of the work, be left in a clean and neat condition.

3. On or before the completion of the work, the Contractor shall, unless otherwise especially directed or permitted in writing, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools, and machinery or other construction equipment furnished by him; shall remove, acceptably disinfect, and cover all organic matter and material containing organic matter in, under, and around privies, houses, and other buildings used by him; shall remove all rubbish from any grounds which he has occupied; and shall leave the roads and all parts of the premises and adjacent property affected by his operations in a neat and satisfactory condition.

4. The Contractor shall thoroughly clean all materials and equipment installed by him and his sub-contractors, and on completion of the work shall deliver it undamaged and in fresh and new-appearing condition. All mechanical equipment shall be left fully charged with lubricant and ready for operation.

5. The Contractor shall restore or replace, when and as directed, any public or private property damaged by his work, equipment, or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary highway or driveway, walk, and landscaping work. Suitable materials, equipment, and methods shall be used for such restoration. The restoration of existing property or structures shall be done as promptly as practicable as work progresses and shall not be left until the end of the contract period.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS – Not Used

1.05 - PRODUCT HANDLING – Not Used

1.06 - DESIGN CRITERIA – Not Used

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.07 - SPECIAL REQUIREMENTS – Not Used

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION

3.01 – CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 1
1.03 - DEFINITIONS 1
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING – Not Used 3
1.06 - DESIGN CRITERIA – Not Used 3
1.07 - REFERENCED STANDARDS – Not Used 3
1.08 - WARRANTY REQUIREMENT 3
PART 2 - PRODUCTS AND SERVICES – Not Used 3
PART 3 - EXECUTION 3
3.01 - CONTRACT CLOSEOUT 3

PART 1 - GENERAL

1.01 - SCOPE

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.
10. Standard Product Warranties are pre-printed written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
11. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Submit written warranties to the Owner prior to the date fixed by the Engineer for Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Owner.
2. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner within fifteen days of completion of that designated portion of the Work.
3. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Engineer for approval prior to final execution.
4. Refer to individual Sections of DIVISION 2 through DIVISION 16, inclusive, for specific content requirements, and particular requirements for submittal of special warranties.
5. At Final Completion, compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
6. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-in. by 11-in. paper.
7. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification Section in which specified, and the name of the product or work item.
8. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer, supplier, and manufacturer.
9. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name, address, and telephone numbers of the Contractor and equipment supplier.
10. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.
11. Schedule of Special Warranties

1.05 - PRODUCT HANDLING – Not Used

1.06 - DESIGN CRITERIA – Not Used

1.07 - REFERENCED STANDARDS – Not Used

1.08 - WARRANTY REQUIREMENT

A. Related Damages and Losses - When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty - When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost - Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse - Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights or remedies.

E. Rejection of Warranties - The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

F. Disclaimers and Limitations - Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

G. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

PART 2 - PRODUCTS AND SERVICES – Not Used

PART 3 - EXECUTION

3.01 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 01900

SEISMIC AND WIND REQUIREMENTS

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 1
1.03 - DEFINITIONS 1
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING – NOT USED 2
1.06 - DESIGN CRITERIA – NOT USED 2
1.07 - REFERENCES 2
1.08 - SEISMIC AND WIND DESIGN REQUIREMENTS 3
1.09 - SPECIFIC COMPONENTS 3
PART 2 – PRODUCTS – Not Used 3
PART 3 – EXECUTION – Not Used 3

PART 1 - GENERAL

1.01 - SCOPE

A. This section establishes the minimum seismic and wind loading design requirements for architectural, mechanical, electrical and non-structural components.

B. The Contractor shall be responsible for compliance with the seismic and wind requirements specified including conformance by all Subcontractors, manufacturers and Suppliers.

C. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.
10. Components are defined as systems, equipment, parts, or other elements, including supporting structures and attachments.
11. The reference Building Code is the building code cited on the structural drawings or specified herein for the design of the basic structure.
12. The specified seismic criteria is defined as the seismic criteria cited on the structural drawings or specified herein for the design of the basic structure.
13. The specified wind criteria is defined as the wind criteria cited on the structural drawings or specified herein for the design of the basic structure.
14. The specified wind criteria is defined as the wind criteria cited on the structural drawings or specified herein for the design of the basic structure.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Where specified in the technical specifications, provide and complete the Certificate of Unit Responsibility form in SECTION 01300, SUBMITTALS and submit to Engineer prior to manufacture of components.
2. In addition, submit the following support data along with Certificate of Unit Responsibility:
    a. Certification, signed and sealed by a Professional Structural Engineer registered in the jurisdiction in which the project is located stating that all systems, equipment, and other elements, including supporting structures, attachments and connections are designed to withstand the required seismic and wind forces and displacements.
    b. Codes and specifications to which structural design conforms.

1.05 - PRODUCT HANDLING – Not Used

1.06 - DESIGN CRITERIA – Not Used

1.07 - REFERENCES

A. American Society of Civil Engineers (ASCE):

1. ASCE/SEI 7: Minimum Design Loads for Buildings and Other Structures

B. American Society of Mechanical Engineers (ASME):

1. B31: Code for Pressure Piping

C. International Code Council (ICC):

1. International Building Code

D. Manufacturers Standardization Society of the Valve and Fitting Industry:

1. SP-58: Pipe Hangers and Supports - Materials, Design and Manufacture

E. National Fire Protection Association (NFPA):

1. Standard for the Installation of Sprinkler Systems

F. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.08 - SEISMIC AND WIND DESIGN REQUIREMENTS

A. Refer to structural drawings for project specific seismic and wind requirements and also conform to the requirements specified herein.

B. Seismic and wind design shall conform to the International Building Code and ASCE/SEI 7.

C. Architectural, mechanical, electrical and non-structural components shall be designed and constructed to resist the seismic and wind forces and displacements based upon ASCE/SEI 7, the reference building code, and the specified seismic and wind criteria. In the case of conflict the more stringent requirements shall govern.

D. The interrelationship of components and their effect on each other shall be such that the failure of one component shall not cause the failure of any other component.

E. Components shall be anchored to the building structure to transfer seismic and wind forces. Connections shall be bolted, welded or otherwise positively anchored to the structure. Anchorage shall not rely on friction for force transfer.

F. Post-installed anchors in concrete shall be prequalified for seismic applications in accordance with ACI 355.2, ICC-ES AC-193, or ICC-ES AC-308. Drop-in anchors are prohibited for concrete anchorage.

G. Post-installed anchors in masonry shall be prequalified for seismic applications in accordance with ICC-ES AC-01, or ICC-ES AC-58. Drop-in anchors are prohibited for masonry anchorage.

H. Exceptions: Exemption from the requirements for seismic and wind analysis and design are permitted only to the extent permitted by applicable codes and standards.

1.09 - SPECIFIC COMPONENTS

A. Compound Equipment: Connecting elements for equipment combinations such as pumps and motors, valves and operators, engines and generators, etc. which are not capable of transferring seismic and/or wind loads or accommodating seismic and wind displacements shall be protected by appropriate design.

B. Storage Tanks: Tanks, supporting structures and anchorages shall be designed for the weight of the tank, appurtenances and the tank contents at the maximum capacity. Tank contents shall not be considered in resistance to seismic and wind loads.

C. Ductwork: Equipment installed within ductwork shall be independently supported and braced. Support and bracing of heating and cooling coils shall account for the weight of the contents.

D. Piping Systems: Support and bracing of piping systems shall account for the weight and hydrodynamic effects of the contents.

E. Pressure Piping: Pressure piping support and bracing shall conform to ASME B 31 in addition to the force and displacement requirements of the reference code.

F. Sprinkler Systems: Sprinkler system support and bracing shall conform to NFPA 13 in addition to the force and displacement requirements of the reference code.

G. General Supports: Pipe, duct, raceways and cable tray supports and bracing shall conform to the AISC Manual of Steel Construction and MSS SP-58 in addition to the force and displacement requirements of the reference code.

PART 2 – PRODUCTS – Not Used

PART 3 – EXECUTION – Not Used

END OF SECTION

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SECTION 02100

SITE PREPARATION

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 1
1.03 - DEFINITIONS 1
1.04 - SUBMITTALS – Not Used 2
1.05 - PRODUCT HANDLING – Not Used 2
1.06 - DESIGN CRITERIA 2
1.07 - SPECIAL REQUIREMENTS 2
PART 2 - PRODUCTS – Not Used 2
PART 3 - EXECUTION 3
3.01 - GENERAL REQUIREMENTS 3
3.02 - CLEARING, GRUBBING, TREE AND STUMP REMOVAL 3
3.03 - DISPOSAL OF WASTE MATERIALS 3
3.04 - SEDIMENT AND EROSION CONTROL 4
3.05 - CONTRACT CLOSEOUT 4

PART 1 - GENERAL

1.01 - SCOPE

A. The work of this section includes all labor, equipment, tools, and materials necessary for the performance of all operations in connection with clearing and grubbing, and the removal of pavement, curbing and all incidental and appurtenant work pertaining thereto, as specified herein, and as shown on the drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS – Not Used

1.05 - PRODUCT HANDLING – Not Used

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.07 - SPECIAL REQUIREMENTS

A. Prior to the performance of any work of this section or any related work required by other sections of the specifications, the Limit of Work Line shall be laid out and staked in the field by the Contractor, according to the drawings. The Contractor shall be responsible for maintaining the Limit of Work Line during the construction operation.

B. At all times throughout the duration of this contract, the Contractor shall be responsible for the appearance and condition of the area within and surrounding the project site. The Contractor shall repair or replace, at no additional expense to the Owner, any structures, either natural or man-made such, as but not limited to, utilities, trees, plants, water bodies, and pavements that are damaged or destroyed by any actions or sequences of events related to the Contractor's operations.

C. Any existing plant materials designated to be saved, protected and/or undisturbed, that are cut or damaged without prior approval of the Engineer, shall be replaced in kind and size by the Contractor, at no expense to the Owner. If the Engineer agrees that tree replacement is impossible or impractical, the Contractor shall pay the Owner damages of One Thousand Five Hundred Dollars ($1,500.00) per inch of diameter measured four (4) feet from the ground surface.

D. Disposal of waste/surplus materials may involve securing permits, licenses, or approvals, which may vary according to the type of material to be disposed of prior to the start of construction. The Contractor shall apply for these, as they may be required by the various governing agencies and pay all required fees. The Contractor shall have sole responsibility for the legal disposal of all waste surplus material of this project. The Contractor shall be responsible for any and all fines due to any illegal activity with regards to the disposal of waste/surplus materials.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION

3.01 - GENERAL REQUIREMENTS

A. All graded areas, and all areas within the Limit of Work Line on which proposed work is to be installed, shall be cleared and grubbed as indicated on the drawings.

B. The Contractor shall be careful to note any areas that may be designated on the drawings to receive only selective clearing and thinning.

3.02 - CLEARING, GRUBBING, TREE AND STUMP REMOVAL

A. Trees

1. Preparation of the site shall include the complete removal of all trees within the Limit of Work Line, except in those areas where selective clearing and thinning is required. Any trees within the Limit of Work Line not to be removed shall be protected from damage during clearing and construction operations by barriers or by such other methods as conditions may require. No construction materials or debris shall be stored or stockpiled, or vehicles parked or operated within the limits of the branch spread of the trees to be saved.

2. Clearing operations shall be performed in a manner which will prevent damage by falling trees to trees left standing or to structures under construction, and by methods which will provide for the safety of employees and other persons.

3. Limited clearing and thinning shall be performed in areas identified on the drawings, as required or as directed by the Engineer. This work will involve the removal of brush, small trees, dead, damaged and/or diseased trees. The Engineer will tag or otherwise mark and designate trees and brush to be saved. Where branches of trees which are to be saved interfere with the work, limbs and branches shall be trimmed off neatly and cleanly close to the bole of the tree or to main branches. Cut surfaces shall be painted with a tree wound paint. Pruning shall be done in accordance with the National Arborist Association "Pruning Standards for Shade Trees" and only by persons experienced with this work. The Contractor shall legally dispose of all branches and limbs off site.

4. All trees, above a four-inch caliper, which are designated to be removed shall become the property of the Contractor to be disposed of by sale or otherwise, provided that such material shall be removed from the property of the Owner before the completion of the site clearance work. The Owner assumes no responsibility for the protection and safekeeping of such materials. The Contractor shall be responsible for all taxes, if any, incurred in the sale of materials.

B. Grubbing shall consist of the grubbing up, removal and disposal of all stumps, roots larger than 1-1/2 inches in diameter, and matted root formations from the designated areas. All rocks or boulders near the existing surface grade, which may interfere with planned construction operations, shall be removed and disposed of as surplus/waste material, or used as fill, where specifically permitted by the Engineer.

3.03 - DISPOSAL OF WASTE MATERIALS

A. All cleared and grubbed materials shall be legally disposed of off-site by the Contractor. Burning of cleared and grubbed materials is not permitted.

B. 500 Cubic yards of pavement millings shall be disposed of at the Orleans Public Works Department, 40 Giddiah Hill Road, Orleans, MA 02563. The remaining pavement millings shall be legally disposed of off-site by the contractor.

C. All waste materials shall be legally disposed of off-site by the Contractor.

3.04 - SEDIMENT AND EROSION CONTROL

A. The Contractor shall take such actions as may be required to ensure that his construction activities do not interfere with or adversely impact the hydraulic characteristics or aesthetic qualities of any natural or manmade watercourse or drain.

B. The Contractor shall provide acceptable siltation control devices such as straw bales and/or straw wattles sediment control devices; control basins for the settling and filtering of fine sands, silts and clay resulting from rainfall runoff or dewatering operations. Any natural areas or manmade structures which have been affected by siltation or erosion due to construction activities shall be restored to their pre-construction condition by the Contractor at no additional cost to the Owner.

C. For more specific requirements for control of erosion and siltation, refer to SECTION 01140, ENVIRONMENTAL PROTECTION.

3.05 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 02140

DEWATERING

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 2
1.03 - DEFINITIONS 2
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING 3
1.06 - DESIGN CRITERIA 3
1.07 - QUALITY ASSURANCE 3
1.06 - PROJECT/SITE CONDITIONS 4
PART 2 - PRODUCTS 4
2.01 - MATERIALS 4
PART 3 - EXECUTION 4
3.01 - EXECUTION 4
3.02 - CONTRACT CLOSEOUT 5

PART 1 - GENERAL

1.01 - SCOPE

A. Design, furnish, operate, maintain, and remove temporary dewatering systems to control groundwater and surface water to maintain stable, undisturbed subgrades, and permit work to be performed under dry and stable conditions. Work to be done as part of dewatering includes, but is not limited to:

1. Lower the groundwater level.
2. Lower hydrostatic pressure.
3. Prevent surface water from entering the excavation and other work areas on the project during construction.
4. Control and remove seepage, surface water, and precipitation in excavations and/or work areas.
5. Implement erosion control measures for disposing of discharge water.
6. Provide and monitor observation wells and geotechnical instrumentation as specified.

B. Groundwater within the excavation area shall be lowered to at least 2 feet below the lowest excavation levels as specified and as indicated.

C. Common dewatering methods include, but are not limited to, sump pumping, deep wells, well points, vacuum well points or any combinations thereof.

D. The Contractor shall obtain the required permits for discharge from the Contractor’s dewatering systems in accordance with 40 CFR Part 122 and 61 FR 19284. The discharge location shall be in accordance with permit requirements.

E. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Brochures and/or Catalogue Cuts of All Materials.
2. Qualification of the Contractor’s dewatering specialist's or firm's qualifications a minimum of four (4) weeks prior to execution of any dewatering. The submittal shall include, but not be limited to:
    a. Qualifications of specialist's or firm's Registered Professional Engineer in the Commonwealth of Massachusetts and as specified in Paragraph 1.07.
    b. Qualifications of specialist's or firm's field representative, as specified in Paragraph 1.07, who shall oversee the installation, operation and maintenance of the dewatering system.
3. Submit a dewatering plan at least two weeks prior to start of any dewatering operation. Do not submit design calculations. The review will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include the following items as a minimum:
    a. Dewatering plan and details stamped and signed by a Registered Professional Engineer in the Commonwealth of Massachusetts.
    b. Certificate of Design: Refer to SECTION 01300, SUBMITTALS.
    c. A list of equipment including, but not limited to, pumps, prime movers, and standby equipment.
    d. Detailed description of dewatering, maintenance, and system removal procedures.

e. Monitoring plan and details, including, but not limited to, number and locations of observation wells, and geotechnical instruments such as settlement markers and piezometers, and frequency of reading the monitoring devices.

f. Erosion/sedimentation control measures, and methods of disposal of pumped water.

g. List of all applicable laws, regulations, rules, and codes to which dewatering design conforms.

h. List of assumptions and mode for design of dewatering, including but not limited to groundwater levels, soil profile, permeabilities, and duration of pumping.

i. The proposed methods for removing the dewatering system elements, including method to ensure that no significant ground movements will occur as a result of extraction that could adversely impact any structures. If deemed necessary, the Contractor shall describe locations of, or conditions under which dewatering systems will be left in place, including proposed cutoff levels and methods for tremie grouting the wells or well points.

4. Measurement records consisting of observation well groundwater records and the geotechnical instrumentation readings within one day of monitoring.

5. A modified dewatering plan within 24 hours, if open pumping from sumps and ditches results in boils, loss of fines or softening of the ground.

1.05 - PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed according to the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance.

B. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

C. If stored for more than two (2) weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials and equipment shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. The design conditions and other pertinent requirements for the equipment are listed on the Contract Drawings.

1.07 - QUALITY ASSURANCE

A. Provide in accordance with Section 01400, and as specified.

B. Employ the services of a dewatering specialist or firm having the following qualifications:

1. Have completed at least five (5) successful dewatering projects of equal size and complexity and with equal systems within the last five (5) years.

2. Retain the services of a Registered Professional Engineer registered in the Commonwealth of Massachusetts and having a minimum of five (5) years experience in the design of well points, deep wells, or equal systems.

3. Retain the services of a field representative having a minimum of 5 years experience in installation of well points, deep wells, or equal systems.

C. If subgrade soils are disturbed or become unstable due to dewatering operation or an inadequate dewatering system, notify the Engineer, stabilize the subgrade, and modify system to perform as specified at no additional cost to the Owner.

D. Notify the Engineer immediately if any settlement or movement is detected on structures. If the settlement or movement is deemed by the Engineer to be related to the dewatering, take actions to protect the adjacent structures and submit a modified dewatering plan to the Engineer within 24 hours. Implement the modified plan and repair any damage incurred to the adjacent structures at no additional cost to the Owner.

E. If oil and/or other hazardous materials are encountered after dewatering begins, immediately notify the Engineer.

1.06 - PROJECT/SITE CONDITIONS

A. Subsurface Conditions: Refer to Appendix A.

PART 2 - PRODUCTS

2.01 - MATERIALS

A. Provide observation wells, settlement markers, piezometers and/or any other geotechnical instruments in accordance with the submitted dewatering plan or as specified.

B. Provide casings, well screens, piping, fittings, pumps, power and other items required for dewatering system.

C. Provide sand and gravel filter around the well screen. Wrapping geotextile fabric directly around the well screen shall not be allowed.

D. When deep wells, well points, or vacuum well points are used, provide pumping units capable of maintaining high vacuum and handling large volumes of air and water at the same time.

E. Provide and store auxiliary dewatering equipment, consisting of pumps and hoses on the site in the event of breakdown, at least one (1) pump for every five (5) used.

F. Provide and maintain erosion/sedimentation control devices as indicated or specified and in accordance with the dewatering plan.

G. Provide temporary pipes, hoses, flumes, or channels for the transport of discharge water to the discharge location.

H. Provide cement grout having a water to cement ratio of 1 to 1 by volume.

PART 3 - EXECUTION

3.01 - EXECUTION

A. Execution of any earth excavation, installing earth retention systems, and dewatering shall not commence until the related submittals have been reviewed by the Engineer with all Engineer's comments satisfactorily addressed and the geotechnical instrumentation has been installed.

B. Furnish, install and maintain dewatering system in accordance with the dewatering plan.

C. Permanent utilities and piping shall not be used as part of the dewatering system.

D. Carry out dewatering program in such a manner as to prevent undermining or disturbing foundations of existing structures or of work ongoing or previously completed.

E. Do not excavate until the dewatering system is operational.

F. Unless otherwise specified, continue dewatering uninterrupted until all structures, pipes, and appurtenances below groundwater level have been completed such that they will not be floated or otherwise damaged by an increase in groundwater elevation.

G. Discontinue open pumping from sumps and ditches, if such pumping is resulting in boils, loss of fines, softening of the ground, or instability of the slopes. Modify dewatering plan and submit to the Engineer at no additional cost to the Owner.

H. Where subgrade materials are disturbed or become unstable due to dewatering operations, remove and replace the materials in accordance with SECTION 02210, EARTH EXCAVATION, BACKFILL, FILL AND GRADING at no additional cost to the Owner.

I. Dewatering Discharge

1. Install sand and gravel filters in conjunction with well points and deep wells to prevent the migration of fines from the existing soil during the dewatering operation.
2. Transport pumped or drained water to discharge location without interference to other work, damage to pavement, other surfaces, or property.
3. Provide separately controllable pumping lines.
4. The Engineer reserves the right to sample discharge water at any time.
5. Immediately notify the Engineer if suspected contaminated groundwater is encountered. Do not pump water found to be contaminated with oil or other hazardous material to the discharge locations.

J. Monitoring Devices and Records

1. Install, maintain, monitor and take readings from the observation wells and geotechnical instruments in accordance with the dewatering plan.
2. Install settlement markers on structures within the zone of influence for dewatering a distance equal to twice the depth of the excavation, from the closest edge of the excavation. Conduct and report settlement surveys to 0.01 feet.
3. For linear excavations such as trenches, the zone of influence for dewatering shall be established by the Contractor's specialist based on the soil conditions and depth of dewatering.
4. For large rectangular, square or circular mass excavations the zone of influence shall be defined by the actual cone of watering influence corresponding to a 10 percent increase in effective vertical stress.

K. Install and maintain erosion/sedimentation control devices at the point of discharge as indicated or specified and in accordance with the dewatering plan.

L. Removal

1. Do not remove dewatering system without written approval from the Engineer.
2. Backfill and compact sumps or ditches with screened gravel or crushed stone wrapped with geotextile fabric in accordance with SECTION 02210, EARTH EXCAVATION, BACKFILL, FILL AND GRADING.
3. All dewatering wells shall be abandoned upon completion of the work, and completely backfilled with cement grout.

3.02 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 02150

HIGHWAY CROSSING (JACKING)

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PART 1 - GENERAL

1.01 - SCOPE

A. The work of this section includes furnishing all labor, equipment, tools and materials, and performing all operations in connection with the jacking of a 48-inch diameter steel pipe casing under Route 6, that is owned by the Massachusetts Department of Transportation (MassDOT) and installing force mains and conduits inside the 48-inch diameter casing as shown on the Drawings and as specified herein.

B. The work includes but is not limited to excavation, backfill, compaction, sheeting and shoring, furnishing and installing the 48-inch diameter steel casing, furnishing and installing the force mains and appurtenances, furnishing and installing the conduits and appurtenances; furnishing and placing sand to fill the annulus between the casing and the carrier pipe, bulkheads and thrust restraint, performing all testing and paying all MassDOT fees that are not being paid by the Owner and all other work required to complete the jacking operation as specified and shown on the Drawings.

C. The Contractor shall make all necessary arrangements with the MassDOT for the complete installation of the work prior to mobilization and shall do all work required to protect and maintain the roadway and its safe operation. The Contractor shall cooperate fully with the MassDOT throughout the construction of the work and complete the work as expeditiously as possible.

D. MassDOT fees for the services of an Inspector during the course of the work shall be paid to the MassDOT directly by the Contractor. The Contractor shall include an allowance of ten thousand dollars ($10,000) for these services in the General Bid section of this project.

E. The Contractor shall comply with the MassDOT Permit requirements included in SECTION 00858, SPECIAL CONDITIONS - PERMITS AND LICENSES and the following requirements:

1. The Contractor shall fully inform himself of all requirements of the MassDOT as it pertains to the specified project and shall conduct all his work accordingly.
2. The Contractor shall make all necessary arrangements with the MassDOT before entering upon MassDOT property.
3. The MassDOT may require inspection personnel during construction. The MassDOT will provide at its sole discretion such personnel, as it deems necessary or advisable for this project.
4. The Contractor shall submit in writing to the Engineer and MassDOT for written approval the method of construction, plans and time schedule for the work to be completed. No work shall be done until written approval is given.
5. The Contractor shall provide the MassDOT a detailed jacking submittal for review and approval prior to construction.
6. The Contractor shall give ten (10) working days written notice to the Engineer and the MassDOT prior to start of actual work.
7. MassDOT inspection of work shall be permitted at all times and the Contractor shall cooperate fully with the MassDOT's representative.
8. All equipment used by the Contractor on MassDOT property may be inspected by the MassDOT and shall not be used if considered unsatisfactory by the MassDOT representative. Operators of such equipment may be examined by the MassDOT representative to determine their fitness.
9. Route 6 Right-of-Way shall be kept free of obstructions at all times.
10. No work shall occur within the Route 6 Right-of-Way unless specified herein and/or approved in writing by the MassDOT.
11. All work shall be performed and completed in a manner fully satisfactory to the MassDOT's Chief Engineering or his/her authorized representative.
12. The Contractor shall obtain insurance as required by the MassDOT as included in SECTION 00858, SPECIAL CONDITIONS, PERMITS AND LICENSES and DIVISION 00700, GENERAL CONDITIONS.

13. No blasting will be permitted under and/or adjacent to Route 6 road surface.

14. The Contractor shall submit a Trench Permit application with the Town of Orleans and comply with the terms of the Trench Permit.

F. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. The Contractor is responsible to obtain and provide a surety bond in the amount of $500,000 to cover the Crossing work located within the MassDOT Roadway identified as Mid Cape Highway (Route 6).

C. An allowance of $10,000 has been identified in the Bid Proposal to cover the salary, subsistence and travel expenses for any inspector appointed by the MassDOT to supervise the work contemplated.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Jacking Work Plan including Certification of Design. At a minimum, the work plan shall include the following:

a. Layout showing dimensions of jacking shafts and thrust blocks, limits of excavation support, and any necessary specialized equipment and proposed work schedule.

b. Shop drawings and narratives describing proposed pipe jacking including; equipment, equipment layout, procedures, and labor schedule. For jacking shield, show configuration dimensions, method of operation, and steering control capability.

c. Description of proposed dewatering method, in accordance with SECTION 02140 DEWATERING, if needed.

d. Description of precautions to be taken to ensure face stability at locations where obstructions are encountered.

e. Details for supporting carrier pipe during insertion into casing.

f. Details of the settlement monitoring plan for Route 6.

g. Details of the casing lubrication/exterior gravity plan.

h. Time schedule of the work to be completed.

3. Jacking Contractor Qualifications with Certification of Experience. Include resumes of Field Supervisor and Professional Engineer.

4. Calculations: Submit design computations, prepared and stamped by a Professional Structural Engineer registered in the Commonwealth of Massachusetts, that demonstrate that the steel casing pipe to be jacked has been designed to support the maximum anticipated earth loads and superimposed live loads, including but not limited to jacking loads, that may be imposed on the pipe during construction. The Contractor shall determine the additional stresses imposed on the pipe during jacking operations and upgrade the quality and strength of the pipe and pipe joints to the extent necessary to withstand the additional stresses imposed by the jacking operation. The design and computations will not be reviewed by the Engineer.

1.05 - PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed according to the written recommendations of the manufacturer and as to not degrade quality, serviceability or appearance.

B. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

C. If stored for more than two (2) weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. Work required to install the sleeve and piping under the Highway Right-of-Way shall be accomplished by jacking method by an experienced Jacking Contractor. The Jacking Contractor shall have a minimum of ten (10) years of experience in this type of jacking operation. The Contractor shall submit sufficient information to the Engineer and MassDOT’s Chief Engineer to demonstrate that he or his subcontractor has the required previous experience.

C. The Highway Crossing shall be made in accordance with:

1. These Contract Documents;

2. “Geotechnical Section Application Requirements and Permit Conditions: Trenchless Pipe Installation” by the Massachusetts Department of Transportation, dated March 2015;

3. “Geotechnical Section Application Requirements and Permit Conditions: Trenchless Pipe Installation” by the Massachusetts Department of Transportation, dated June 1996; and

4. MassDOT Permit Requirements.

D. Settlement of the ground surface and existing utilities adjacent to temporary excavation support systems shall be limited to 0.5 inch.

PART 2 - PRODUCTS

2.01 - FORCE MAIN PIPE AND FITTINGS

A. All force main pipe and fittings shall be as specified in SECTION 02630, HDPE FORCE MAIN.

2.02 - CONDUITS AND FITTINGS

A. All conduit and fittings shall be as specified in SECTION 16402, UNDERGROUND DISTRIBUTION SYSTEM.

2.03 - CASING PIPE (SLEEVE)

A. Steel casing pipe for the crossing shall be 48-inches in diameter with a nominal thickness of 0.688 inches as shown on the Drawings and shall be designed for earth and/or other pressures present, plus AASHTO H20 live loading with 50 percent added for impacts. The steel casing pipe shall be fully tar coated. The steel casing pipe shall be in full conformance with the specifications.

B. Steel casing pipe shall be ASTM A252, Grade 2, and shall have a minimum yield strength of 36,000 psi. The casing pipe shall conform to ASTM A139 for electric fusion welded steel pipe. Joints shall be fully welded completely around the circumference of the pipe. Each joint in the casing pipe shall be welded and approved prior to subjecting the joint to jacking stresses and placing the pipe to be joined to such a position that the outside surface of the weld cannot be readily inspected by the Engineer. Casing pipe shall conform to the latest revisions of the requirements of AWA Standards for fabricating electrically welded steel water pipes and AWS welding code, or its equivalent.

C. Casing pipe shall be supplied with grout nozzles that meet or exceed the following conditions. Three (3) grout nozzles shall be spaced evenly along the casing per ten- (10) foot length, offset from the adjacent nozzles by one hundred twenty (120) degrees around the circumference. Nozzles shall be two (2) inch NPT threaded with removable plugs.

D. Permalok Casing Pipe and Tri-Loc Casing Pipe can be substituted for the Casing Pipe (Sleeve) subject to the Casing Pipe requirements of the previous paragraphs and subject to MassDOT approval.

2.04 - CASING SPACERS

A. The pipe shall be supported inside the casing with stainless steel casing spacers and polyethylene pipe runners. Spacers shall be located every five (5) feet with a minimum of three (3) per pipe length.

B. Spacers shall be as manufactured by Cascade Waterworks Manufacturing, Co., or equal.

2.05 - CASING END SEALS

A. Masonry brick and mortar casing end seals shall be constructed at each end of the casing to seal the casing and around the pipe protrusions.

2.06 - ANNULUS FILL

A. The annular space between the force main pipe and casing shall be filled with sand.

B. Sand to conform to ASTM C 144; except:

1. Fineness modulus shall be between 1.50 and 2.00.
2. The following Grading requirements:

Sieve Sizes	Percentage Passing by Weight
No. 8	100
No. 16	95 - 100
No. 30	60 - 85
No. 50	20 - 50
No. 100	10 - 30
No. 200	0 - 5

3. Sand shall have a chloride ion concentration less than 50 mg/kg, a sulfate ion concentration less than 100 mg/kg and an electrical resistivity greater than 10,000 ohm-cm. Contractor shall provide laboratory testing results for the sand to be used on this project, demonstrating compliance with these requirements.

C. Beach sand is not acceptable and shall not be utilized.

2.07 - SIGNS

A. The pipeline shall be prominently marked at the MassDOT Right-of-Way on both sides of the highway by durable, weather-proof signs located over the centerline of the pipe. Signs shall include the name and address of the owner, the contents of the pipe, pressure in the pipe, depth below grade at the signs, and an emergency telephone number in the event of a pipe rupture.

B. The Contractor shall provide a submittal showing the proposed layout of the signs to the Engineer for approval prior to erecting them.

2.08 - JACKING SHIELD

A. The steel casing shall be installed with the use of a jacking shield attached to the leading edge of the casing pipe. The shield shall be of steel construction designed to support the required soil loading and jacking stresses and shall be adequately braced and be provided with the necessary appurtenances for completely bulkheading the face with horizontal or vertical breast boards. The shield shall be capable of being steered by steering jacks located in the shield or other suitable means.

2.09 - GROUT

A. Cement Grout shall be a mixture of one part Portland cement conforming to ASTM C150 Type II, and one to two parts sand conforming to ASTM C33 with sufficient water to place the grout. The water content shall be sufficient to impart workability to the grout, but not to the degree that it will allow the grout to flow.

2.10 - OTHER MATERIALS

A. The Contractor shall furnish all necessary materials for complete installation, and materials required by the Engineer and the MassDOT for the proper completion of the work.

PART 3 - EXECUTION

3.01 - GENERAL

A. The Contractor shall furnish and install the pipe within the steel pipe casing beneath the highway at the location shown on the Drawings and to the satisfaction of the Engineer and the MassDOT.

B. Construction of the Highway Crossing shall also conform to the applicable requirements specified in the MassDOT Permit included in SECTION 00858, SPECIAL CONDITIONS, PERMITS AND LICENSES.

C. The method of constructing the steel pipe sleeve under the highway shall be by jacking. Bracing and backstops shall be so designed, and jacks of sufficient rating used, so that the jacking can advance without stoppage (except for adding lengths of pipe) until the leading edge is at the limits shown on the plans.

D. The material excavated from the casing shall be removed immediately from the site and legally disposed of by the Contractor.

E. If the invert of the proposed casing is less than 12-inches above the groundwater level, the Contractor shall install temporary monitor wells in the jacking and receiving pits and lower the water level during construction by pumping from sumps and/or well points and in accordance with MassDOT Guidelines and Permit Requirements, and SECTION 02140 DEWATERING.

F. The pipes shall be carefully placed to the line and grade, and secured to prevent moving. Casing spacers shall be installed as required, as specified herein, and as shown on the drawings.

G. Remove obstructions in a controlled manner while maintaining face stability and avoiding loss of ground.

H. Field joining of sections of casing shall be by welding in conformance with the AWS Welding Code by a Certified Welder.

I. All machine operations are to be performed from a pit constructed to the satisfaction of the Jacking Contractor, Engineer and MassDOT.

J. Before any work is begun within the limits of jacking, the Contractor shall have assembled all tools, materials, and equipment that will be required. When the Contractor has started the jacking operation, he shall proceed in a continuous operation without stopping.

K. A jacking shield shall be used and jacked ahead of the casing pipe. The excavation within the jacking pipe shall not advance beyond the head of the pipe shield. If the stability at the face needs to be maintained from raveling or running soil, suitable temporary bulkheads, struts, and bracing shall be required. After completion of the sleeve installation the annular space around it shall be completely grouted with cement grout under pressure.

L. Upon completion of the jacking operation either a continuous butt weld will be performed, or a continuous collar plate will be provided as shown on the Drawings.

M. The Contractor shall excavate for the jacking pit and receiving pit at each side of the highway. The excavation shall be properly protected by fencing, barricades and warning signs. All excavations shall be covered with steel plates during periods of no work.

N. The use of water or other liquids to facilitate casing equipment and spoil removal is prohibited.

O. If an obstruction is encountered during the installation which stops the advancement of the casing pipe, and it becomes evident that it is impossible to advance the casing further, operations will cease, and the casing shall be left in place and filled with grout, after written approval of the Engineer and MassDOT.

P. Sleeve installations shall have a hole essentially the same as the outside diameter of the casing pipe, plus the thickness of the protective coating. If voids shall develop, grouting or other approved methods shall be employed to fill such voids. The Contractor shall record such occurrences of over excavation in order to identify these zones and stabilize them during post jacking grouting. If unsuitable jacking soil conditions exist, pre-grouting of the underlying soils may be required ahead of the jacking operation, before advancing the sleeve or casing. The Contractor shall notify the Engineer and submit a proposed pre-grouting procedure plan prior to commencement of work. All grouting operations shall follow industry standards. Upon installation of the sleeve, grout shall be pumped through each grout nozzle until all voids are filled. Cement grout shall be injected under pressure using a grout mixture and sequence of operations that will ensure complete filling of all voids.

Q. The Contractor shall be solely responsible for damages resulting from the ground losses and for the filling of voids resulting therefrom. Where ground losses result in damage to underground or surface structures, particularly the existing highway, storm water drain and other existing utilities, and to the ground surface or any improvements thereon, the Contractor shall be solely responsible for the repair of such damage. Where the filling of such collapsed portions cannot be effectively carried out from below, the Engineer and MassDOT reserves the right to order the Contractor, at no additional cost to the Owner, to make an opening from the surface for the purpose of backfilling the voids.

3.02 - SETTLEMENT MONITORING

A. The Contractor shall employ a Professional Land Surveyor licensed in the Commonwealth of Massachusetts to establish lines and grades to install steel casing pipe at the correct location, and to monitor for settlement.

B. The Contractor shall take photographs of the proposed casing alignment prior to starting work. Copies of the photographs shall be supplied to the Engineer and MassDOT.

C. The Contractor shall be responsible for monitoring the ground surrounding the roads, highways and existing utilities for settlement associated with the pipe jacking work and making suitable changes in the construction methods to control ground settlement to 0.5 inch. The Contractor shall monitor ground, highway pavement, and existing utility settlement at the following locations, or at the locations specified in the MassDOT permit:

1. One point at each shoulder of the travelled ways
2. One point at each of the boundaries of the State Highway Layout along the casing pipe alignment.

D. The locations of the settlement monitoring points are shown on the permit and construction plans.

E. Surveying at the indicated deformation monitoring points shall begin two days prior to the start of jacking operations and continue for a minimum of two weeks after the completion of the jacking and grouting. All survey readings shall be recorded to the nearest one-hundredth (0.01) of a foot to detect settlements in the order of one-half (½) inch.

F. Readings will be taken at the end of each work day. The data will be tabulated and provided to the Engineer and MassDOT (District Office and Geotechnical Section). The readings must include the date, the time, weather conditions, temperature and the change in elevation. A plan showing the monitoring locations, the base elevation, the identification of the highway, utilities, and compass direction shall be provided with the survey readings. "Dynamic readings" and "total deflection" shall be recorded. The readings shall be accurate to one-hundredth (0.01) of a foot. The "static" and "dynamic" differential readings shall be combined and the sum compared to the baseline. The resultant number demonstrates the difference in elevation caused by the jacking operation.

G. The Contractor shall keep a record of the daily monitoring operations and supply a copy of this record to the Engineer and MassDOT (District Office and Geotechnical Section) every Friday during the life of the project.

H. The Contractor shall halt all construction activities immediately whenever monitoring points indicate a vertical change in elevation of one-half (½) inch or more, or any surface disruption is observed. The Contractor shall then immediately report the amount of settlement to the Engineer, MassDOT District Permits Engineer and Geotechnical Section.

I. Work will be halted until the problem is resolved at the Contractor's expense to the satisfaction of the Department. Work will commence only after the District Highway Director notifies the Contractor, in writing, to proceed.

J. Any utility realignment, or repairs will be at the expense of the Contractor.

K. Any paving, shoulder regrading or median repairs shall be at the expense of the Contractor.

3.03 - PIPE LAYING

A. General

1. All pipe shall be laid with extreme care as to grade and alignment. Each pipe shall be laid so as to form a close joint with the next adjoining pipe and to bring the inverts continuously to the required grade.

2. All openings to the pipelines shall be satisfactorily protected to prevent the entrance of earth or water.

B. Laying Pipe

1. Excavations shall be made to accommodate the bedding material as previously specified. All excavations shall be kept dry while pipe is being laid and until each joint and pipe has been viewed by the Engineer and approval given to commence backfilling operations. Any pipe which is not laid to grade and alignment shall be relaid to the satisfaction of the Engineer. No blocking shall be used. Pipe shall be installed in accordance with published recommendations of the pipe manufacturer.

2. The pipe shall be set with a laser beam. The laser beam projector shall be rigidly mounted with two point suspension to its support platforms. This will assure that all ground equipment vibrations will be kept to a minimum and permit the laser beam to project itself coaxially through the center of the pipe. All units shall have equipment to control atmosphere conditions in the pipe that could affect the acceptable standard of construction. The alignment method selected must be shown to have worked satisfactorily on at least 3 contracts and laser shall be operated by competent, trained personnel. Establish center line and offset stakes at each manhole, plus one intermediate center line and offset stakes as a check point between manholes. Laser aligning shall not be used to establish a continuous line in excess of 900 feet.

3.04 - GROUTING APPLICATION

A. The Contractor shall pressure grout from the interior of the casing through pre-installed grout holes or nipples. Three holes shall be installed at 120° spacing for every 10 feet of casing. After completing the grouting, the Contractor shall close each grout hole with a ⅛-inch steel plate welded to the casing to ensure water tightness. Alternatively, the holes may be sealed with threaded plugs.

B. Contractor shall submit grout specifications and a step-by-step outline of the grouting procedure to be followed by the Grouting Contractor.

C. The Grouting Contractor shall be a specialist in the field with a minimum of five (5) continuous years of experience in the grouting of soils.

D. Where unavoidable voids are created outside of the casing during the advance of the casing, or due to the removal of material at the front of the casing, such voids shall be immediately filled with sand, clay, bentonite or other non-decomposable material and rammed into place. When the casing has been completely installed all voids filled with temporary material shall be finally filled with cement grout pumped through the grout holes in the casing by starting at the low end.

E. The material to be used and the method of injections shall be prepared by a Professional Engineer and submitted for information prior to the start of work.

F. At all times when the work is being progressed, a Field Supervisor for the work with no less than 24 months experience in the operation of the equipment being used shall be present.

3.05 - LEAKAGE AND TESTING

A. The pipe lines shall be tested by water in the presence of the Engineer, to a pressure equal to 2 times the total dynamic head of the pump (estimated at 110 feet) to which the force main is attached, unless the test pressure is greater than the working pressure of the pipe. In that case the pipe shall be tested to the working pressure of the pipe. The Engineer shall provide the test pressure. This pressure shall be held for a period of at least 15 minutes, allowing a maximum pressure drop of 1 psi. Any defective work shown by this test shall be replaced at no additional cost to the Owner.

B. All equipment, labor, water, gauges, and the like for the testing of the force main shall be supplied at no cost to the Owner.

3.06 - VISUAL INSPECTION

A. At the conclusion of the work, all pipelines shall be visually inspected by the Engineer to insure a straight and plumb alignment.

B. All pipelines which are not straight, and plumb shall be removed and replaced.

3.07 - SAND FILL

A. After the carrier pipe has been successfully installed in the casing pipe, the space between the outside of the carrier pipe and the inside of the casing pipe shall be filled with sand in accordance with approved submittals.

B. The Contractor shall take all precautions necessary to ensure that the carrier pipe does not move and that the annular space between the carrier pipe and casing is evenly and completely filled with the specified annular fill.

3.08 - CLEANING

A. At the conclusion of the work, thoroughly clean the pipe lines by flushing with water or other means to remove dirt, stones, and other material. Prior to acceptance, all pipe lines shall be inspected for cleanliness and to be sure no sand bags, broken pipe, or other obstructions exist.

B. Cleaning and television inspection is as specified in SECTION 02702, CLEANING AND TELEVISION INSPECTION OF SEWER LINES.

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SECTION 02160

EXCAVATION SUPPORT SYSTEMS

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PART 1 - GENERAL

1.01 - SCOPE

A. Design, furnish and install excavation support systems as required to maintain lateral support, prevent loss of ground, limit soil movements to acceptable limits and protect from damage existing and proposed improvements including, but not limited to, pipelines, utilities, structures, roadways, railroads and other facilities.

B. The requirement of sheeting left in place in areas indicated on the drawings does not relieve the Contractor from the responsibility of furnishing and installing proper excavation support systems in other areas.

C. Common types of excavation support system include, but are not limited to, singular or multiple stages comprised of cantilevered or internally braced soldier piles and lagging, steel sheet pile wall, timber sheet pile wall, trench box, or combinations thereof. Trench box temporary excavation support system is only acceptable for pipe or utility trench excavations. Temporary unsupported open cut excavation with stable sloping sides is allowed where applicable.

D. Wherever the word "sheeting" is used in this section or on the contract drawings, it shall be in reference to any type of excavation support system specified except trench box.

E. Construction of the excavation support systems shall not disturb the existing structures or the completed proposed structures. Damage to such structures shall be repaired by the Contractor at no additional cost to the Owner.

F. Adjacent structures are those that bear upon soils above the proposed excavation depth and within a distance equal to twice the total depth of the excavation away from the closest edge of the excavation. Monitor and protect adjacent structures as specified and indicated.

G. Vibration monitoring for excavation support systems will be performed by Contractor's vibration consultant and monitoring firm. Vibration due to Contractor's operations shall not exceed thresholds specified herein.

H. Construction operations not to exceed specified noise limits in accordance with SECTION 01110, ENVIRONMENTAL PROTECTION PROCEDURES.

I. The Contractor shall bear the entire cost and responsibility of correcting any failure, damages, subsidence, upheaval or cave-ins as a result of improper installation, maintenance or design of the excavation support systems. The Contractor shall pay for all claims, costs and damages that arise as a result of the work performed at no additional cost to the Owner.

J. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. "Work" shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. "Furnished by others" shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Submit the following qualifications four (4) weeks prior to the construction:

a. Qualifications of independent vibration consulting and monitoring firm as specified in Paragraph 1.07 D.

b. Qualifications of Contractor's excavation support system designer as specified in Paragraph 1.07 G.

c. Qualifications of Contractor's excavation support system installer as specified in Paragraph 1.07 H.

d. Qualifications of Contractor's independent tieback testing laboratory as specified in Paragraph 1.07 I, if a tieback system is utilized.

e. Qualifications of Contractor's excavation support system installation supervisor as specified in Paragraph 1.07 J.

f. Qualifications of vacuum excavation subcontractor as specified in Paragraph 1.07 F, if deformation monitoring points (DMPs) for utilities are utilized.

2. Submit an excavation support plan stamped and signed by a Registered Professional Engineer in the Commonwealth of Massachusetts, at least two weeks prior to start of the construction. Do not submit design calculations. The review will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include the following items as a minimum:

   a. Proposed excavation support system(s), details, location, layout, depths, extent of different types of support relative to existing features and the permanent structures to be constructed, and methods and sequence of installation and removal.

   b. Certificate of Design: Refer to SECTION 01300, SUBMITTALS.

   c. A list of all design assumptions, including safety factors used for the excavation support system(s) and all lateral pressures used for each system.

   d. If utilizing a tieback system, include tieback installation procedures and criteria for acceptance of tiebacks for performance and proof tests. Submit the tieback testing results to the Engineer for information only.

   e. Requirements of dewatering during the construction.

   f. Minimum lateral distance from the edge of the excavation support system for use for vehicles, construction equipment, and stockpiled construction and excavated materials.

   g. List of equipment used for installing the excavation support systems.

   h. Monitoring schedule, installation procedures and location plans for vibration/noise monitoring, geotechnical instrumentation (deformation monitoring points, inclinometers, etc.) and observation wells/piezometers to monitor ground, excavation support system, adjacent structures and groundwater fluctuation during the entire construction period.

3. Submit a Construction Contingency Plan specifying the methods and procedures to maintain excavation support system stability if the allowable movement of the adjacent ground and adjacent structures is exceeded.

4. Monitoring data within one (1) day of data collection from vibration and noise recording equipment, observation wells, deformation monitoring points and offset lines. Data shall include:

   a. Horizontal and vertical movements of geotechnical instruments and groundwater readings.

   b. New movements since the initial readings of the geotechnical instruments.

   c. Weekly summary in tabular and graphic form at the end of each week.

   d. A schematic plan of excavation and/or relevant construction activities at the time of monitoring.

5. For excavation support systems left in place, submit the following as-built information prior to backfilling and covering the excavation support systems:
    a. Survey locations of the temporary excavation support systems, including coordinates of the ends and points of change in direction.
    b. Type of the excavation support system.
    c. Elevations of top and bottom of the excavation support systems left in place.

1.05 - PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed according to the written recommendations of the manufacturer and as to not degrade quality, serviceability or appearance.

B. If stored for more than two (2) weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

C. Store sheeting and bracing materials to prevent sagging which would produce permanent deformation. Keep concentrated loads which occur during stacking or lifting below the level which would produce permanent deformation of the material.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. Design of excavation support systems shall meet the following minimum requirements:
    1. Support systems shall be designed for earth pressures, hydrostatic pressure, equipment, temporary stockpiles, construction loads, roadways, railroads, and other surcharge loads.
    2. Design a bracing system to provide sufficient reaction to maintain stability.
    3. Limit movement of ground adjacent to the excavation support system to be within the allowable ground deformation as specified.
    4. Design the embedment depth below bottom of excavation to minimize lateral and vertical earth movements and provide bottom stability. Toe of braced excavation support systems shall not be less than 5 feet below the bottom of the excavation.
    5. Design temporary excavation support systems to withstand an additional 2 feet of excavation below proposed bottom of excavation without redesign except for the addition of lagging and/or bracing.
    6. Maximum width of pipe trench excavation shall be as indicated on the drawings.
    7. Do not cast permanent structure walls directly against excavation support walls.
    8. The design location of the excavation support wall shall be determined such that the installed wall and bracing system components are all located outside the limits of the permanent structure. Construction tolerances (e.g. wall verticality) shall be considered in determining the plan location.

1.07 - QUALITY ASSURANCE

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE and as specified.

B. Conform to the requirements of the OSHA Standards and Interpretations: "Part 1926 Subpart P - Excavation, Trenching, and Shoring", and all other applicable laws, regulations, rules, and codes.

C. Construction operations to conform to noise regulations provided in the Noise Control Plan and as required by local regulations.

D. Retain the services of an independent vibration consulting firm with the following in-house personnel to conduct the following vibration monitoring requirements:

1. Preparing, reviewing and signing of monitoring plans and daily reports, and overseeing of the monitoring and interpretation of the vibration data shall be performed by personnel with the following qualifications:

a. Be a Registered Professional Engineer in the Commonwealth of Massachusetts.

b. Have a minimum of five (5) years' experience in the vibration consulting field.

c. Have successfully completed at least five (5) projects with vibration-inducing construction operations, pile driving, and noise levels equal to or more severe than those to be encountered.

2. Assist Contractor in selecting pile driving equipment which will generate the lowest vibration and noise levels.

3. Installation, monitoring and interpretation of monitoring equipment shall be performed by personnel with the following qualifications:

a. Have at least three (3) years of experience in the operation of monitoring equipment proposed for use and interpretation of records produced by such equipment.

b. Have installed, operated, monitored and interpreted equipment and records on at least three (3) projects with vibration-inducing construction operations, pile driving, and noise levels equal to or more severe than those to be encountered.

E. The peak particle velocity for pile driving, or other vibration-inducing operations, shall not exceed the following:

Type of Concrete	Age of Concrete hrs.	Peak Particle Velocity in/sec
Mass Concrete (footings, mats, slab-on-grade, fill concrete, etc.)	0 – 11	1.0
	11 and over	2.0
Concrete Structures (walls, columns, elevated slabs, etc.)	0 – 11	0.5
	11 – 24	1.0
	24 and over	2.0
Existing Structures, residences or utilities		0.5

F. If utilizing DMPs for utilities, vacuum excavation shall be performed by subcontractor having five (5) years of experience in non-destructive vacuum excavation methods for utilities.

G. Prepare design, including calculations and drawings, under the direction of a Professional Engineer registered in the Commonwealth of Massachusetts and having the following qualifications:

1. Not less than ten (10) years' experience in the design of specific excavation support systems to be used.

2. Completed not less than five (5) successful excavation support system projects of equal type, size, and complexity within the last five (5) years.

H. Excavation Support System Installer's Qualifications:

1. Not less than five (5) years' experience in the installation of similar types and equal complexity as the proposed system.

2. Completed not less than five (5) successful excavation support systems of similar type and equal complexity as the proposed system.

I. If utilizing a tieback system, employ an independent testing laboratory to test the tieback system with the following qualifications:

1. Be accredited by the American Association of State Highway and Transportation Officials (AASHTO) Accreditation Program.

2. Employ personnel conducting testing who are trained in the methods and procedures to test and monitor tieback systems of similar type and equal complexity, as the proposed system.

3. Have not less than five (5) years' experience in testing of tieback systems of similar type and equal complexity as the proposed system.

4. Have successfully tested at least three (3) tieback systems of similar type and equal complexity as the proposed system.

J. Install all temporary excavation support systems under the supervision of a supervisor having the following qualifications:

1. Not less than five (5) years' experience in installation of systems of similar type and equal complexity as the proposed system.

2. Completed at least five (5) successful excavation support systems of similar type and equal complexity as the proposed system.

K. All welding shall be performed in accordance with AWS D1.1.

1.08 - REFERENCES

A. American Society for Testing and Materials (ASTM):

1. A36: Standard Specification for Carbon Structural Steel

2. A416: Standard Specification for Low Relaxation, Seven-Wire Steel Strand for Prestressed Concrete

3. A572: Standard Specification for High-Strength Low Alloy Columbium Vanadium Structural Steel.

4. A722: Specification for High-Strength Steel Bars for Prestressed Concrete

5. A615: Standard Specifications for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

B. American Wood Protection Association (AWPA) Standards.

C. American Welding Society (AWS) Code: D1.1.

D. Federal Standard, FS TT-W-571 and Supplements: Wood Preservation and Treating Practices.

E. Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29: Subpart P - Excavations, Trenching and Shoring.

F. American Concrete Institute (ACI)

1. ACI 304: Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

G. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.09 - PROJECT/SITE CONDITIONS

A. Subsurface Conditions: Refer to SECTION 01310, MISCELLANEOUS TESTING AND SOIL DATA.

PART 2 - PRODUCTS

2.01 - MATERIALS

A. Structural Steel: All soldier piles, wales, rakers, struts, wedges, plates, waterstops and accessory steel shapes shall conform to ASTM A36.

B. Steel Sheet Piling: ASTM A572, continuous interlocking type.

C. Timber Lagging Left in Place: Pressure treated per appropriate AWPA standards.

D. Tieback Tendons: Tieback tendons shall be high strength steel wire strand cables conforming to ASTM A416, or bars conforming to ASTM A722. Splicing of individual cables shall not be permitted.

E. Raker Ties: ASTM A615 Grade 60.

F. Cement Grout Materials and Admixtures for Tieback Anchorages: Grout cube strength shall be a minimum 3500 psi at 7 days and 5000 psi at 28 days.

G. Concrete: SECTION 03300, CAST-IN-PLACE CONCRETE.

H. Tamping tools adapted for backfilling voids after removal of the excavation support system.

I. Provide specific trench box sizes for each pipe and utility excavation with structural capacity of retaining soil types as described in OSHA's 29 CFR Part 1926 Subpart P.

2.02 - EQUIPMENT

A. The sheetpile driving equipment shall meet the vibration/noise requirements of the specifications.

PART 3 - EXECUTION

3.01 - INSTALLATION

A. Installation of the excavation support systems shall not commence until the related earth excavation and dewatering submittals have been reviewed by the Engineer with all Engineer’s comments satisfactorily addressed.

B. Install excavation support systems in accordance with the excavation support plan.

C. If utilizing a tieback system, all performance and proof tests shall be conducted in the presence of the Engineer. Testing performed without the Engineer present will not be accepted. Repeat testing in the Engineer's presence at no additional cost to the Owner.

D. Do not drive sheeting within 100 feet of concrete less than seven (7) days old.

E. Carry out program of excavation support in such a manner as to prevent undermining or disturbing foundations of existing structures of work ongoing or previously completed.

F. Bottom of the trench box excavation support system shall be above the pipe invert prior to installing the pipe.

G. Install and read geotechnical instrumentation in accordance with the excavation support plan. Notify the Engineer immediately if any geotechnical instrumentation is damaged. Repair or replace damaged geotechnical instrumentation at the sole option of the Engineer and at no additional cost to the Owner.

H. Continuously monitor movements of the ground adjacent to excavation support systems and adjacent structures. In events of the measured movements approaching or exceeding the allowable movements, take immediate steps to arrest further movement by revising procedures such as providing supplementary bracing, filling voids behind the trench box, supporting utilities or other measures (Construction Contingency Plan) as required.

I. Notify utility owners if existing utilities interfere with the excavation support system. Modify the existing utility with the utility owner's permission or have the utility owner make the modifications at no additional cost to Owner.

3.02 - GROUND DEFORMATION ADJACENT TO EXCAVATION SUPPORT SYSTEMS

A. Allowable Vertical (heave/settlement) and Lateral Movements: 2 inches maximum for the trench box excavation support system, and 1 inch maximum for other types of excavation support systems at any location behind the excavation support system.

B. Monitoring personnel shall use a procedure for reading and recording geotechnical instrumentation data which compares the current reading to the last reading during data collection to eliminate spurious readings.

C. Plot the observed ground deformation readings versus time. Annotate the plots with construction loading and excavation events having an impact on the readings. Evaluate plots by means of secondary rate-of-change plots to provide early warning of accelerating ground movements.

D. Notify the Engineer when the allowable ground deformation is exceeded.

E. Implement Construction Contingency Plan under direction of the excavation support system designer and the Engineer.

3.03 - REMOVAL OF EARTH RETENTION SYSTEM

A. Sheeting shall be left in place unless otherwise indicated or approved in writing by the Engineer.

B. When indicated or approved by the Engineer, remove the excavation support system without endangering the constructed or adjacent structures, utilities, or property. Immediately backfill all voids left or caused by withdrawal of excavation support systems with bank-run gravel, screened gravel or select borrow by tamping with tools specifically adapted for that purpose.

C. When tiebacks are used, release tension in tiebacks as the excavation is backfilled. Do not leave tensioned tieback in place at the completion of the work.

D. The excavation support system left-in-place shall be cut-off a minimum of 2 feet below the bottom of the next higher foundation level or a minimum of 5 feet below finished grade.

E. Conduct survey of the locations and final cut-off elevations of the excavation support systems left in place.

3.04 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 02210

EARTH EXCAVATION, BACKFILL, FILL AND GRADING

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PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide Earth Excavation, Backfill, Fill and Grading as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

C. Perform the following earth excavation, backfill, fill and grading as indicated or specified:

1. Make excavations to accommodate piping, conduits, foundations and other structures.
2. Provide materials for backfilling excavations and constructing embankments and fills as indicated and specified.
3. Construct embankments of compacted materials. Grade surfaces to meet finished grades indicated.
4. Immediately notify the Engineer if suspected hazardous materials are encountered and cease operations in that part of work.
5. Remove boulders within the excavation limits.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.
10. Percentage of compaction is defined as the ratio of the field dry density, as determined by ASTM D1556 to the maximum dry density determined by ASTM D1557 Procedure C, multiplied by 100.
11. Proof Roll: Compaction with a minimum of 4 passes of a vibratory steel drum or rubber tire roller. Vibratory plate compactors shall be used in small areas where vibratory steel drum or rubber tire roller cannot be used.

12. Acceptable Material: Material which does not contain organic silt or organic clay, peat, vegetation, wood or roots, stones or rock fragments over 6-inch in diameter, porous biodegradable matter, loose or soft fill, excavated pavement, construction debris, or refuse. Stones or rock fragments shall not exceed 40 percent by weight of the backfill material.

13. Unacceptable Materials: Materials that do not comply with the requirements for the acceptable material or which cannot be compacted to the specified or indicated density.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Qualifications of the Contractor's Independent Testing Laboratory as specified in Paragraph 1.06.G, four (4) weeks prior to the execution of any earth excavation, backfilling, filling, or compaction process.

2. Submit an excavation, backfilling, and filling plan at least two weeks prior to start of any earth moving activities. The review will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include, but not be limited to the following items:

a. Detailed sequence of work.

b. General description of construction methods.

c. Numbers, types, and sizes of equipment proposed to perform excavation and compaction.

d. Details of dust control measures.

e. Proposed locations of stockpiled excavation and/or backfill materials.

f. Proposed surplus excavated material off-site disposal areas and required permits.

g. Details of erosion and sedimentation control measures which will prevent erosion and sedimentation during the earth moving activities.

3. The following material submittals shall be submitted to the Engineer prior to backfilling and filling:

a. Screened Gravel: As specified in SECTION 02223, SCREENED GRAVEL.

b. Bank-run Gravel: As specified in SECTION 02224, BANK-RUN GRAVEL.

c. Select Borrow: As specified in SECTION 02225, SELECT BORROW.

d. Crushed Stone: As specified in SECTION 02435, CRUSHED STONE.

e. Other Acceptable Materials: Laboratory testing results of gradation and moisture-density relationship. Submittal shall include specific location of the source and the date when sample was taken.

4. During Construction, submit written confirmation of fill lift thickness, in-place soil moisture content, and percentage of compaction to the Engineer before placing the next lift or constructing foundations.

1.05 - PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed according to the written recommendations of the manufacturer and as to not degrade quality, serviceability or appearance.

B. All products delivered to the project site shall be accompanied by test reports certifying that the product conforms to the ASTM specifications listed herein, where applicable. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

C. If stored for more than two (2) weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

B. The design conditions and other pertinent requirements for the equipment are listed on the Contract Drawings.

1.07 – QUALITY ASSURANCE

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE and as specified.

B. Dewatering and Groundwater Control: Provide and maintain as specified in SECTION 02140, DEWATERING.

C. Excavations shall be performed in the dry, and kept free from water, snow and ice during construction. Bedding and backfill material shall not be placed in water. Water shall not be allowed to rise upon or flow over the bedding and backfill material.

D. Temporary Excavation Support Systems: Provide and maintain as specified in SECTION 02160, EXCAVATION SUPPORT SYSTEMS.

1. The Contractor shall be solely responsible for making all excavations in a safe manner. All excavation, trenching, and related sheeting, bracing, etc. shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926 Subpart P) and State requirements. Where conflict between OSHA and State regulations exists, the more stringent requirements shall apply.

2. Do not excavate, construct embankments, or fill until all the required submittals have been reviewed by the Engineer.

3. Formulate excavation, backfilling, and filling schedule and procedures to eliminate possibility of undermining or disturbing foundations of partially and completed structures, pipelines and embankments or existing structures and pipelines.

E. Employ an Independent Testing Laboratory to perform particle size and gradation analyses in accordance with ASTM D422, and to determine compactibility in accordance with ASTM D1557 for all the proposed backfill and fill materials, and monitoring field compaction operations. The Contractor’s Independent Testing Laboratory shall have the following qualifications:

1. Be accredited by the American Associates of State Highway and Transportation Officials (AASHTO) Accreditation Program.

2. Have three (3) years’ experience in sampling, testing and analysis of soil and aggregates, and monitoring field compaction operations.

3. Able to provide three (3) references from previous work.

F. Field Testing and Inspections

1. By Contractor’s Independent Testing Laboratory, acceptable to the Engineer, at Contractor's expense as specified in herein.

2. Location of tests mutually acceptable to testing laboratory and the Engineer or as directed by the Engineer.

3. In the event compacted material does not meet specified in-place density, recompact material and retest this area until specified results are obtained at no additional cost to the Owner.

4. Contractor’s Independent Testing Laboratory to perform inspection at least once daily to confirm lift thickness and compaction effort for entire fill area.

G. Methods of Field Testing

1. In-Place Density: ASTM D1556, ASTM D2167, or ASTM D6938.

2. In-Place Moisture Content: ASTM D6938, ASTM D4944, or ASTM D4959.

H. Material Testing Frequency: The following testing frequencies are minimum required for all structural and non-structural fill, grading and embankment.

1. Field In-Place Density and Moisture Content - Screened gravel and crushed stone shall be compacted as specified and indicated. For other backfill and fill materials, minimum test frequency shall be as follows, and no less than one test per:

    a. Trenches under structures' foundation preparation or roadways subbase: Every 1,000 lin. ft. per lift.

    b. Trenches in areas without structures or roadways: Every 1,000 lin. ft. per alternate lift.

    c. Paved Roadways: Every 200 lin. ft. per lift.

    d. Paved Areas: 3,500 sq. ft. per lift.

    e. Under Structure: 1,000 sq. ft. per lift.

    f. Around Structures: 1,500 sq. ft. per lift.

    g. Embankment Fills: 10,000 sq. ft. per lift.

2. Moisture Density - One per source, except for screened gravel and crushed stone. Repeat the moisture density test for every 5,000 cubic yard of material use, and whenever visual inspection indicates a change in material gradation as determined by the Engineer.

3. Gradation Analysis – A minimum of one per source and for each moisture density test and whenever visual inspection indicates a change in material gradation.

4. Liquid Limit, Plastic Limit and Plasticity Index - Minimum of one test per 5,000 cubic yard of soil for use as fill material and whenever classification of material is in doubt as determined by the Engineer

I. Construction Tolerances

1. Construct finished surfaces to plus or minus 1 inch of the elevations indicated.

2. Grade cut and fill areas to plus or minus 0.20 foot of the grades indicated.

3. Complete embankment edges to plus or minus 6 inches of the slope lines indicated.

4. Provide the Engineer with adequate survey information to verify compliance with above tolerances.

J. Cut pavement with a saw or pneumatic tools to prevent damage to remaining pavement without extra compensation. Where pavement is removed in large pieces, dispose of pieces before proceeding with excavation.

K. Pipes, drains, and other utilities may exist in certain locations not indicated on drawings. No attempt has been made to show all services. Completeness or accuracy of information given is not guaranteed.

L. Dig test pits considered as incidental to the normal excavation as indicated and specified in this Section, at no additional compensation.

M. Carefully support and protect from damage, existing pipes, poles, wires, fences, curbs, property line markers, and other structures, which the Engineer determines must be preserved in place without being temporarily or permanently relocated. Should such items be damaged, restore without compensation therefore, to at least as good condition as that in which they were found immediately before the work was begun.

N. Whenever certain existing structures, as described below, are encountered, and the Engineer so directs, change the location, remove and later restore, or replace such structures, or assist the Owner in doing so. Such work to be paid for under applicable items of work, otherwise as Extra Work.

O. In removing existing pipes or other structures, include for payment only those new materials which are necessary to replace those unavoidably damaged as determined by the Engineer.

P. The preceding two paragraphs apply to pipes, wires, and other structures which meet the following: (a) are not indicated on the drawings or otherwise provided for, (b) encroach upon or are encountered near and substantially parallel to the edge of the excavation, and (c) in the opinion of the Engineer, will impede progress to such an extent that satisfactory construction cannot proceed until they have been changed in location, removed (to be later restored), or replaced.

Q. Restore existing property or structures as promptly as practicable.

R. If material unacceptable for foundation (in the opinion of the Engineer) is found at or below the grade to which excavation would normally be carried in accordance with the drawings and/or specifications, remove such material to the required width and depth as directed by the Engineer and replace it with screened gravel, select borrow, or concrete.

S. Do not remove excavation materials from the site of the work or dispose of except as directed or permitted by the Engineer.

T. Haul away and dispose of surplus excavated materials at locations directed by the Engineer at no additional cost to the Owner.

U. During progress of work, conduct earth moving operations and maintain work site so as to minimize the creation and dispersion of dust. Furnish and spread calcium chloride if the Engineer decides that it is necessary for more effective dust control.

V. Provide suitable and safe bridges and other crossings where required for accommodation of travel, and to provide access to private property during construction, and remove said structures thereafter.

1.08 - REFERENCES

A. American Society for Testing and Materials (ASTM) Publications:

1. ASTM C33 - Specification for Concrete Aggregates.
2. ASTM C136 - Test Method for Sieve Analysis of Fine and Coarse Aggregates.
3. ASTM D6913 – Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
4. ASTM D7928 - Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis.
5. ASTM D1140 - Test Methods for Determining the Amount of Material Finer than the 75 µm (No. 200) Sieve in Soils by Washing.
6. ASTM D1556 - Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
7. ASTM D1557 - Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft^3 (2,700 kN-m/m^3)).
8. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
9. ASTM D4318 - Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
10. ASTM D4718 - Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
11. ASTM D4944 - Test Method for Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Gas Pressure Tester.
12. ASTM D4959 - Test Method for Determination of Water Content of Soil by Direct Heating.
13. ASTM D5080 - Test Method for Rapid Determination of Percent Compaction.
14. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

B. Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29: Subpart P - Excavations, Trenching and Shoring.

C. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.09 - SITE CONDITIONS

A. Subsurface Conditions: Refer to SECTION 01310, MISCELLANEOUS TESTING AND SOIL DATA.

PART 2 - PRODUCTS

2.01 - GENERAL

A. Use only acceptable materials from excavations or borrows.

B. Provide 1,500 psi concrete, Screened Gravel, Bank-Run Gravel, fine aggregate, Select Borrow, and Crushed Stone.

C. Provide Fine Aggregate conforming to ASTM C33.

D. Provide erosion/sedimentation control devices as indicated, including geotextile fabric in accordance with SECTION 02223, SCREENED GRAVEL.

E. Provide geotextile fabric as indicated, meeting the requirements and conforming to SECTION 02273, GEOTEXTILE FABRIC.

2.02 - EQUIPMENT

A. The compaction equipment shall be selected by the Contractor and shall be capable of consistently achieving the specified compaction requirements. The selected compaction equipment shall meet the following minimum requirements:

1. Manually operated vibratory plate compactors weighing no less than 200 pounds with vibration frequency no less than 1,600 cycles per minute.

2. Vibratory steel drum or rubber tire roller weighing at least 12,000 pounds.

PART 3 - EXECUTION

3.01 - SITE MAINTENANCE

A. Roadway and Site Leveling: Grade roadway and site as to maintain them in a level unrutted condition and to eliminate puddling of surface and subsurface water.

3.02 - EXCAVATION

A. Execution of any earth excavation shall not commence until the related dewatering, excavation support systems, and backfill and fill materials submittals are reviewed by the Engineer and all Engineer’s comments satisfactorily addressed.

B. Carry out program of excavation, dewatering, and excavation support systems to eliminate possibility of undermining or disturbing foundations of existing structures or of work previously completed under this contract.

C. Excavate to widths that give suitable room for building structures or laying and jointing piping.

D. Do not plow, scrape or dig by machinery near to finished subgrade in a manner that would result in disturbance of subgrade.

E. Excavate to lines and grades indicated in an orderly and continuous program.

F. Establish limits of excavation to allow adequate working space for installing forms and for safety of personnel.

G. Excavate to elevations indicated, or deeper, as directed by the Engineer, to remove unacceptable bottom material.

H. Exercise care to preserve material below and beyond the lines of excavations.

I. Place excavated material at the approved stockpile locations and in no case closer than 3 feet from edge of excavations to prevent cave-ins of bank slides.

J. Regard small, less than one cubic yard, boulders, rock fragments, and concrete encountered during excavation as a normal part of in-place soils and not included for payment as rock.

K. Excavate for depressed foundations, where mat foundations are indicated as depressed. Sheet and shore existing ground so that adjacent sections of foundation mat will rest on undisturbed ground as indicated. Installation of sheeting shall be in accordance with SECTION 02160, EXCAVATION SUPPORT SYSTEMS.

3.03 - SEPARATION OF EXCAVATED MATERIALS FOR REUSE

A. Remove only existing pavement that is necessary for prosecution of work.

B. Carefully remove loam and topsoil from excavated areas. Store separately for further use or furnish equivalent loam and topsoil as directed.

C. Carefully remove acceptable material from excavated areas and store separately for further use as backfill material.

3.04 - TRENCH EXCAVATION

A. When pipe is to be laid in gravel bedding or concrete cradle, excavate trench by machinery to, or just below designated subgrade. If material remaining at bottom of trench is disturbed, recompaction shall be required.

B. When pipe is to be laid directly on bottom of trench, do not excavate lower part of trenches by machinery to subgrade. Remove remainder of material to be excavated just before placing of pipe by use of hand tools. Form a flat or shaped bottom, true to grade, so pipe will have a uniform and continuous bearing. Support on firm and undisturbed material between joints, except for limited areas where use of pipe slings has disturbed bottom.

3.05 - DEPTH OF TRENCH

A. Excavate trenches to depths so as to permit pipe to be laid at elevations, slopes, or depths of cover indicated on drawings, and at uniform slopes between indicated elevations.

3.06 - WIDTH OF TRENCH

A. Make pipe trenches as narrow as practicable and do not widen by scraping or loosening materials from the sides. Make every effort to maintain sides of trenches firm and undisturbed until backfilling has been placed and compacted.

B. Excavate trenches with approximately vertical sides between spring line of pipe and elevation of 1 foot above the top of pipe.

3.07 - TRENCH EXCAVATION IN FILL

A. Place and compact material to top of fill or to a minimum height of 1 foot above the top of pipe, whichever is less, when pipe is to be laid in embankment or other recently filled material. Take particular care to ensure maximum consolidation of material under pipe location. Excavate pipe trench as though in undisturbed material.

3.08 - EXCAVATION NEAR EXISTING STRUCTURES

A. Discontinue digging by machinery when excavation approaches pipes, conduits, or other underground structures. Continue excavation by use of hand tools. Include such manual excavation in work to be done when incidental to normal excavation and under items involving normal excavation.

B. Excavate test pits when determination of exact location of pipe or other underground structure is necessary for doing work properly.

3.09 - REMOVAL OF SUBSURFACE OBSTRUCTIONS

A. Remove indicated subsurface structures and related obstructions to extent shown.

B. Promptly notify the Engineer when any unexpected subsurface facilities are encountered during excavation such as utility lines and appurtenances, walls and foundations.

3.10 - UNAUTHORIZED EXCAVATION

A. When the bottom of any excavation for structures is taken out beyond limits indicated or specified, backfill, with screened gravel and crushed stone wrapped with non-woven geotextile fabric or with 1,500 psi concrete.

3.11 - REUSE AND DISPOSAL OF SURPLUS EXCAVATED MATERIALS

A. Reuse surplus acceptable excavated materials for backfill; deposit neatly and grade so as to make or widen fills, flatten side slopes, or fill depressions; or legally dispose off-site; all as directed or permitted and without additional compensation.

3.12 - SUBGRADE PREPARATION AND PROTECTION

A. Remove loam and topsoil, loose vegetative matter, stumps and large roots from areas upon which embankments will be built or material will be placed for grading. Shape subgrade as indicated on drawings, and prepare by forking, furrowing, or plowing so that the first layer of new material placed thereon will be well bonded to it.

B. As directed by the Engineer, over-excavate unacceptable materials below the foundation subgrade. Backfill the over-excavation with compacted screened gravel or crushed stone wrapped with nonwoven geotextile fabric. In no case shall the screened gravel be placed directly on the exposed subgrade prior to placing the geotextile fabric.

C. Proof roll the foundation subgrade prior to backfilling and filling operation or placing foundation concrete.

D. Proof roll the pipe trench foundation subgrade prior to backfilling and filling operation or placing soil-supported pipeline.

E. Utilize excavating equipment equipped with a toothless or smooth edged, excavating bucket to expose the pipe trench foundation subgrade to avoid disturbance of the bearing surface. Tamp the exposed subgrade with the excavating bucket prior to backfilling and filling operation or placing soil-supported pipeline.

3.13 - CARE AND RESTORATION OF PROPERTY

A. Enclose uncut tree trunks adjacent to work in wooden boxes of such height as may be necessary for protection from injury from piled material, equipment, operations, or otherwise due to work. Operate excavating machinery and cranes of suitable type with care to prevent injury to trees not to be cut and particularly to overhanging branches and limbs.

B. Cut all branches, limbs, and roots smoothly and neatly without splitting or crushing. Neatly trim, cut the injured portions and cover with an application of grafting wax or tree healing paint as directed.

C. Protect cultivated hedges, shrubs, and plants which might be injured by the Contractor's operations by suitable means or dig up and temporarily replant and maintain. After construction operations have been substantially completed, replant in original positions and care for until growth is reestablished. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish in their beauty or usefulness, replace by items of equal kind and quality existing at the start of the work.

D. Do not use or operate tractors, bulldozers, or other power-operated equipment on paved surfaces when their treads or wheels are so shaped as to cut or otherwise damage such surfaces.

E. Restore surfaces damaged by the Contractor's operations to a condition at least equal to that in which they were found immediately before work commenced. Use suitable materials and methods for such restoration.

3.14 - BACKFILLING - GENERAL

A. Do not place frozen materials in backfill or place backfill upon frozen material. Remove previously frozen material or treat before new backfill is placed.

B. Do not place, spread, roll or compact fill material during unfavorable weather conditions. If interrupted by heavy rain or other unfavorable conditions, do not resume until ascertaining that the moisture content and density of the previously placed soil are as specified.

C. Do not use puddling, ponding or flooding as a means of compaction.

3.15 - MATERIAL PLACEMENT AND COMPACTION REQUIREMENTS

A. Select Borrow, and Fine Aggregate:

1. Dump and spread in layers not to exceed 8-inch uncompacted thickness.

2. Compact, fill and backfill under structure and bedding for pipes (from below pipe to spring line) as indicated but to not less than 95 percent. Compact to not less than 90 percent in other areas unless otherwise indicated.

B. Screened Gravel and Crushed Stone:

1. Dump and spread in layers not to exceed 8-inch uncompacted thickness.

2. Compact using self-propelled vibratory steel drum or rubber tire rollers with a minimum of 4 passes in directions perpendicular to one another in open areas. In small areas, use manually operated vibratory plate compactors with a minimum of 4 passes.

C. Bank-Run Gravel and Acceptable materials for use as non-structural fill:

1. Dump and spread in layers not to exceed 12-inch. uncompacted thickness.

2. Compact to not less than 90 percent unless otherwise indicated.

D. Backfilling and filling operation shall be suspended in areas where tests are being made until tests are completed and the testing laboratory has advised the Engineer that adequate densities are obtained.

E. **Material Placement and Compaction Requirements – State Roads**

1. Material placement and compaction requirements for work in State Roads shall comply with the requirements of MassDOT Permit No. 5-2019-0487.

2. The Contractor shall perform the work for backfill testing methods as follows:

a. All methods used to determine and verify the proper compaction of backfill shall be in accordance with AASHTO Standard Specifications of Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth) (Designation T238-86 Method B - Direct Transmission shall be used to determine in-place density) and Moisture Content of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth) (Designation T239-91). Backfill material shall be in accordance with MassDOT, Highway Division Standard Specifications, Section 150.64, Subsection C.

b. All methods and work shall be performed by a technician on location certified in "soils" by the New England Transportation Technician Certification Program (NETTCP). All data and results shall be submitted to the appropriate District Highway Director for its review and acceptance.

3.16 - STRUCTURAL FILL AND BACKFILL UNDER STRUCTURES

A. Compact fill and backfill under structures and pavements with screened gravel, crushed stone, select borrow, or fine aggregate as specified and indicated.

3.17 - NON-STRUCTURAL BACKFILL AROUND STRUCTURES

A. Use acceptable materials for non-structural backfill around structures and compacted as specified and indicated.

B. Conduct hydraulic testing as soon as practicable after structures are constructed and other necessary work has been done. Start backfilling promptly after completion of tests.

C. Deposit material evenly around structure to avoid unequal soil pressure.

D. Do not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking, or other damage.

3.18 - BACKFILLING PIPE TRENCHES

A. General:

1. Begin backfilling and proceed until completed after: the pipes and conduits have been laid, joints have acquired maximum degree of hardness, pipelines and conduits have successfully passed tests and inspections as required in the Specifications, and concrete or masonry structures within the trench have reached their design strength to support all loads.
2. Backfill and compact indicated material under, around, and above pipes, conduits, and other structures to the indicated or specified compaction density requirement. Utilize compaction devices which will not damage the pipe, conduit, or structure within the trench.
3. Do not drop backfill material into trench from a height of more than 5 ft., or in a manner which will damage the pipe, conduit, or other structure within trench.

B. Pipe Trenches:

1. Materials:
   a. From below pipe to 1 foot above the top of pipe: Use Screened Gravel, or Crushed Stone, unless otherwise indicated.
   b. One foot above top of pipe to finished grade or to pavement subbase: Use Bank-Run Gravel or acceptable materials, unless otherwise indicated.
2. Compacting Around Pipes: Compact material around circumference of pipe and the area between the trench wall and the pipe by hand tamping in 6 inches layers.
3. Compacting Above Pipe: Compact material by hand tamping. If trench width is wide enough to accommodate power tools and the compacted material over the pipe will support the load of the power tools without damage to the pipe, use rollers or other powered compaction equipment able to more readily achieve compaction requirements.

3.19 - MATERIAL FOR FILLING AND EMBANKMENTS

A. Use acceptable materials for filling and building embankments unless otherwise indicated.

3.20 - PLACING AND COMPACTING EMBANKMENT MATERIAL

A. Compact fill material as specified and indicated.

B. Perform fill operation in an orderly and systematic manner using equipment in proper sequence to meet the specified compaction requirements.

C. Place fill on surfaces which are free of unacceptable materials.

D. Begin filling in lowest section of work area. Grade surface of fill approximately horizontal but provide with sufficient longitudinal and transverse slope to allow for runoff of surface water from every point.

E. Conduct filling so that no obstruction to drainage from other sections of fill area is created at any time.

F. Install temporary dewatering sumps in low areas during filling operation where excessive amounts of rain runoff collect.

G. Reduce moisture content of fill material, if necessary, in source area by working it over under warm and dry atmospheric conditions. A large disc harrow with two to three-foot diameter disks may be required for working soil in a drying operation.

H. Compact uniformly throughout. Keep surfaces of fill reasonably smooth and free from humps and hollows which would prevent proper and uniform compaction. Do not permit hauling equipment to follow a single track on the same layer but direct equipment to spread out to prevent over-compaction in localized areas. Take care in obtaining thorough compaction at edges of fill.

I. Slightly slope surface of fill to ensure drainage during periods of wet weather. Do not place fill while rain is falling or after a rain-storm until the Engineer considers conditions satisfactory. During such periods and upon suspension of filling operations for any period in excess of 12 hours, roll smooth the surface of fill using a smooth wheel static roller to prevent excessive absorption of rainfall and surface moisture. Prior to resuming compaction operations, remove muddy material off surface to expose firm, compacted material, as determined by the Engineer.

J. When fill is placed against an earlier fill or against in-situ material under and around structures, including around piping beneath structures or embankments, slope junction between two sections of fill, 1 vertical to 1.5 horizontal. Bench edge of existing fill 24-inches to form a serrated edge of compact stable material against which to place the new fill. Ensure that rolling extends over junction between fills.

K. When fill is placed directly upon another older fill, clean surface thoroughly of debris and remove any loose material. Then proof roll the entire old surface.

L. After spreading each loose lift to the required thickness and adjusting its moisture content as necessary, roll with sufficient number of passes to obtain the required compaction. One pass is defined as the required number of successive trips which by means of sufficient overlap will insure complete coverage and uniform compaction of an entire lift. Do not make additional passes until previous pass has been completed.

M. In the case that material of any fill sinks and weaves under roller or under hauling units and other equipment, required degree of compaction is not being obtained. Reduce the moisture content. If such sinking and weaving produces surface cracks, suspend operations on that part of the embankment until it becomes sufficiently stabilized. Ideal condition in fill is that attained when the entire fill below the surface being rolled is so firm and hard as to show only the slightest weaving and deflection as roller passes. Spread out rolling operations over the maximum practicable area to minimize condition of sinking and weaving.

N. If because of defective workmanship, compaction obtained over any area is less than that required, remedy condition at no cost to Owner. If additional rolling or other means fail to produce satisfactory results, remove material in that area down to a level of satisfactory density. Perform removal, replacement, and rerolling without additional compensation.

3.21 - COMPACTION CONTROL OF BACKFILL, FILL, AND EMBANKMENT

A. Compact to density specified and indicated for various types of material. Control moisture content of material being placed as specified or if not specified, at a level slightly lower than optimum.

B. The soil testing laboratory shall provide inspection during filling or backfilling operations to ensure compaction of screened gravel or crushed stone and record compaction equipment in use.

C. Moisture control may be required either at the stockpile area, pits, or on embankment or backfill. Increase moisture content when material is too dry by sprinkling or other means of wetting uniformly. Reduce moisture content when material is too wet by using ditches, pumps, drainage wells, or other devices and by exposing the greatest possible area to sun and air in conjunction with harrowing, plowing, spreading of material or any other effective methods.

3.22 - ALLOWANCE FOR SHRINKAGE

A. Build embankments or backfill to a height above finished grade which will, in the opinion of the Engineer, allow for the shrinkage or consolidation of material. Initially, provide at all points, an excess of at least one percent of total height of backfill measured from stripped surface to top of finished surface.

B. Supply specified materials and build up low places as directed, without additional cost if embankment or backfilling settles so as to be below the indicated level for proposed finished surface at any time before final acceptance of the work.

3.23 -CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 02223

SCREENED GRAVEL

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PART 3 – EXECUTION 3
3.01 - PLACEMENT AND COMPACTION 3
3.02 - CONTRACT CLOSEOUT 3

PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide and compact Screened Gravel as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Gradation test result from the Contractor’s Independent Testing Laboratory, at least two (2) weeks prior to hauling material, for the Engineer’s acceptance.
2. Submit a 20-pound sample of the material when requested by the Engineer.

1.05 - PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed according to the written recommendations of the manufacturer and as to not degrade quality, serviceability or appearance.

1.06 - DESIGN CRITERIA

A. Qualifications of the Independent Testing Laboratory as specified in SECTION 02210, EARTH EXCAVATION, BACKFILL, FILL AND GRADING.

B. Maximum particle size and gradation analyses shall be performed in accordance with ASTM D6913.

C. Material testing frequency and requirements as specified in SECTION 02210, EARTH EXCAVATION, BACKFILL, FILL AND GRADING.

1.07 - REFERENCES

A. American Society for Testing and Materials (ASTM) Publications:

1. ASTM C33 - Specification for Concrete Aggregates
2. ASTM D6913 - Test Method for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.

B. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 – PRODUCTS

2.01 - MATERIAL

A. Screened Gravel: Gradation and physical property requirements of Screened Gravel shall conform to ASTM C33, Coarse Aggregate Number 67.

B. Screened Gravel shall be free from roots, vegetation, leaves, and other organic materials, and free of ice, snow, clay, frost, frozen soil particles and other fine or harmful substances.

C. Crushed rock of equivalent size and grading may be used instead of Screened Gravel.

PART 3 – EXECUTION

3.01 - PLACEMENT AND COMPACTION

A. Specified in SECTION 02210, EARTH EXCAVATION, BACKFILL, FILL AND GRADING and as indicated on the drawings.

3.02 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT

END OF SECTION

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SECTION 02224

BANK-RUN GRAVEL

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 1
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2.01 - MATERIAL 2
PART 3 – EXECUTION 3
3.01 - PLACEMENT AND COMPACTION 3
3.02 - CONTRACT CLOSEOUT 3

PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide and compact Bank-Run Gravel as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Gradation and compaction test results from the Contractor’s Independent Testing Laboratory, at least two (2) weeks prior to hauling material, for the Engineer’s acceptance.
2. Submit a 20-pound sample of the material when requested by the Engineer.

1.05 - PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed according to the written recommendations of the manufacturer and as to not degrade quality, serviceability or appearance.

1.06 - QUALITY ASSURANCE

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE and as specified.

B. Qualifications of the Independent Testing Laboratory as specified in SECTION 02210, EARTH EXCAVATION, BACKFILL, FILL AND GRADING.

C. Maximum particle size and gradation analyses shall be performed in accordance with ASTM D6913 and D1140. Soil compaction test shall be performed in accordance with ASTM D1557 Procedure C.

D. Material testing frequency and requirements as specified in SECTION 02210, EARTH EXCAVATION, BACKFILL, FILL AND GRADING.

1.07 - REFERENCES

A. American Society for Testing and Materials (ASTM) Publications:

1. C33: Specification for Concrete Aggregates.
2. D1140: Test Methods for Determining the Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing.
3. D1557: Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (600 kN-m/m^3).
4. D6913: Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.

B. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 – PRODUCTS

2.01 - MATERIAL

A. Bank-Run Gravel shall be obtained from approved natural deposits and unprocessed except for the removal of deleterious materials and stones larger than the maximum size permitted.

B. Bank-Run Gravel shall be unfrozen and substantially free from vegetation, roots, loam and other organic matter, clay, snow, frozen particles and other fine or harmful substances.

C. Bank-Run Gravel: Inorganic granular material meeting the following gradation:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
6 in.	100
2 in.	80 - 100
No. 4.	20 - 65
No. 200	0 - 12

PART 3 – EXECUTION

3.01 - PLACEMENT AND COMPACTION

A. Specified in SECTION 02210, EARTH EXCAVATION, BACKFILL, FILL AND GRADING and as indicated on the drawings.

3.02 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 02225

SELECT BORROW

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 1
1.03 - DEFINITIONS 1
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING 2
1.06 - DESIGN CRITERIA 2
1.07 - REFERENCES 2
PART 2 - PRODUCTS 3
2.01 - MATERIAL 3
PART 3 – EXECUTION 3
3.01 - PLACEMENT AND COMPACTION 3
3.02 - CONTRACT CLOSEOUT 3

PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide Select Borrow as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Gradation and compaction test results from the Contractor’s Independent Testing Laboratory, at least two (2) weeks prior to hauling material, for the Engineer’s acceptance.
2. Submit a 20-pound sample of the material when requested by the Engineer.

1.05 - PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed according to the written recommendations of the supplier and as to not degrade quality, serviceability or appearance.

1.06 - QUALITY ASSURANCE

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE and as specified.

B. Qualifications of the Independent Testing Laboratory as specified in SECTION 02210, EARTH EXCAVATION, BACKFILL, FILL AND GRADING.

C. Maximum particle size and gradation analyses shall be performed in accordance with ASTM D6913 and D1140. Soil compaction test shall be performed in accordance with ASTM D1557 Procedure C.

D. Material testing frequency and requirements as specified in SECTION 02210, EARTH EXCAVATION, BACKFILL, FILL AND GRADING.

1.07 - REFERENCES

A. American Society for Testing and Materials (ASTM) Publications:

1. C33: Specification for Concrete Aggregates
2. D6913: Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
3. D1140: Test Methods for Determining the Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing.
4. D1557: Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3).
5. D2487: Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

B. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - MATERIAL

A. Use only material free from roots, leaves, and organic matter, and free of ice, snow, frost and frozen soil particles.

B. Select Borrow shall be well-graded coarse-grained soil in accordance with ASTM D2487 and shall meet the following gradation:

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
3 in.	100
1-1/2 in.	70 - 100
3/4 in.	50 - 85
No. 4	30 - 60
No. 50	10 - 25
No. 200	0 - 5

Soil particles shall conform to the physical property requirements of ASTM C33.

PART 3 – EXECUTION

3.01 - PLACEMENT AND COMPACTION

A. Specified in SECTION 02210, EARTH EXCAVATION, BACKFILL, FILL AND GRADING and as indicated on the drawings.

3.02 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 02273

GEOTEXTILE FABRIC

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 1
1.03 - DEFINITIONS 1
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING 2
1.06 - DESIGN CRITERIA 2
1.07 - REFERENCES 2
PART 2 - PRODUCTS 3
2.01 - MANUFACTURERS 3
2.02 - MATERIAL 3
PART 3 - EXECUTION 4
3.01 - INSTALLATION 4
3.02 - CONTRACT CLOSEOUT 4

PART 1 - GENERAL

1.01 - SCOPE

A. Provide nonwoven geotextile fabric in foundation preparation for separation of existing soil from Screened Gravel or Crushed Stone.

B. Provide woven geotextile fabric for temporary road reinforcement, and riprap separation as indicated or specified.

C. Provide woven geotextile fabric for silt fence as indicated or specified.

D. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. At least two weeks prior to shipment, submit manufacturer's certificate of compliance and physical property data sheet indicating that requirements for materials and manufacture are in conformance as specified.
2. For informational purposes only, submit manufacturer’s printed installation instructions.

1.05 - PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed according to the written recommendations of the manufacturer and as to not degrade quality, serviceability or appearance.

B. Provide geotextile fabric in rolls wrapped with protective covering to protect geotextile fabric from mud, dirt, dust, debris, and ultraviolet light. Label each roll of geotextile fabric with number or symbol to identify production run.

C. Protect geotextile fabric from sunlight during transportation and storage. Do not leave geotextile fabric exposed to sunlight for more than 14 days during installation operations.

1.06 - QUALITY ASSURANCE

A. Producer of the geotextile fabric is to maintain competent laboratory at point of manufacture to insure quality control in accordance with ASTM testing procedures. Laboratory to maintain records of quality control results.

B. Do not expose geotextile fabric, except the geotextile fabric for silt fence, to ultraviolet radiation (sunlight) for more than 14 days total during the period of time following manufacture, until geotextile fabric is installed and covered with fill or backfill material.

C. Take all precautions to protect geotextile fabric from damage resulting from any cause. Either repair or replace geotextile fabric to Engineer's satisfaction at no additional cost to the Owner.

1.07 - REFERENCES

A. American Society for Testing and Materials (ASTM) Publications:

1. D4355: Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon ARC Type Apparatus.
2. D4491: Test Methods for Water Permeability of Geotextiles by Permittivity.
3. D4533: Test Method for Trapezoid Tearing Strength of Geotextiles.
4. D4632: Test Method for Grab Breaking Load and Elongation of Geotextiles.
5. D4751: Test Method for Determining Apparent Opening Size of a Geotextile.
6. D4833: Test Method for Index Puncture Resistance of Geomembranes and Related Products.
7. D6241: Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

B. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

A. Provide the following nonwoven geotextile fabric:

1. Geotex 601 as manufactured by Propex.
2. Mirafi 160N as manufactured by TenCate Geosynthetics.
3. 150 EX as manufactured by Thrace-LINQ.
4. Or acceptable equivalent product.

B. Provide the following woven geotextile fabric except for silt fence:

1. Geotex 200 ST as manufactured by Propex.
2. Mirafi 500X as manufactured by TenCate Geosynthetics.
3. GTF 200 as manufactured by Thrace-LINQ.
4. Or acceptable equivalent product.

C. Provide the following woven geotextile fabric for silt fence:

1. Geotex 2130 as manufactured by Propex.
2. Mirafi 100X as manufactured by TenCate Geosynthetics.
3. Beltech 1935 by Belton Industries Inc.
4. Or acceptable equivalent product.

2.02 - MATERIAL

A. Geotextile fabric shall conforms to test requirements for minimum average roll value (weakest principle direction) for strength properties of any individual roll tested from manufacturing lot or lots of particular shipment in excess of minimum average roll value (weakest principle direction) as specified hereafter:

B. Physical Properties of Minimum Average Roll of the Nonwoven Geotextile Fabric shall be as follows:

Property	ASTM Test Method	Units	Value
1. Grab Strength	D4632	lbs.	150 (min.)
2. Grab Elongation	D4632	%	50 (min.)
3. Trapezoidal Tear Strength	D4533	lbs.	60 (min.)
4. Puncture Strength	D4833	lbs.	75 (min.)
5. Permittivity	D4491	sec -1	1.3 (min.)
6. Apparent Opening Size	D4751	Sieve Number	70 - 100
7. Ultraviolet Stability	D4355	Percent	70 (min.)

C. Physical Properties of Minimum Average Roll of Woven Geotextile Fabric, except for silt fence, shall be as follows:

Property	ASTM Test Method	Units	Value
1. Grab Strength	D4632	lbs.	200 (min.)
2. Grab Elongation	D4632	%	15 (min.)
3. Trapezoidal Tear Strength	D4533	lbs.	75 (min.)
4. Puncture Strength	D4833	lbs.	80 (min.)
5. Permittivity	D4491	sec -1	0.02 (min.)
6. Apparent Opening Size	D4751	Sieve Number	30 - 70
7. Ultraviolet Stability	D4355	Percent	70 (min.)

D. Physical Properties of Minimum Average Roll of the Woven Geotextile Fabric for silt fence shall be as follows:

Property	ASTM Test Method	Units	Value
1. Grab Strength	D4632	lbs.	100 (min.)
2. Permittivity	D4491	sec -1	0.10 (min.)
3. Apparent Opening Size	D4751	Sieve Number	20 - 30
4. Ultraviolet Stability	D4355	Percent	70 (min.)

PART 3 - EXECUTION

3.01 - INSTALLATION

A. Install geotextile fabric in accordance with manufacturer's printed instructions.

B. Place geotextile fabric on the foundation subgrade prior to placing the screened gravel or crushed stone.

C. Overlap geotextile fabric 18-inches minimum for unsewn lap joint. Overlap fabric 6-inches at seam for sewn joint.

D. Do not permit traffic or construction equipment to travel directly on geotextile fabric.

E. Place geotextile fabric in relatively smooth condition to prevent tearing or puncturing. Lay geotextile fabric loosely but without wrinkles or creases so that placement of the backfill materials will not stretch or tear geotextile fabric. Leave sufficient slack in geotextile fabric around irregularities to allow for readjustments.

F. Patch all tears in geotextile fabric by placing additional section of geotextile fabric over tear with a minimum of 3-feet overlay.

G. Extend the geotextile fabric and wrap around the Screened Gravel or Crushed Stone along the perimeter of the foundation.

H. Install silt fence in accordance with the manufacturer's printed instructions and as indicated.

3.02 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT

END OF SECTION

SECTION 02435

CRUSHED STONE

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 1
1.03 - DEFINITIONS 1
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING 2
1.06 - DESIGN CRITERIA 2
1.07 - REFERENCES: 2
PART 2 - PRODUCTS 2
2.01 - MATERIAL 2
PART 3 - EXECUTION 3
3.01 - PLACEMENT AND COMPACTION 3
3.02 - CONTRACT CLOSEOUT 3

PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide and compact Crushed Stone as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Gradation test result from the Contractor’s Independent Testing Laboratory, at least two (2) weeks prior to hauling material, for the Engineer’s acceptance.
2. If crushed stone is utilized, a 10-pound sample shall be submitted, if requested by the Engineer.
3. If PGA is utilized, a 10-pound sample shall be submitted. In addition, provide a certified test report that indicates that the PGA is free of debris and other materials that is associated with the glass recycling process.

1.05 - PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed according to the written recommendations of the manufacturer and as to not degrade quality, serviceability or appearance.

1.06 - DESIGN ASSURANCE

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE and as specified.

B. Qualifications of the independent soil testing laboratory as specified in SECTION 02210, EARTH EXCAVATION, BACKFILL, FILL AND GRADING.

C. Maximum particle size and gradation analyses shall be performed in accordance with ASTM D6913.

D. Material testing frequency and requirements as specified in SECTION 02210, EARTH EXCAVATION, BACKFILL, FILL AND GRADING.

1.07 - REFERENCES:

A. American Society for Testing and Materials (ASTM) Publications:

1. C33: Specification for Concrete Aggregates
2. D6913: Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.

B. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - MATERIAL

A. Crushed Stone

1. Gradation and physical property requirements of crushed stone shall conform to ASTM C33, Coarse Aggregate Number 67.

Crushed Stone shall be free from roots, vegetation, leaves, and other organic materials, and free of ice, snow, clay, frost, frozen soil particles and other fine or harmful substances.

B. Processed Glass Aggregate (PGA)

1. In lieu Crushed Stone, the Contractor may utilize PGA for bedding of pipe lines.

2. Processed Glass Aggregate shall be manufactured from an approved supplier of crushed cullet. The material shall consist of recycled glass food or beverage containers free of debris such as paper, metals, fabrics, toxins, clay, loam, or other materials that would be associated with the glass recycling process. A maximum of 5 percent mass of the material may be produced from china dishes, ceramics, plate glass or other glass products. Other glass products (i.e. fluorescent lights, video screens, automobile glass, lead crystal, etc.) shall not be incorporated into PGA.

3. The material will have a nominal aggregate size of 3/8 inch and meet the following gradation requirements.

Sieve Designation	Percent by Mass Passing
3/8 inch	100
No. 4	70-100
No. 8	35-88
No. 16	15-40
No. 50	4-12
No. 200	0-5

4. The percent wear as determined by the Los Angeles Abrasion Test, Class C or D will be a maximum of 40 percent.

5. Sources of PGA are as follows:

6. David Johansen, Director Department of Public Works
Town of Dennis
120 Theophilus F. Smith Road
South Dennis, MA 02660
Phone: 508-760-6220
e-Mail: djohansen@town.dennis.ma.us

7. Reagan Bissonnette, Executive Director
Northeast Resource Recovery Association
2101 Dover Road
Epsom, NH 03234
Phone: 603-736-4401
e-Mail: rbissonnette@nrra.net

PART 3 - EXECUTION

3.01 - PLACEMENT AND COMPACTION

A. Specified in SECTION 02210, EARTH EXCAVATION, BACKFILL, FILL AND GRADING and as indicated on the drawings.

3.02 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 02446

HORIZONTAL DIRECTIONAL DRILLING

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 3
1.03 - DEFINITIONS 3
1.04 - SUBMITTALS 3
1.05 - PRODUCT HANDLING 4
1.06 - DESIGN CRITERIA 4
PART 2 - PRODUCTS 4
2.01 - EQUIPMENT REQUIREMENT 4
2.02 - MATERIALS 6
PART 3 - EXECUTION 6
3.01 - GENERAL 6
3.02 - PERSONNEL REQUIREMENTS 7
3.03 - BORING PROCEDURE 7
3.04 - PIPE TESTING 8
3.05 - SITE RESTORATION 8
3.06 - RECORD KEEPING 8
3.07 - CONTRACT CLOSEOUT 8

PART 1 - GENERAL

1.01 - SCOPE

A. The work of this section includes furnishing all labor, tools, equipment and materials, testing, restoration of underground utilities and environmental protection and restoration, and performing all operations in connection with the Horizontal Directional Drilling of the force mains and conduits and other related items, as specified herein and in the location shown on the drawings.

B. Horizontal Directional Drilling is required to install the High Density Polyethylene (HDPE) force mains and conduits under Route 6, (Mid Cape Highway) that is owned by the Massachusetts Department of Transportation (MassDOT) as shown on the Drawings and as specified herein, performing all testing and paying all MassDOT fees and all other work required to complete the Horizontal Directional Drilling operation as specified and in the location shown on the Drawings.

C. The 48-inch Casing Pipe shown on the drawings is not required to be provided as part of this section.

D. The Owner has obtained a MassDOT permit for the Highway Crossing via Jacking in accordance with SECTION 02150, HIGHWAY CROSSING (JACKING). If the Highway Crossing is provided via the Horizontal Directional Drilling, the Owner will prepare and request a modification to the MassDOT Permit to complete the Highway Crossing via Horizontal Directional Drilling.

E. The Contractor is responsible to maintain the existing condition of the existing drainage pipe in the State highway Layout. Any damage to the existing drainage pipe shall be repaired by the Contractor at no cost to the MassDOT or the Owner. The Contractor is responsible to provide all labor, materials and equipment as well to coordinate and obtain all necessary permits from the federal, state and/or local regulatory agencies for such substitution at no cost to the MassDOT and/or Owner.

F. The Contractor shall make all necessary arrangements with the MassDOT for the complete installation of the work prior to mobilization and shall do all work required to protect and maintain the roadway and its safe operation. The Contractor shall cooperate fully with the MassDOT and Owner throughout the construction of the work and complete the work as expeditiously as possible.

G. MassDOT fees for the services of an Inspector during the course of the work shall be paid to the MassDOT directly by the Contractor. The Contractor shall include an allowance of ten thousand dollars ($10,000) for these services in the General Bid section of this project.

H. The Contractor shall comply with the MassDOT Permit requirements included in SECTION 00858, SPECIAL CONDITIONS - PERMITS AND LICENSES and the following requirements:

1. The Contractor shall fully inform themselves of all requirements of the MassDOT as it pertains to the specified project and shall conduct all his work accordingly.
2. The Contractor shall make all necessary arrangements with the MassDOT before entering upon MassDOT property.
3. The MassDOT may require inspection personnel during construction. The MassDOT will provide at its sole discretion such personnel, as it deems necessary or advisable for this project.
4. The Contractor shall submit in writing to the Engineer and MassDOT for written approval the method of construction, plans and time schedule for the work to be completed. No work shall be ndertaken until written approval is given.
5. The Contractor shall provide the MassDOT a detailed Horizontal Directional Drilling submittal for review and approval prior to construction.
6. The Contractor shall give ten (10) working days written notice to the Engineer and the MassDOT prior to start of actual work.
7. MassDOT inspection of work shall be permitted at all times and the Contractor shall cooperate fully with the MassDOT's representative.
8. All equipment used by the Contractor on MassDOT property may be inspected by the MassDOT and shall not be used if considered unsatisfactory by the MassDOT representative. Operators of such equipment may be examined by the MassDOT representative to determine their fitness.
9. Route 6 Right-of-Way shall be kept free of obstructions at all times.
10. No work shall occur within the Route 6 Right-of-Way unless specified herein and/or approved in writing by the MassDOT.
11. All work shall be performed and completed in a manner fully satisfactory to the MassDOT's Chief Engineering or his/her authorized representative.
12. The Contractor shall obtain insurance as required by the MassDOT as included in SECTION 00858, SPECIAL CONDITIONS, PERMITS AND LICENSES and DIVISION 00700, GENERAL CONDITIONS.
13. No blasting is permitted under and/or adjacent to Route 6 road surface.
14. The Contractor shall submit a Trench Permit application with the Town of Orleans and comply with the terms of the Trench Permit.

I. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. The Contractor is responsible to obtain and provide a surety bond in the amount of $500,000 to cover the Crossing work located within the MassDOT Roadway identified as Mid Cape Highway (Route 6).

C. An allowance of $10,000 has been identified in the Bid Proposal to cover the salary, subsistence and travel expenses for any inspector appointed by the MassDOT to supervise the work contemplated.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT C-700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT C-700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. WORK PLAN: A general work plan outlining the procedure and schedule to be used to execute the project. The Plan should document the thoughtful planning required to successfully complete the project.

2. EQUIPMENT and MATERIALS: Specifications on directional boring equipment and materials to be used to ensure that the equipment and materials are adequate to complete the project.

(a) Size, capacity and arrangement of equipment.

(b) Location and size of drilling and receiving pits.

(c) Dewatering and methods of removing spoils material.

(d) Method of installing detection wire and pipe.

(e) Type, location and method of installing locator station.

(f) Method of fusion pipe segment and type of equipment.

(g) Type of cutting head.

(h) Method of monitoring and controlling line and grade.

(i) Detection of surface movement.

(j) Bentonite drilling mud for information only:

- Products information, material specifications, and handling procedures.
- Material safety data sheet and special precautions required.
- Method of mixing and application.

3. FIRM: Documentation of contractor's similar experience of at least 10 years. Document shall include, but not be limited to, the owner's name, address, telephone number, contact person, date and duration of work, location, pipe information, and contents handled by pipeline.
4. PERSONNEL: Documentation of contractor's supervisory field personnel similar experience and training of at least 5 years. Document shall include, but not be limited to, the owner's name, address, telephone number, contact person, date and duration of work, location, pipe information, and contents handled by pipeline.

1.05 - PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. The requirements set forth in this document specify a wide range of procedural precautions necessary to ensure that the very basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this specification. Adherence to the specifications contained herein, or the Engineer's approval of any aspect of any directional bore operation covered by this specification, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the Contract.

C. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

D. Complete horizontal directional drilling so as not to interfere with, interrupt, or endanger surface and activity thereon.

E. Experience: The contractor shall be actively engaged in horizontal directional drilling for minimum of 10 years.

F. Field Supervisory Personnel: The contractor's field supervisory personnel shall have a minimum of 5 years' experience in the performance of the work and tasks required. At least one field supervisors listed must be at the site when horizontal directional drilling operations are in progress.

PART 2 - PRODUCTS

2.01 - EQUIPMENT REQUIREMENT

A. General - The directional boring equipment shall consist of a directional boring rig of sufficient capacity to perform the bores and pullback the pipe, a boring fluid mixing and delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

B. Boring System

1. Boring Rig - The directional boring machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the crossing. The hydraulic power system shall be self-contained with sufficient pressure and volume to power boring operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations. The rig shall be grounded during boring and pull-back operations. Sufficient spares shall be kept on hand for any break-down which can be reasonably anticipated.

2. Bore Head - The bore head shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and boring fluid jets.

3. Mud Motors (if required) - Mud motors shall be of adequate power to turn the required boring tools.

4. Drill Pipe - Shall be constructed of high quality 4130 seamless tubing, grade D or better, with threaded box and pins. Tool joints should be hardened to 32-36 RC.

C. Guidance System - The Guidance System shall be of a proven type and shall be setup and operated by personnel trained and experienced with this system. The Operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of the guidance system if using a magnetic system.

D. Boring Fluid (Mud) System

1. Mixing System - A self-contained, closed, boring fluid mixing system shall be of sufficient size to mix and deliver boring fluid composed of bentonite clay, potable water and appropriate additives. Mixing system shall be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping and ensure thorough mixing. Mixing system shall continually agitate the boring fluid during boring operations.

2. Boring Fluids - Drilling fluid shall be composed of clean water and an appropriate additive. Water shall be from a clean source with a pH of 8.5 to 10. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal. The water and additives shall be mixed thoroughly and be absent of any clumps or clods. No hazardous additives may be used. Boring fluid shall be maintained at a viscosity sufficient to suspend cuttings and maintain the integrity of bore wall.

3. Delivery System - The mud pumping system shall be capable of delivering the boring fluid at a constant rate. The delivery system shall have filters in-line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be relatively leak-free. Used boring fluid and boring fluid spilled during boring operations shall be contained and legally disposed of. A berm, minimum of 12-inch high, shall be maintained around boring equipment, boring fluid mixing system, entry and exit pits and boring fluid recycling system (if used) to prevent spills into the surrounding environment. Pumps and or vacuum truck(s) of sufficient size shall be in place to convey excess boring fluid from containment areas to storage facilities.

E. Other Equipment

1. Pipe Rollers - Pipe rollers, if required, shall be of sufficient size to fully support the weight of the pipe while being hydro-tested and during pull-back operations. Sufficient number of rollers shall be used to prevent excess sagging of pipe.

2. Pipe Rammers/Pullers - Hydraulic or pneumatic pipe rammers or pullers may only be used if necessary and with the authorization of Engineer.

F. Other Equipment - Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding sections shall not be used unless approved by the Engineer prior to commencement of the work. Consideration for approval shall be made on an individual basis for each specified location. The proposed device or system shall be evaluated prior to approval or rejection on its potential ability to complete the utility placement satisfactorily without undue stoppage and to maintain line and grade within the tolerances prescribed by the particular conditions of the project.

2.02 - MATERIALS

A. Force Mains and Conduits

1. Force Mains and Conduits shall be in accordance with SECTION 02630, HIGH DENSITY POLYETHYLENE FORCE MAIN.
2. All couplings, fittings, adapters, valves, reducers, and wyes shall be compatible with the type of pipe used.
3. Mechanical Couplings are not permitted for joining of directional drilled pipe sections.

B. Drilling Fluid

1. Bentonite drilling mud compatible with the environment.
2. Waste oil or environmentally non-compatible polymers shall be part of composition.

C. Detection Wire: TW, THW, THWN, or HMWPE insulated copper, 10 gage or thicker wire.

D. Locator Station

1. Underground Flush Mounted
   (a) Tube minimum 15 inches long with minimum inside diameter of 2-1/2-inches made of non-corrosive material, schedule 40 PVC, HDPE, or equal.
   (b) Factory attached cast iron or high-impact plastic collar with ribs to prevent rotation when removing locking lid after locator station is set in concrete.
   (c) Light blue cast iron or high-impact plastic locking lid that will withstand AASHTO H-20 traffic loads and ultra-violet rays.
   (d) Mark locking lid to identify pipeline with a permanent identification such as P.S. Locator.
   (e) Terminal block made of high dielectric material, which is made of phenolic resin, plastic, micarta, Lexan or Bakelite for each locator station.
   (f) Terminal block furnished with two 3/16-inch threaded studs, nuts, and washers made of nickel-plated brass.
   (g) Approved manufacturers: C.P. Test Services, Inc., Model Mini; Handly, Industries, Model T2IS2; or equal.
2. Manhole Mounted
   (a) Waterproof enclosure made from cast aluminum, galvanized steel, high-impact plastic, Lexan, Gyrlyn, or equal.
   (b) Light blue schedule 40 PVC pipe or schedule 40 galvanized steel with outside diameter of at least 3/4-inch to mount enclosure.
   (c) Use similar materials for pipe and enclosure to fasten enclosure onto pipe following manufacturer's instructions.
   (d) Approved manufacturers: Cott Manufacturing Company, Model Finklet or Finkplate, 2 leads; Gerome Manufacturing Company, Inc., Model Testox Series 300, 2 leads; or equal.

PART 3 - EXECUTION

3.01 - GENERAL

A. The Contractor shall give ten (10) working days written notice to the Engineer and the MassDOT prior to start of actual work.

B. The Engineer and the MassDOT must be notified 48 hours in advance of starting work. The Directional Bore shall not begin until the Engineer is present at the job site and agrees that proper preparations for the operation have been made.

C. The Engineer approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the Contract.

3.02 - PERSONNEL REQUIREMENTS

A. All personnel shall be fully trained in their respective duties as part of the directional boring crew and in safety. Training shall be provided specific to the project if any potential hazards may be encountered which has not already been included in personnel's training.

3.03 - BORING PROCEDURE

A. Site Preparation - Prior to any alterations to work-site, contractor shall photograph or video tape entire work area, including entry and exit points. One copy of each shall be given to Engineer and the MassDOT and one copy to remain with contractor for a period of one year following the completion of the project. Work site as indicated on drawings, within right-of-way, shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made. Contractor shall confine all activities to designated work areas.

B. Bore Path Survey - Entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings. If contractor is using a magnetic guidance system, drill path shall be surveyed for any surface geo-magnetic variations or anomalies.

C. Environmental Protection - Contractor shall place silt fence between all boring operations and any drainage, wetland, waterway or other area designated for such protection by con- tract documents, state, federal and local regulations. Additional environmental protection necessary to contain any hydraulic or boring fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. Contractor shall adhere to all applicable environmental regulations. Fuel or oil may not be stored in bulk containers within 200-feet of any waterbody or wetland.

D. Utility Locations - Contractor shall notify all companies with underground utilities in the work area. Once the utilities have been located Contractor shall physically identify (test pit) the exact location of the utilities by vacuum or hand excavation, when possible, in order to determine the actual location and path of any underground utilities which might be within 20 feet of the bore path. Contractor shall not commence boring operations until the location of all underground utilities within the work area have been verified.

E. Safety - Contractor shall adhere to all applicable state, federal and local safety regulations and all operations shall be conducted in a safe manner. Safety meetings shall be conducted at least weekly with a written record of attendance and topic submitted to Engineer.

F. Pipe - Pipe shall be connected together in one length prior to pull-back operations, if space permits. Pipe shall be placed on pipe rollers before pulling into bore hole with rollers spaced close enough to prevent excessive sagging of pipe.

G. Pilot Hole

1. Pilot hole shall be drilled on bore path with no deviations greater than 5 percent of depth over a length of 100-feet. In the event that pilot does deviate from bore path more than 5 percent of depth in 100-feet, contractor shall notify Engineer and Engineer may require contractor to pull-back and re-drill from the location along bore path before the deviation.

2. In the event that a boring fluid fracture, inadvertent returns or returns loss occurs during pilot hole boring operations, contractor shall cease boring, wait at least 30 minutes, inject a quantity of boring fluid with a viscosity exceeding 120 seconds as measured by a March funnel and then wait another 30 minutes. If mud fracture or returns loss continues, contractor shall cease operations and notify Engineer. Engineer and Contractor shall discuss additional options and work shall then proceed accordingly.

H. Reaming - Upon successful completion of pilot hole, Contractor shall ream bore hole to a minimum of 25 percent greater than outside diameter of pipe using the appropriate tools. Contractor shall not attempt to ream at one time more than the boring equipment and mud system are designed to safely handle.

I. Pull-Back

1. After successfully reaming bore hole to the required diameter, contractor shall pull the pipe through the bore hole. In front of the pipe shall be a swivel. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. During pull-back operations contractor shall not apply more than the maximum safe pipe pull pressure at any time.

2. In the event that pipe becomes stuck, contractor shall cease pulling operations to allow any potential hydro-lock to subside and shall commence pulling operations. If pipe remains stuck, contractor shall notify Engineer. Engineer and contractor shall discuss options and then work shall proceed accordingly.

3.04 - PIPE TESTING

A. Following successful pull-back of pipe, contractor shall hydro-test pipe using potable water.

B. The pressure pipe shall be tested in the presence of the Engineer, by water to a pressure equal to 2 times the total dynamic head of the Prefabricated Low-Pressure Sewage Pump Systems to which the pressure pipe is attached, unless the test pressure is greater than the working pressure of the pipe. In that case the pipe shall be tested to the working pressure of the pipe. Testing shall conform to the requirements of the AWWA Standard C600. The Engineer shall provide the test pressure. This pressure shall be held for a period of at least 15 minutes, allowing a maximum pressure drop of 5 psi. Any defective work shown by this test shall be replaced at no additional cost to the Owner.

C. All equipment, labor, water, gauges, and the like for the testing of the force main shall be supplied at no additional cost to the Owner.

D. After successful completion of hydro-test, pipe shall be pigged dry and caps provided at each end of the line.

3.05 - SITE RESTORATION

A. Following boring operations, contractor shall de-mobilize equipment and restore the worksite to original condition. All excavations shall be backfilled and compacted to 95 percent of original density. Landscaping shall be restored to original.

3.06 - RECORD KEEPING

A. Contractor shall maintain a daily project log of boring operations and a guidance system log with a copy given to Engineer at completion of project.

B. As-built drawings shall be certified as to accuracy by contractor.

3.07 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 02483

PLANTING OPERATIONS

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PART 1 - GENERAL

1.01 - SCOPE

A. The work of this section includes furnishing all labor, equipment, tools, materials and accessories necessary for the complete planting and maintenance of trees, shrubs and ground cover as may be indicated on the drawings, and as specified herein.

B. Attention is directed to all sections within BIDDING REQUIREMENTS, CONTRACT FORMS AND CONDITIONS OF THE CONTRACT; all sections within OTHER DOCUMENTS; DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. An allowance has been established to provide planting materials. Should the actual charges exceed or be less than the amount indicated, the difference will be paid by or returned to the Owner. A paid invoice from the nursery shall be submitted to the Engineer by the Contractor. Refer to SECTION 01020, ALLOWANCES.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop drawings and brochures shall be submitted for all items to be furnished in accordance with provisions of DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals shall include shop drawings including at least the following:

1. Information about the Landscape Contractor or Arborist.

2. Complete list of all materials to be provided showing the details identified herein.

1.05 - PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed according to the American Association of Nurserymen’s written recommendations.

B. The Contractor shall maintain all plant material and associated work until final acceptance by the Engineer. Maintenance shall include all pruning, spraying, watering, cultivation and weeding of all planted areas, and the repairing or replacement of all staking, wrapping, mulching and edging materials and any other operations necessary until final acceptance.

C. Water will be furnished by the Contractor. The Contractor shall furnish all necessary hoses and such other accessories as may be required.

1.06 - DESIGN CRITERIA

A. Plant material shall be installed by a competent Landscape Contractor or Arborist. Such company shall be certified, or licensed, or affiliated (by membership) with the American Association of Nurserymen or appropriate State organization. The Landscape Contractor or Arborist shall provide references of similar installations.

B. All planting materials shall comply with the American Association of Nurserymen's American Standard for Nursery Stock as last amended. All plant names shall be "Standardized Plant Names" as designated by the American Joint Committee on Horticultural Nomenclature (1942), as last amended.

C. All plant material shall be inspected and approved by the Engineer prior to planting. Any plant material which does not meet the criteria specified shall be replaced with approved plants at the Contractor's expense.

D. All plants shall meet the requirements specified on the planting plan.

E. All plant material shall be nursery grown and shall be shapely, well-grown, healthy, sound, and free of disease, insect pests, eggs or larvae, and shall have a well developed root system.

F. All trees and shrubs shall be freshly dug; no heeled-in plants or plants from cold storage will be accepted. All plants shall be hardy under climatic conditions similar to those in the locality of the project.

G. All plants shall be handled so that roots will be adequately protected at all times from drying out and from other injury. All plants shall be covered and braced during transportation.

H. Each tree or shrub shall be properly identified by name on legible, weatherproof labels securely attached thereto. Balled and burlapped plants shall have firm, natural balls of soil, the diameter and depth of which shall be sufficient to include the roots. The earth ball shall be adequately wrapped and secured with burlap. Container grown shrubs may be substituted for balled and burlapped shrubs.

I. Container grown plants shall have sufficient roots to hold planting mix in tact after removal from containers without being root bound.

J. When plants of kinds and sizes specified are not available within a reasonable distance, substitutions may be made upon written approval of the Engineer.

K. All plants shall conform to the measurements specified in the plant list and as set forth in American Association of Nurserymen's American Standard for Nursery Stock as last amended. Where a size range is given, at least 40 percent of those plants shall be at or above the average for that size range. Exceptions are as follows: Plants larger than specified in the plant list may be used if approved by the Owner, but use of such plants shall not increase the cost to the Owner.

L. Prior to planting, all planting pits will be inspected by the Engineer. Planting pits which do not meet the minimum requirements of the details indicated, shall be reshaped as necessary for approval by the Engineer.

PART 2 - PRODUCTS

2.01 - MATERIALS FOR GUYING, STAKING AND WRAPPING

A. Stakes - Stakes for supporting trees shall be of the sound wood of uniform size, reasonably free of knots and capable of standing in the ground at least two years. Stakes shall be 2 inches square and shall not be less than 8 feet in length.

B. Wire - Wire for tree bracing and guywire shall be pliable No. 12 gauge galvanized soft steel wire.

C. Hose - Cinch-tie or approved equal hose, if used, shall be two-ply fiber bearing garden hose, not less than 1 inch inside diameter.

D. Webbing - Web straps shall be three inches wide as manufactured by Duckbill, or equal and shall be provided with grommets. Hose shall not be allowed.

E. Wrapping Material - Wrapping material shall be first quality, heavy waterproof crepe paper manufactured for this purpose.

2.02 - PLANTING SOIL FOR PLANTING PITS AND PLANTING BEDS

A. Topsoil shall meet the specifications and shall be analyzed as described in SECTION 02485, LOAMING AND SEEDING.

B. Prepared planting mixture shall conform to standard planting practices and the following minimum requirements. Any deviations will be subject to the Engineer's approval.

1. Prepared planting mix shall be 1/3 peat and 2/3 topsoil plus fertilizer/additives as required by the Engineer based on recommendations from testing laboratory reports.

2. Ground cover and shrub planting beds shall have 1-inch layer of peat plus fertilizer/additives as required spread evenly over beds. Peat/additives shall then be cultivated into the top six inches of soil.

C. Peat shall be a commercial grade peat meeting the approval of the Engineer.

D. Fertilizer shall be furnished in manufacturer's standard containers clearly marked with the guaranteed chemical analysis of the product and shall be of the type and formulation specified by the Engineer. The fertilizer shall conform to local and federal regulations.

E. Limestone shall be standard agricultural ground limestone and shall be delivered in the manufacturer's standard containers with a guaranteed analysis appearing on each container.

F. Mulch shall be chip or chunk bark. Bark shall be fresh and undecayed, clean and free from weeds, leaves, moss, sticks and any other debris, and be of such a texture to resist washing or blowing. No long strips, decayed material nor sawdust will be permitted.

G. Wetting agent shall be non-ionic surfactant consisting of a 50 percent polyoxyethylene ether and 50 percent polyoxyethylene ether chemical type, preferably in a granular form for spreader application.

H. Anti-Transpirant shall be delivered in manufacturer's containers, unopened, with manufacturer's labels attached.

PART 3 - EXECUTION

3.01 - SEASONS FOR PLANTING

A. Seasons for planting shall be as recommended to the Contractor by the nursery supplying the plant materials, relating to site conditions, plant species, and region where planting is to be done.

B. Planting shall be prohibited in frozen or muddy ground.

C. Approximate planting dates shall be furnished to the Engineer for approval. Material planted out-of-season shall be given extra care and attention by the Contractor. Any out-of-season planting shall be entirely at the Contractor's risk.

3.02 - PLANTING OPERATIONS

A. Locations for planting beds, trees and shrubs shall be staked out by the Contractor as shown on the drawings and approved by the Engineer.

B. Plant pits shall be excavated with vertical sides in accordance with the details on the drawings. Plant pits shall not be backfilled with prepared topsoil mixture until they have been approved by the Engineer. If pits are prepared and backfilled with topsoil to grade prior to planting, their location shall be marked and recorded on the plans so that when planting proceeds they can readily be located.

C. Prepared topsoil mixture for backfill in all planting areas shall have all fertilizer/additives, as specified herein, thoroughly incorporated before backfilling.

D. Plants shall be set in center of pits plumb and straight and at such a level that after settlement, the crown of the plant will be at the surrounding finished grade.

E. Backfilling and Watering

1. When balled and burlapped trees are set, topsoil shall be compacted around bases of balls to fill all voids. All burlap, ropes or wires shall be removed from the tops of balls.

2. Planting pit shall be backfilled to its depth. Backfill shall be compacted and pit then filled with water.

3. After two waterings have been completely absorbed, the top half of the pit shall be backfilled and compacted.

4. 1-3/4 pounds of granular wetting agent/100 square foot shall be applied to newly planted area. Wetting agent shall be raked lightly into top inch of soil and then soil raked smooth.

5. A shallow saucer larger than pit shall be formed with a 4-inch ridge of soil to facilitate and contain watering.

6. Immediately after planting, the plant shall be thoroughly watered by completely filling the saucer with water a minimum of two times.

7. Ground cover beds shall be watered to a minimum depth of 4 inches immediately after planting (after application of wetting agent).

F. Tree guying or staking shall be in accordance with the plan detail. Care shall be taken that stakes do not pierce rootballs.

3.03 - OBSTRUCTIONS BELOW GROUND

A. In the event that rock, underground construction work or obstructions are encountered in any plant pit excavation work to be done under this contract, alternative locations may be selected by the Engineer.

B. Where locations cannot be changed, the obstruction shall be removed to a depth of not more than 3 feet below grade and no less than 6 inches below bottom of ball or roots when plant is properly set at the required grade.

C. The Contractor shall be paid for the removal of such rock or underground obstructions encountered at the Contract rate per cubic yard, under the appropriate item in the proposal. Limits of payment for excavation in rock fill are 1 foot outside the plant or tree root ball as shown on the drawings.

3.04 - UNDERGROUND UTILITIES

A. The Contractor shall be responsible for obtaining plans and locations of utilities and existing underground structures.

3.05 - WRAPPING

A. Wrapping of all trees shall be done immediately after they are planted. The trunks of all trees shall be wrapped spirally from the bottom to top with material as specified and shall be adequately secured. The wrapping shall overlap and entirely cover the trunk from the ground to the height of the second branches and shall be neat and snug. Overlap shall be approximately 2 inches apart.

3.06 - PRUNING, MULCHING AND WATERING

A. Each tree and shrub shall be pruned in accordance with American Nurserymen Association Standards to preserve the natural character of the plant and in a manner to meet its particular requirements in the landscape plan.

B. All dead wood, suckers and all broken or badly bruised branches shall be removed. Leaders shall not be cut back. Container grown plants shall not be thinned.

C. Pruning shall be done with clean, sharp tools. All cuts are to be made flush and clean.

D. Cuts over 1 inch in diameter shall be painted with an approved tree wound paint. Paint shall cover all exposed cambium as well as other exposed living tissue.

E. Immediately after planting operations are completed, all tree and shrub pits and ground cover beds shall be covered with a uniform 4-inch layer of bark mulch as indicated on the drawings. All remaining planting beds and disturbed areas where no grass is specified shall be mulched with a uniform 4-inch layer of bark mulch which shall extend to edging strips, walks, walls, curbs or other hard surfaces or undisturbed areas.

F. All plant material shall be watered (by flooding) twice during the first 24-hour period after planting.

G. If a problem should arise with a planting, an anti-transparent shall be applied as directed by the Engineer.

3.07 - INSPECTION AND ACCEPTANCE

A. Inspection for Provisional Acceptance

1. Upon completion of work, the Contractor shall request an inspection for provisional acceptance by the Engineer. The request shall be received at least 10 days prior to the requested date for provisional inspection.

2. Upon completion of all repairs and replacements by the Contractor as requested by the Engineer, the Engineer shall issue a dated written order of provisional acceptance.

B. All plantings shall be guaranteed by the Contractor for one year. Provisional acceptance will be given by the Engineer following inspection to ensure compliance with the drawings, details and specifications.

C. At the end of the guarantee period, a final inspection of the work shall be made to determine the condition of plant materials. All plants not in a healthy growing condition as determined by the Engineer shall be removed from the site and promptly replaced with plants as specified for the original planting at no expense to the Owner.

D. Plantings replaced at final inspection shall be subject to all requirements in the specifications for the original work including planting, provisional acceptance, guarantee period and final inspection.

3.08 – CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 02485

LOAMING AND SEEDING

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PART 1 - GENERAL

1.01 - SCOPE

A. The work of this section includes the furnishing of all labor, materials, tools and equipment required to furnish and install loam and seeding in areas as shown on the drawings, unpaved areas disturbed by the Contractor's operations and work, or any cross-country or lawn areas disturbed by the Contractor's operations during the course of construction.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Soil test results and recommendations for liming and fertilizing shall be submitted to the Engineer at least 45 days prior to loaming operations.
2. Certification of variety, proportions and percent germination of species in the seed mixture and percentage of crop seeds, weed seeds, noxious weeds and inert matter shall be submitted to the Engineer at least 45 days prior to loaming and seeding operations.
3. Brochures and samples for woven jute mesh netting and erosion control blanket.

1.05 - PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed according to the American Association of Nurserymen’s written recommendations.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.07 - SEASONS FOR PLANTING

A. Seeding shall take place as soon as possible after each loam area has been prepared, in accordance with the recommendations of the seed supplier relating to the site conditions and region where seeding is to be done. Seeding shall be prohibited during windy or inclement weather, or in frozen or muddy ground; in general, conditions for seeding shall meet with the approval of the Engineer. This does not relieve the Contractor of the responsibility of providing a growth that is full and healthy, in the opinion of the Engineer.

PART 2 - MATERIALS

2.01 - LOAM

A. Testing

1. All loam used in the work of this section of the specifications will be tested and approved for use by the Engineer prior to being spread. Stripped material may be used if approved in accordance with the following requirements. Approved material shall be stockpiled so as not to interfere with the other work and other subgrade or fill materials.

2. All testing shall be done by an independent test laboratory approved by the Engineer. The Contractor shall provide the laboratory with representative soil samples for testing and send test reports directly to the Engineer.

3. Loam shall be tested for the following: pH, organics, buffer pH, soluble salts (expressed in millimhos), available Nitrogen, Phosphorous, exchangeable Potassium, Magnesium, Calcium and Sodium, Cation Exchange Capacity, percent H base saturation, percent Ca base saturation, percent M base saturation, and available Zinc, Manganese, Copper, Iron, humus content and soil type. All nutrient results shall be expressed in parts per million (ppm).

4. Test reports shall also contain specific recommendations as to the exact types and times and rates of application of soil additives and fertilizers based upon the soil test results. These recommendations shall be followed during lawn construction. All Contractors shall note that any and all materials and procedures, with respect to soil additives and fertilizers, contained herein are approximate and are given to assist bidding and that they will be adjusted to comply with test reports.

B. Loam shall be a "fine sandy loam", or a "sandy loam" determined by mechanical analysis and based on the "U.S.D.A. Classification System". It shall be of uniform composition, without mixture of subsoil. It shall be free of stones, lumps, plants and their roots, debris and other extraneous matter over 1/2 inches in diameter or excess quantities of smaller pieces of the same materials as determined by the Engineer. It shall not contain toxic substances harmful to plant growth. It shall be obtained from naturally well drained areas which have never been stripped before.

C. No more than 10 percent of loam shall be clay, with organic matter comprising not less than 4 percent, nor more than 20 percent of the total weight per load.

D. Loam shall not be delivered or worked in a frozen or muddy condition.

E. Soluble salts shall not be higher than 75 parts per million.

2.02 - LIME

A. Limestone shall be standard commercial ground limestone and shall be applied at a rate to be determined by the Engineer subsequent to the testing of loam; however, the rate shall not exceed 4,000 pounds per acre. Limestone shall not be installed during windy or inclement weather. Limestone in hydro-seeding operations shall be restricted in building areas. Any buildings or structures discolored or damaged from limestone spray shall be the Contractor's responsibility.

B. The Contractor shall take whatever precautions are deemed necessary to prevent damage by distribution of limestone. Any damage incurred by the Contractor's negligence shall be repaired at no additional cost to the Owner.

2.03 - COMMERCIAL FERTILIZER

A. Commercial fertilizer shall be a standard dry granular mixture, delivered in the manufacturer's containers and containing a guaranteed analysis by weight of Nitrogen, Phosphorous and Potash, applied at the rate to be determined by testing.

2.04 - SEED

A. Grass seed shall be fresh, clean new crop seed. It may be mixed by an approved method on the site or may be mixed by the dealer. If mixed on the site, each variety shall be delivered in the original containers which shall bear the dealers analysis. If the seed is mixed by the dealer, the Contractor shall furnish to the Engineer, the dealer's guaranteed statement of the composition of the mixture and the percentage of purity and germination of each variety.

B. The seed shall be furnished and delivered premixed in the proportions specified below. All seed shall comply with the State and Federal seed laws.

C. Grass seed shall be the previous year's crop and in no case shall the weed seed content exceed 1 percent by weight.

D. The seed mixture specified for slopes are for use on slopes graded at the rate of 4:1 and steeper slopes.

E. A manufacture's certificate of compliance to the specifications shall be submitted to the Engineer by the manufacturers with each shipment of each type of seed. These certificates shall include the guaranteed percentages of purity, weed content and sown until the contractor has submitted the certificates to the Engineer.

F. Seed Mixture shall conform with MassDOT M6.03.0 and shall be used for all loamed areas (150 pounds/acre). Seed mixture shall be in accordance with the following:

Seed Type	Proportion	Germination Minimum	Purity Minimum
For Grassplots & Islands			
Creeping Red Fescue	50%	85%	95%
Kentucky Blue	25%	85%	90%
Domestic Rye	10%	90%	98%
Red Top	10%	85%	92%
Ladino Clover	5%	85%	96%
For Slopes & Shoulders			
Creeping Red Fescue	50%	85%	95%
Kentucky 31	30%	85%	95%
Domestic Rye	10%	90%	98%
Red Top	5%	85%	92%
Ladino Clover	5%	85%	96%

G. Wildflower Seed Mixture (34 pounds/acre)

1. Wildflower seed mixture shall be eight pounds of Loft's "Pinto" Wildflower Mix, mixed with 26 pounds sheep or hard fescue per acre of seeding.

2. Northeast Mixture by Applewood Seed Co., Arvada, Co., or Northeastern U.S. Wild Flowers by Environmental Seed Producers, Inc., El Monte, CA will be considered at double the manufacturer's recommended rate of application, mixed with sheep or hard fescue as specified above.

3. Wildflower Seed Mixture shall only be allowed in locations approved by the Owner and Engineer.

H. Wetland Seed Mixture

1. Wetland Seed Mixture shall be applied at a rate of 35 pounds per acre. Wetland Seed Mixture shall consist of a mixture of plant species as described below. Unavailability of the specified seed types or mix shall be verified in writing to the Engineer. Substitutions for the above table will be permitted only upon approval of the Engineer. Seed which has become wet, moldy, or otherwise damaged shall not be used.

2. The seeds shall be delivered to the project in labeled and sealed containers. Official Seed tags and shipment invoices from the seed suppliers shall be furnished to the Engineer. Seed may be sampled and tested by the Owner to verify the seed tag information. The Engineer will inspect each shipment for acceptability, upon delivery to the project.

3. The weight of the pure live seed (PLS) is computed by the labeled purity percent times the labeled germination percent times the weight. For example: Requirement is for 20 pounds of pure live seed of a specified variety and the Seed Tag data indicates that the variety is 99.41 percent pure and with 92 percent germination. Then the conversion to PLS is: 20 pounds divided by the product of 0.9941 and 0.92 equals 21.8 pounds, which meets the 20 pounds PLS requirement.

4. The wetland seed mix shall consist of a mixture of at least 15 wetland plant species native to Rhode Island. Seed shall be produced in nurseries in the northeastern United States. The seed quality and mixtures are based on pure live seed, and variation is allowed in the species composition and proportions of seed for individual species provided that:

   a) 65 to 80 percent of the seed by weight belongs to the genera *Carex*, *Juncus*, *Scirpus*, *Cyperus*, and/or *Shoenoplectus* and Fox sedge (*Carex vulpinoidea*) makes up 25 to 40 percent of the seed mix by weight.

      At least three additional species belonging to the genus *Carex* make up 15 to 25 percent of the mix. Recommended species are *C. comosa*, *C. crinita*, *C. gynandra*, *C. intumescens*, *C. lupulina*, *C. lurida*, and *C. scoparia*.

      At least three species that belong to the genus *Scirpus* (now *Shoenoplectus* in part) make up 10 to 15 percent of the seed mix by weight. Recommended species include: *Scirpus cyperinus, S. atrovirens, S. acutus,* and *S. validus* (now *Shoenoplectus tabernaemontani*).

      At least one species of the genus *Juncus* provides five to 10 percent of the seed mix by weight. Recommended species: *Juncus acuminatus*, *J. articulatus*, *J. canadensis*, and J. *effusus*.

      An additional eight or more native grasses and forbs species make up the remaining fraction of the seed mixture (minimum 20 percent by weight). Recommended species include Mud plantain (*Alisma plantago-aquatica*), swamp milkweed (*Asclepias incarnate*), flat-top aster (*Asterumbellatus*), spotted Joe-Pye-Weed (*Eupatoriadelphus maculatus*), boneset (*Eupatorium perfoliatum*), grass-leaved goldenrod (*Euthamia graminifolia*), fowl manna-grass (*Glyceria striata*), blueflag iris (*Iris versicolor*), swamp candles (*Lysimachia terrestris*), monkey flower (*Mimulus ringens*), sensitive fern (Onoclea sensibilis) (spore), marsh St. John's-wort (*Triadenum virginicum*), blue vervain (*Verbena hastata*), ironweed (*Vernonia noveboracensis*).

   b) No woody plant species will be acceptable.

   c) Seed mixes containing species included in the list of Invasive and other Unacceptable Plant Species in the most recent version of the U. S. Army Corps of Engineers New England District's "Guidelines for Mitigation Plan Checklist" will not be accepted. (The document is available at: http://www.nae.usace.army.mil/reg/check3.pdf).

3. Wetland Seed Mixture shall only be allowed in locations approved by the Owner and Engineer.

I. All topsoil stockpiles shall be stabilized by seeding with annual ryegrass at the rate specified for mowable grass seed mixture. Stockpiles shall be reseeded as necessary to maintain good cover for enrichment and to prevent erosion.

2.05 - EROSION CONTROL BLANKET

A. Erosion control blanket shall be "Hi-Velocity Curlex Blanket", as manufactured by American Excelsior, Co., Arlington, TX, or an approved equal. Erosion control blanket shall be placed on all slopes greater than 3 to 1.

Erosion control blanket will be required for the protection of all seed areas or in any area where erosion is a problem.

2.06 - WOVEN JUTE MESH NETTING

A. Woven jute mesh netting shall be "Ludlow Soil Saver", as manufactured by the Ludlow Corp., Needham Heights, Massachusetts, or an equal manufactured by Advance Netting Company, Lodi, New Jersey, or "Jute - Net" by Bemis, Inc., St. Louis, Missouri, and shall be placed on all slopes greater than 3 to 1, and all slopes 3 to 1 which are higher than 10 feet. Woven Jute Mesh Netting will only be required for the protection of mowable grassed areas or in any other areas where erosion is a problem.

2.07 - STRAW

A. Straw for erosion control and moisture retention shall consist of stems or stalks after threshing. Straw shall be kept in place by stakes, netting, pins or liquid coatings as may be required and as approved by the Engineer.

PART 3 - EXECUTION

3.01 - SEEDING OPERATIONS

A. Personnel for lawn work shall be familiar with lawn construction and shall be under the constant supervision of a qualified foreman.

B. Preparation for Seeding

1. Preparation of Subgrade. After the Engineer has accepted the subgrade, the Contractor shall do whatever additional grading is necessary to bring the subgrade to a true smooth slope, parallel to finish grade or to the level of adjacent existing loam areas. Subgrade depth for Lawn Areas shall be 6 inches while Subgrade depth for Cross Country Areas shall be 4 inches.

2. The top 3 inches of the subgrade immediately prior to being covered with loam shall be raked or otherwise loosened and shall be free from stones, rock and other foreign materials 3 inches or greater in dimension.

3. Sufficient grade stakes as determined by the Engineer shall be provided to insure correct line and grade of subgrade and of finished grade.

4. Subgrade shall be inspected and approved by Engineer before placing of loam.

5. Loam shall be as specified herein and shall be placed and spread over approved areas to a sufficient depth so that after natural settlement and light rolling for lawn areas, the completed work will conform to the lines, grades and elevations indicated.

6. Finish grading. After loam has been spread, it shall be prepared by scarifying or harrowing and hand raking. All large stiff clods, lumps, brush, roots, stumps, litter and other foreign matter, and stones over 1 inch in diameter shall be removed from the loam which shall also be free of smaller stones in excessive quantities.

7. The surface for lawn areas shall then be rolled with a hand roller weighing not more than 100 pounds per foot of width.

8. During the rolling, all depressions caused by settlement of rolling shall be filled with additional loam and the surface shall be regraded and rolled until presenting a smooth and even finish to the required grade.

9. Subsequent to or during raking of the loam and at least 4 days prior to seeding, lime shall be applied and raked into the soil over all loam areas.

10. After the lime has been applied and worked into the loam, the entire area shall receive an application of commercial fertilizer. Fertilizer shall be spread in advance of seeding by approved mechanical spreading devices and lightly taken into the top of the soil.

C. Placement of Seed

1. Seed shall be spread at least 4 days after fertilization of the soil by an approved mechanical method and at the rate of 5 pounds per thousand square feet or as noted with seed mix. Seed shall be lightly raked into the soil to a depth of approximately 1/8 inch and no greater than 1/4 inch and the entire seeded area shall be rolled with a lightweight roller.
2. Seeding shall not be done during windy weather.
3. For lawn areas, seeding shall be done in 3 directions, 2 at right angles to each other, and one diagonally.
4. Culti-packer or approved similar equipment may be used to cover the seed and to form the seed bed in one operation. Due to the small size of the seed in the cross-country mix, the Contractor shall increase the bulk prior to seeding by the addition and thorough mixing of sand, Milorganite or other approved materials.
5. Immediately after seeding, all seeded areas shall be watered to a depth of approximately 4 inches and shall be covered with a loose, uniform layer of straw or hay.

3.02 - INSTALLATION OF EROSION CONTROL BLANKET

A. Erosion control blanket shall be installed in accordance with the accepted practices and the manufacturer's instructions and recommendations by personnel experienced with similar installations. All products and/or fastenings shall be as supplied by or recommended by the manufacturer, subject to approval by the Engineer.

B. Erosion control blanket shall lay loose on the grade and shall not be stretched or tightened in any direction. The blanket shall conform naturally to the contour and grade of the proposed topography.

C. Anchor slots, butts with structures, walls, curbs, etc., side and junction overlaps and terminal folds shall be made and fastened in accordance with the manufacturer's recommendations or as directed by the Engineer.

3.03 - INSTALLATION OF MESH NETTING

A. Mesh netting shall be installed in accordance with accepted practices and the manufacturer's instructions and recommendations by personnel experienced with similar installations. All products and/or fastenings shall be as supplied by or recommended by the manufacturer, subject to approval by the Engineer.

B. Netting shall lay loose on the grade and shall not be stretched or tightened in any direction. The netting shall conform naturally to the contour and grade of the proposed topography.

C. Anchor slots, butts with structures, walls, curbs, etc., side and junction overlaps and terminal folds shall be made and fastened in accordance with the manufacturer's recommendations or as directed by the Engineer.

3.04 - MAINTENANCE AND PROTECTION

A. Maintenance shall begin immediately after each portion of the lawn is installed.

B. Lawns shall be maintained for at least 60 days or as much longer as necessary to establish a uniform stand of the specified grasses.

C. Maintenance and protection of seeded areas shall consist of temporary protective fences, barriers, signs, watering, weeding, cutting, and reseeding as necessary, as well as maintaining the straw or mesh cover in a uniform layer.

D. The surface layer of soil shall be kept damp at all times during the germination period. In the absence of adequate rainfall, watering shall be performed two or three times daily or as often as necessary during the germination period and in sufficient quantities to maintain moist soil to a depth of at least 4 inches. Watering shall be done during the heat of the day to prevent the soil from drying out.

E. After first cutting, watering shall be once per week as necessary to supplement natural rain, to the equivalent of 1 inch per week, or to 4 inches in depth. Weekly inspection shall be made to determine the moisture content of the soil and the approved schedule shall be adjusted to fit conditions.

F. At the time of the first cutting, when grass is 4 inches high, mower blades shall be set at 2-l/2 inches high. In subsequent mowings, lawn areas shall be cut to a 2-l/2 inches height with not more than 40 percent of the grass leaf being removed. Naturalized seed mixture shall be cut only once per year during dormant periods as recommended by the manufacturer.

G. All clippings shall be removed after each mowing. Mowing shall be done only in dry weather.

H. The Contractor shall be responsible for providing a second application of commercial fertilizer should lawn work not be accepted within a 90-day period following the first application of fertilizer.

I. Excessive weeds shall be removed by methods approved by the Engineer.

J. The Contractor shall, at his own expense, repair bare spots and/or damage resulting from erosion, gulleys, washouts, or other causes by filling with topsoil and reseeding.

K. In the event that lawn operations are completed too late in the fall for adequate germination and/or growth of grass, maintenance shall continue into the following spring.

3.05 - INSPECTION AND ACCEPTANCE

A. The Engineer will inspect the seeded areas upon written request by the Contractor. The request shall be received at least 10 days before the anticipated date of inspection.

B. Inspection and acceptance of seeded areas may be requested and granted in part, provided the area for which acceptance is requested is relatively substantial in size and reasonably regular in shape with clearly definable boundaries.

C. An acceptable seeded area shall be one that has a dense, uniform stand of the specified species. It shall be free of ruts, gullies, bare spots, and the grass areas shall be healthy and free of weeds.

D. Upon acceptance of the work, the Contractor shall be relieved of further responsibility for care or maintenance of accepted lawns.

3.06 - DAMAGE AFTER ACCEPTANCE

A. Any lawns damaged after final acceptance of seeded areas and before project acceptance shall be repaired, reseeded, and maintained as specified above with an inspection and formal acceptance required.

3.07 - CLEANING UP

A. When any of this work is done while buildings are occupied, pavements shall be kept clear at all times, and broomed clean to prevent tracking dirt into buildings.

B. After completion of all landscaping work, all debris and excess material shall be disposed of to the satisfaction of the Engineer. All pavements shall be broomed and hosed clean.

3.18 – CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 02503

PAVING, CURBING, SIDEWALKS AND ROADWAYS

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PART 1 - GENERAL

1.01 - SCOPE

A. The work covered by this section of the specifications includes furnishing all labor, equipment, tools, and materials, and in performing all operations in connection with roadway pavement overlay, and the replacement of existing paved surfaces, tack coat, installation of bituminous concrete curb, brick sidewalks, cement concrete sidewalks, bituminous concrete sidewalks, pavement markings, and all incidental work pertaining thereto as indicated on the drawings and as specified herein.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. Prior to the start of construction, the Contractor shall prepare, submit and obtain written approval from the Owner for the various proposed methods of site restoration work. As part of this approval process and prior to the start of grading and paving operations, the Contractor and the Contractor's paving subcontractor shall meet with the Owner and Engineer to review the requirements for Project Site restoration. No payment shall be made for any work on this project unless these requirements have been met.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. "Work" shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals shall include shop drawings showing complete fabrication and construction details, materials, weights, dimensions, clearances, anchorage details, piping and utility requirements. Submittals shall include at least the following:

1. Material reports for bituminous concrete pavement job mix formula and tack coat.
2. Material report (job mix formula) for cement concrete.
3. Survey of establishment of roadway grades along the entire length of each roadway.

1.05 - PRODUCT HANDLING – Not Used

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

B. Environmental Conditions

1. Permanent paving shall be placed only when the underlying surface is dry, when the atmospheric temperature in the shade is above 40 degrees F, and when the weather is not foggy or rainy, provided, however, that the Engineer may permit, in case of sudden rain, the placing of mixture then in transit from the plant, if laid at proper temperature and if the roadbed is free from pools of water. Such permission shall in no way relax the requirements for quality of the pavement and smoothness of surface.
2. No material shall be laid upon a frozen base course or when wind conditions are such that rapid cooling will prevent satisfactory compaction. No load shall be sent out so late in the day that spreading and compaction cannot be completed during daylight.

PART 2 - PRODUCTS

2.01 - GENERAL

A. All materials shall conform to the requirements of "The Commonwealth of Massachusetts Highway Department (MHD), Standard Specifications for Highways and Bridges", latest edition (hereinafter referred to as the "State Specifications") and as specified herein.

2.02 - CALCIUM CHLORIDE – Not Used

2.03 - BASE COURSE

A. Gravel base course shall conform to the requirements for gravel fill in SECTION 02220, EARTHWORK, except that the maximum size of stone in the gravel shall be 3 inches.

B. Dense graded crushed stone base course shall conform to the requirements of Section M2.01.7 of the State Specifications.

C. Base Course in State Highways shall conform with the requirements of MassDOT Permit 5-2019-0487. The Base Course shall consist of 8-inches of gravel plus 4-inches of Dense Graded Crushed Stone over it. Materials shall meet MassDOT’s latest (2020) Standards and Specifications for Highways and Bridges.

2.04 - BITUMINOUS CONCRETE PAVEMENT

A. The binder and top courses for Class I, Type I-1, bituminous concrete pavement shall conform to the requirements of Section M3.11.00 of the State Specifications.

B. The general composition limits of materials, which make up the Job Mix Formula, shall conform to columns entitled "Binder Course" and "Top Course" as listed in Section M3.11.03 of the State Specifications. No bituminous concrete pavement shall be placed until the Engineer approves the Job Mix Formula.

2.05 - BITUMINOUS CONCRETE FOR TEMPORARY SURFACING

A. Hot mixed bituminous concrete shall be as specified hereinbefore for binder course or top course unless otherwise authorized by the Engineer.

B. Cold mixed bituminous concrete shall be a suitable type as approved by the Engineer. Cold mix may only be used when hot mixed bituminous concrete is not available and when authorized by the Engineer.

2.06 - TACK COAT

A. Tack Coat shall conform to the requirements of Section M3.03.0 of the State Specifications.

2.07 - CONCRETE SIDEWALKS

A. Cement concrete for walks shall be of 5,000 psi compressive strength at 28 days and shall conform to Section M4.02.00 (air entrained) of the State Specifications.

B. Welded steel wire fabric shall conform to the requirements of Section M8.01.2 of the State Specifications and shall meet AASHTO-M55 and shall have a minimum end-lap of six inches except where expansion joints occur. Mesh shall be 6 inches by 6 inches, W2.9 by W2.9 welded wire fabric.

C. Pre-molded expansion joint filler shall conform to Section M9.14.0 of the State Specifications and shall meet AASHTO-M153 thickness and widths required for the expansion joint widths.

2.08 - TEXTURED CONCRETE SIDEWALKS – Not Used

2.09 - GRANITE CURBING

A. Curbing shall be of a hard and durable granite, light gray in color, free from seams which would impair its structural integrity, and of a smooth splitting character. Natural color variations characteristic of the deposit will be permitted. Curbing shall be of the sizes indicated on the drawings.

B. Vertical Curbing shall be type VA-4 and shall conform to Section M9.04.1 of the State Specifications. Stone set on a radius of 100 feet or less shall be cut to the curve required.

C. Sloped Curbing shall be Type SA and shall conform to Section M9.04.2 of the State Specifications.

D. Transition Stones shall be as manufactured by Fletcher Co., Baretto Granite Corp., North Carolina Granite Corp. or equal. Stone shall match curb Type VA-4 at one end and SA at the other and shall conform in all other respects to the State Specifications.

E. Curb Inlets shall conform to Section M9.04.5 of the State Specifications.

F. Curb Corners shall be Type A (2 foot radius) and shall conform to Section M9.04.6 of the State Specifications.

2.10 - MORTAR – Not Used

A. Mortar for pointing joints in granite curbing shall be composed of equal parts of cement and sand with sufficient water to form a workable mixture. The materials shall conform to the requirements of Section M4.02.15 of the State Specifications.

2.11 - GUARDRAIL – Not Used

2.12 - PARKING AND ROADWAY MARKINGS

A. Paint for parking and roadway markings shall be a white and/or yellow reflectorized, fast drying paint, conforming to Section M7.01.0 of the State Specification with glass beads conforming to Section M7.01.07.

B. Temporary markings for parking and/or roadways shall conform to Section M7.01.16 for reflective glass spheres.

2.13 - VEHICLE LOOP DETECTORS

A. Products used for the installation of Vehicle Loop Detectors shall be installed in accordance with the applicable provisions of the MassDOT Standard Specification for Traffic Control Devices (Section 800), and the latest NEMA standards.

2.14 – PAVEMENT MARKINGS

A. State Roadways

1. Thermoplastic Road Paint shall be utilized for Pavement Markings located in State roadways. Thermoplastic Road Paint shall conform to MassDOT requirements.

2. Glass beads shall be added to the Thermoplastic Road Paint for extra reflectivity.

3. The colors of the marking materials shall be the standard highway colors of white or yellow and as outlined in the Manual on Uniform Traffic Control Devices.

B. Town Roadways

4. Acetone Road Paint shall be utilized for Pavement Markings located in Town roadways. Acetone Road Paint shall meet Federal Specification AA 2886 Type II.

5. Glass beads shall be added to the Acetone Road Paint for extra reflectivity.

C. Glass beads, tapes and paints used for pavement markings shall be lead free, conform to MassDOT requirements and meet the retro-reflectivity requirements of the Manual on Uniform Traffic Control Devices.

PART 3 - EXECUTION

3.01 - DUST CONTROL

A. Water shall be applied to control dust. The use of calcium chloride is not allowed.

B. Water shall be uniformly applied at least once a week or as directed by the Owner and/or Engineer.

C. Water for dust control shall be metered and paid for by the Contractor.

3.02 - PREPARATIONS FOR BITUMINOUS CONCRETE PAVING

A. Subgrade Preparation

1. All trenches shall be backfilled and compacted as required under the SECTION 02220, EARTHWORK. The edges of all pavements along the line of the trench shall be cut back from exposed edges thereof, a sufficient distance to form a clean, sharp straight edge essentially parallel to the centerline of the trench. The minimum lateral cut back to be allowed will be 12 inches. Cut back pavement shall be carefully removed to minimize any disturbance to foundation materials. The exposed surface of the foundation material shall then be rolled, wetting the surface as necessary to obtain a firm, even surface. Any depressions or uneven areas shall be regraded and re-rolled until the surface is smooth and satisfactorily compacted.

2. The edges of all other pavements (driveways and intersecting roadways) along shall be cut back from exposed edges thereof, a sufficient distance (as determined in the field by the Engineer) to form a clean, sharp straight edge essentially parallel to the centerline of the trench.

3. The Contractor shall rough grade and fine grade all roadways. In order to facilitate grading of the roadways, the Contractor shall establish grades along the entire length of each roadway. Grades shall be established along the centerline of each roadway as well as each side of the roadways. Grading shall be adjusted for driveways aprons and sidewalks. The Contractor shall engage an independent Registered Land Surveyor in the state of Massachusetts with experience with establishing roadways grades. The survey shall be submitted as a shop drawing for review and approval. The Owner has the right to adjust existing roadways grades as part of the final rough grading and fine grading at no cost to the Owner.

4. All surfaces to receive pavements shall be examined by the paving subcontractor to see that they are in proper condition to receive paving. Starting work in any area shall constitute acceptance of that surface. Sub-grade shall be maintained in satisfactory condition and properly drained until surface improvement is placed. All defects resulting from use of unaccepted surfaces shall be corrected by the Contractor at no cost to the Owner.

B. The Contractor shall raise all Owner drain and sewer manhole frames and covers, catch basin frames and grates and gate boxes to the established grades as shown on the Contract Drawings before paving is applied.

C. Prior to submitting its bid, the Contractor shall contact the other utilities so as to gain their requirements concerning any possible adjustment of gate boxes and other such structures. If the utility wishes the Contractor to raise these boxes it shall be in accordance with the utilities requirements. If the utility wishes to adjust their own gate boxes the Contractor shall give the utility adequate notice of his paving schedule.

D. If the gravel base course is disturbed by the adjustment of utilities, the disturbed base material shall be carefully removed and replaced with Portland cement concrete. For additional requirements see DIVISION 3 - CONCRETE.

3.03 - DRIVEWAYS

A. All driveways shall be adjusted as required to meet the final grades of the roadway.

B. Bituminous Driveways - Where trenches are excavated through existing bituminous concrete paved driveways, the trench shall be resurfaced to match the existing depth or 2-inch binder course of bituminous concrete (whichever is greater) followed by a 1-1/2-inch top course over the full width of the existing paved driveway. The limits of the overlay course shall be as defined by the Engineer.

C. Brick and Cobblestone Driveways - Where trenches are excavated through existing brick and/or cobblestone driveways, the trench shall be restored with similar materials utilizing existing materials and/or new materials meeting the requirements specified herein. The limits of the restoration shall be as defined by the Engineer

D. Other Types of Driveways - Where trenches are excavated through existing driveway materials not included above, the trench shall be restored with similar materials, including but not limited to color, type, and size, utilizing existing materials and/or new materials. The limits of the restoration shall be as defined by the Engineer.

3.04 - LEVELING COURSE

A. Where specified or directed by the Engineer, the Contractor shall install a leveling course of bituminous concrete to the depths as required and as approved by the Engineer.

B. The leveling course shall be installed utilizing bituminous material as specified above for a top course.

3.05 - TEMPORARY SURFACING

A. Contractor shall place temporary surfacing as directed by the Engineer. Temporary surfacing shall be placed over trenches in hard surfaced streets and roads, and other areas where directed. Temporary surfacing shall be of bituminous concrete base course as specified herein before, laid in one courses, 3-inches thick. Backfill at top of trench shall be removed to allow for placing temporary surfacing.

B. Contractor shall maintain temporary surfacing in good condition. Trenches shall be inspected at least once a week and also immediately after each storm. Holes and settlements shall be promptly refilled with bituminous mixture.

3.06 - PERMANENT SURFACING OF STATE STREETS AND MUNICIPAL STREETS

A. Permanent resurfacing shall occur as specified in SECTION 01030, SPECIAL REQUIREMENTS.

B. Construction requirements for bituminous concrete pavement shall conform to Section 460 of the State Specifications.

C. Construction requirements for hot mix asphalt pavement milling shall conform to the Asphalt Institute Publication MS-22, "Construction of Hot Mix Asphalt Pavements.

D. After the trenches have been completely consolidated and when directed by the Engineer the Contractor shall place full width bituminous concrete pavement. If there has been an appreciable lag in time between installing bituminous concrete courses, or if the binder course has been used extensively during construction, the Engineer shall determine whether tack coat and/or cleaning will be required at no cost to the Owner.

E. Prior to placing bituminous concrete resurfacing over existing pavement, the Contractor shall thoroughly clean and repair the existing pavement to the satisfaction of the Engineer. Upon securing approval, the Contractor shall apply a tack coat as specified and shall place a bituminous concrete mix in an approved manner.

F. Prior to placing bituminous concrete resurfacing, the Contractor shall remove and replace existing curbing in the locations as determined by the Engineer.

3.07 - BASE COURSE

A. Construction requirements for gravel base course shall conform to the requirements for gravel fill in SECTION 02220, EARTHWORK.

B. Material as previously specified shall be placed and compacted to the required thickness for the particular application. The moisture content of material may have to be adjusted to obtain the specified compaction. Refer to the SECTION 02220, EARTHWORK for specific compaction requirements. After compaction, all base course for pavements shall be as indicated on the drawings.

3.08 - CEMENT CONCRETE SIDEWALKS

A. Construction requirements for cement concrete walks shall conform to the requirement of Section 476 of the State Specifications.

B. Walks shall be sloped as indicated on drawings and slightly adjust grades at intersections as required.

C. Concrete walk sections shall be one-course construction and of thickness, widths, and lengths shown on drawings.

D. The concrete shall be tamped and screened true to grade and section.

E. Expansion joints shall be ½-inch expansion joints, with pre-molded fillers here shown on the drawings and at walk junctions and intersections, at top and bottom of steps, and where walks abut building, platforms, or other fixed structures. Expansion joints shall extend full depth of concrete. Pre-molded filler shall extend to within 3/8 inch of the walk surfaces.

F. Control joints shall be located as shown on the drawings, depth and width as required.

G. Finish cement concrete walks shall be finished according to Section 476.67 of the State Specifications. A final medium broom finish shall be applied as indicated on the drawings.

3.09 - BITUMINOUS CONCRETE SIDEWALKS – Not Used

3.10 - TEXTURED CONCRETE SIDEWALKS – Not Used

3.11 - INSTALLATION OF GRANITE CURBING AND CURB CORNERS

A. In general, all work shall conform to Section 500 of the State Specifications.

B. The trench for the curb shall be excavated to a width of 18 inches. The subgrade of the trench shall be a depth below the proposed finish grade of the curb equal to six inches in depth, plus the depth of curbstone.

C. Upon the foundation additional gravel shall be spread and compacted as required and granite curb shall be set thereon. All spaces under the curbstones shall be completely supported throughout their length. The curb shall be set at the line and grade required. Gravel shall be carried up evenly on both sides of curb until curb is firmly anchored.

D. Joints between granite curbstones shall be at least 1/4 inch and no greater than 5/8 inch and shall be carefully filled with mortar for a depth of three inches in from the top front and back faces and shall be neatly pointed on the exposed faces.

E. Curb shall be protected from bituminous concrete during paving operations and shall be cleaned if bituminous concrete does adhere to exposed curb surfaces.

3.12 - GUARDRAIL – Not Used

3.13 – PAVEMENT MARKINGS

A. Pavement marking shall be painted on non-windy days using whatever methods are necessary to prevent overspray from discoloring pavement. The locations, dimensions, color, etc. shall match existing/preconstruction conditions.

B. The Contractor is responsible for replacing all existing pavement markings including center lines, edge line, stop lines, crosswalks and lettering following temporary and permanent restoration of pavement.

3.14 - REPLACEMENT OF CURBS, WALKS, FENCES, STONE WALLS AND OTHER SIMILAR ITEMS

A. All existing curbs, walks, fences, stone walls and other similar items removed for the construction of the sanitary sewer, services, connections, water and/or storm drain lines shall be replaced in a manner equal or better than their original condition.

3.15 - REPLACEMENT OF BRICK AND COBBLESTONE ROADWAYS, SIDEWALKS, AND DRIVEWAYS

A. Existing brick and cobblestones used for roadways, sidewalks, driveways and/or cross walks, as applicable, shall be removed and place in a protected area.

B. Remove and place in a protected area all edging used for existing roadways, sidewalks, driveways and/or cross walks. It should be noted that existing edging consists of but not limited to steel, aluminum, granite and brick. Reset edging and/or replace any edging broken during removal at no additional cost to the Owner.

C. Remove sufficient depth of existing base materials replace with 6-inches of compacted stone dust for bricks and 6-inches of compacted stone dust and sand mixture at a 50/50 ratio for cobblestone. Rough and fine grade stone dust and compact to the required thickness for the particular application. Reset bricks and/or cobblestones with the smooth (worn and “weathered”) side up. Replace any bricks and/or cobblestones broken during removal at no additional cost to the Owner. Spread stone dust between the bricks and/or cobblestones to lock bricks and/or cobblestones in place.

D. Adjust all existing and newly installed utility boxes, frames and covers.

E. Sidewalks shall be sloped away from buildings to no more the ¼-inch per foot maximum toward the roadway. All existing structures including but not limited to tree grades, window wells, curbing, benches, utility boxes, and manholes shall match the elevation of the reset sidewalk.

3.16 - VEHICLE LOOP DETECTORS

A. General

1. The installation of Vehicle Loop Detectors shall be installed in accordance with the applicable provisions of the MassDOT Standard Specification for Traffic Control Devices (Section 800), and the latest NEMA standards.

2. Any Electrical Contractor performing work on roadways or signals under the jurisdiction of MassDOT and the Owner shall have International Municipal Signal Association (IMSA) Certification as a Traffic Signal Electrician Level II.

B. Installation

1. The detector lead-in cables shall be installed in the appropriate loop detector amplifier and labeled with the corresponding street name, approach direction, lane assignment, and phase and terminal number, both in the controller cabinet and in the pull box containing the detector lead-in splice. This labeling and attachment shall be of durable materials such as brass or plastic, attached by wire or plastic ties. Adhesive attachment of the label shall not be acceptable.

2. Wire loop detectors shall be installed in the roadway for vehicle detection. In advance of the loop detector installation, the Contractor shall mark, on site, the loop detectors with any changes required by field conditions such as manholes. The loop detector layout shall be inspected and approved by the Engineer before the loop detectors are installed.

3. Loop wire shall be encased in a protected plastic tubing of PVC or polyethylene plastic, IMSA 51-5, 1-1/4-inch outside diameter, and the wire may have cross-linked polyethylene insulation or it may have THHN/THWN insulation.

4. Splicing insulator shall be an approved re-enterable body splice kit with a non-hardening sealing compound compatible with the wire insulation. Klick-it buried wire closure kit as manufactured by Communication Technology, Inc., or approved equivalent.

5. Splice and Connection: Splicing and connection shall be made in the pull box nearest the roadway loop sensor but not exceeding four loops per pull box. All loops included in a detector group as shown on the plans shall be spliced in a single pull box. Each lead and lead-in connector shall be stripped back and spliced using a pressure type wire connector applied with a crimping tool. Multiple loop sensors shall be identified as detailed on the plans.

6. Lead-in splicing shall be staggered to prevent contact with each other. Each crimped splice shall be soldered and insulated. The insulation material shall be heat-shrinked polyolefin. The shielded lead-in cable outer jacket and shield shall be stripped back sufficiently to ensure that the shield cannot come into contact with the spliced conductors. Follow the instructions of the manufacturer when installing the re-enterable splice kit. The splice shall be done on the day of the loop wire installation to prevent the entrance of any moisture into the plastic tubing.

7. The lead-in conductors shall be connected to the appropriate terminals in the controller cabinet, by using crimped and soldered terminal ends.

8. The heat source for soldering shall be electrical not exceeding 30W capacity.

C. Testing of Loops

1. The test procedure shall be performed in the presence of the Engineer before and after the loop sensor is sealed in the pavement as stipulated in subsection 815.66. The cost of equipment, labor, and materials to perform such testing and similar re- testing following repairs, replacement, or adjustment of any detector within the project area shall be included in the price bid for the traffic control signal items.

2. After installation of wire loop sensors in the roadway and installation of shielded lead-in connecting the loop sensors to the controller cabinet, each loop sensor and lead-in combination shall be tested (at the controller cabinet) for proper installation. The resistance from lead to lead of the same loop shall not exceed three (3) ohms per 305 meters as measured by a high quality meter suitable for measurements of low resistance in the range of 1 to 6 ohms.

3. A megohm meter test at 500 volts DC shall be made between the two leads of a loop/lead-in combination temporarily spliced together, but otherwise disconnected from all terminals, and the shield drain wire and the earth ground connection. These resistances shall be at least one hundred (100) megohms.

4. A megohm meter test at 500 volts DC shall be made between lead-in shield and the earth ground rod. This resistance shall be at least one hundred (100) megohms.

5. The meter used for these tests shall be checked for calibration each day of use by using a resistor block of ±5 percent resistors simulating loads of 1 megohm, 20 megohm and 100 megohms. The observed meter reading shall be +10 percent of the nominal resistor load.

6. If any loop sensor and lead-in combination fails to pass any one of the four (4) tests, it shall be repaired and then re-tested on two occasions at least two (2) weeks apart and then shall pass on each re-test occasion. If the loop sensor lead-in combination does not pass all these re-tests, a new loop sensor and/or lead-in shall be installed, and shall pass these tests, at no additional cost.
7. After the above tests have been satisfactorily completed, all loop sensor/shielded lead-in inductance shall be measured and a written report of the results shall be filed with the Engineer and a copy stored with the "box prints" at the intersection.

3.17 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 02600

WATER MAINS AND APPURTENANCES

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PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes the furnishing of all labor, tools, equipment and materials necessary to perform all operations required for the construction of the replacement of the existing water mains, fittings, valves, hydrants and other related items necessary to complete the Work as specified.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

Note: Funding for this Bid Item is anticipated to be obtained at the Annual Town Meeting proposed to be held in May 2020. Therefore, performing the scope of work specified under this Bid Item is subject to this future appropriation and no payment will be made without written approval by the OWNER.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals shall include shop drawings showing complete fabrication and construction details, materials, weights, dimensions, clearances, anchorage details, piping and utility requirements. Submittals shall include at least the following:

1. Pipe and fittings.
2. Gaskets.
3. Couplings and solid sleeves.
4. Hydrants.
5. Valves.

6. Tapping Sleeves and Valves.
7. Water Service and Blowoff Materials.
8. Manufacturer's Certificates of Compliance with these Specifications and certification that the ductile iron pipe and fittings have been manufactured and tested in accordance with AWWA/ANSI specifications.
9. Manufacturer's documentation demonstrating at least 10 years of successful experience in manufacturing ductile iron pipe and fittings.

1.05 - PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer's written recommendations.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

C. All pipe when shipped shall be packed and separated by wood separators such that pipe-to-pipe contact is prevented during transit and/or storage.

D. Take appropriate measures during the loading, trucking, unloading, and handling of pipe and appurtenant materials so as not to damage them or the roadway surface. Dropping of materials directly from the trucks upon the ground will not be permitted. Suitable effective buffers or runners shall be provided. Metal chain shall not be used for lifting materials.

E. Distribution of pipeline materials along the line of Work is not permitted without written approval of the Owner. Do not obstruct driveways, sidewalks and/or walkways or place materials on private property.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

C. All products and materials shall conform to the applicable standards of ANSI and AWWA and/or as specified herein.

D. All materials supplied shall be manufactured in the United States.

1.07 - REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs 60,000 PSI Tensile Strength.

B. American Water Works Association (AWWA)

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pressure Pipe and Fittings
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings for Water
4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C115 - Standard for Flanged Ductile-Iron Pipe with Threaded Flanges
6. AWWA C150 - Thickness Design of Ductile-Iron Pipe
7. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids

8. AWWA C153 - Ductile-Iron Compact Fittings, 3-in through 16-in for Water and Other Liquids
9. AWWA C500 - Gate Valves for Water and Sewerage System.
10. AWWA C502 - Dry-Barrel Fire Hydrants
11. AWWA C504 - Standard for Rubber-Seated Butterfly Valves
12. AWWA C600 - Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances
13. AWWA C651 - Disinfecting Water Mains
14. AWWA C800 - Underground Service Line Valves and Fittings

C. American National Standards Institute (ANSI)

1. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings

D. Underwriters Laboratory (UL)

E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - PIPE

A. All ductile iron pipe shall be designed and manufactured in accordance with ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51 and the following class:

Pipe Diameter (inches)	Thickness (inches)	Special Thickness Class
6	0.31	52
8	0.33	52
10	0.35	52
12	0.37	52
16	0.37	51
20	0.39	51

B. Pipe shall be designed for the rated working pressure in pounds per square inch shown below and for laying condition Type 2 (Flat bottom trench, backfill consolidated to centerline of pipe) and for eight (8) feet of earth cover.

C. The pipe shall be in nominal laying lengths of eighteen (18) to twenty (20) feet. The grade of iron from which the pipe is made shall be 60-42-10; having 60,000 psi minimum tensile strength, 42,000 psi minimum yield strength and ten (10) percent minimum elongation.

D. Ductile iron pipe shall have either push-on or restrained joints. Restrained joint pipe shall be used in lieu of thrust blocks to resist the movement of the pipe. The “Minimum Restrained Joint Pipe Length” shall be in accordance with the manufacturer’s requirements and operating conditions. All other pipe shall have push-on joints.

E. Gaskets shall meet the material requirements of ANSI/AWWA C111 for mechanical joint gaskets.

F. The interior of the pipe shall be cement-mortar lined to twice the thickness specified in ANSI/AWWA C104/A21.4. The pipe manufacturer under controlled factory conditions shall apply the cement-mortar lining and field application is strictly prohibited. The cement-mortar lining shall be seal coated with an asphaltic material in accordance with ANSI/AWWA C150/A21.50 and NSF Standard 61. Asphaltic seal coat shall not impart taste or odor, or toxic or carcinogenic compounds to the water contained therein. Asphaltic seal coat shall be a product acceptable to the NSF for use in potable water and shall be so listed in the NSF summary of approved products. The asphaltic seal coat shall be applied and cured in strict conformance with the coating manufacturer's instructions. The manufacturer under controlled factory conditions shall apply the asphaltic seal coat and field application is strictly prohibited.

G. The outside of the pipe shall be asphaltic coated to a minimum 1 mil thickness in accordance with ANSI/AWWA C150/A21.50. The manufacturer under controlled factory conditions shall apply the asphaltic seal coat and field application is strictly prohibited

H. Restrained joint pipe shall be TR FLEX® as manufactured by the United States Pipe and Foundry Company or equal.

2.02 - FITTINGS

A. All ductile iron fittings including plugs, caps and blank flanges, shall be Class 350, mechanical joint, conforming to ANSI Specification A21.53 (AWWA C153) and conform to the weights and dimensions shown in the latest edition of the Ductile Iron Pipe Research Association (DIPRA) “Handbook of Ductile Iron Pipe” and be provided complete with all joint accessories.

B. All fittings shall be marked with the weight and shall have distinctly cast upon them the pressure rating, the manufacturer's identification, nominal diameter of openings and the number of degrees or fraction of the circle on all bends.

C. Hydrant tees shall be mechanical joint anchoring tees and have a rotatable mechanical joint gland on the 6-inch plain end branch to provide positive valve restraint.

D. Caps and plugs shall be provided with a threaded corporation or bleeder valve so that air and water pressure can be relieved prior to a future connection.

E. The interior surface of all fittings shall be cement-mortar lined to twice the thickness specified in ANSI/AWWA C104/A21.4. The pipe manufacturer under controlled factory conditions shall apply the cement-mortar lining and field application is strictly prohibited. The cement-mortar lining shall be seal coated with an asphaltic material in accordance with ANSI/AWWA C150/A21.50 and NSF Standard 61. Asphaltic seal coat shall not impart taste or odor, or toxic or carcinogenic compounds to the water contained therein. Asphaltic seal coat shall be a product acceptable to the NSF for use in potable water and shall be so listed in the NSF summary of approved products. The asphaltic seal coat shall be applied and cured in strict conformance with the coating manufacturer's instructions. The manufacturer under controlled factory conditions shall apply the asphaltic seal coat and field application is strictly prohibited.

F. The outside of all fittings shall be asphaltic coated to a minimum one (1) mil thickness in accordance with ANSI/AWWA C150/A21.50. The manufacturer under controlled factory conditions shall apply the asphaltic seal coat and field application is strictly prohibited.

2.03 - FLEXIBLE AND TRANSITION COUPLINGS

A. Flexible couplings shall be Dresser Style 138 or equal. Couplings shall be furnished with black steel bolts and nuts and with pipe stop removed. Gaskets shall be of a material suitable for exposure to liquid within the pipe.

B. Transition couplings shall be Dresser Style 162 or equal. Couplings shall be furnished with black steel bolts and nuts and with pipe stop removed. Gaskets shall be of a material suitable for exposure to liquid within the pipe.

2.04 - SOLID SLEEVES

A. Solid sleeves shall be long body type, ductile iron with mechanical joints.

B. All sleeves shall conform to the weights and dimensions shown in the latest edition of the Ductile Iron Pipe Research Association (DIPRA) “Handbook of Ductile Iron Pipe” and be provided complete with all joint accessories.

2.05 - RESILIENT SEATED GATE VALVES

A. Valves shall be manufactured in full compliance with the content and intent of this specification. Valve body shall be cast iron conforming to the latest edition of ASTM A126, Class B. Valves shall mechanical joint, with a 2-inch operating nut, a non-rising stem and shall conform in every respect to AWWA C509. Valves shall be designed for 250 psi working pressure, 350 psi test pressure and shall be hydrostatically tested with twice the specified rated pressure applied to one side of the gate and 0 pressure on the other side.

B. When mechanical joint ends are specified for use, the gasket seating areas shall be fully machined to fixed dimensions and tolerances as per AWWA specifications. All valves shall be provided with "O" rings. The design of the valve shall be such that the seal plate can be fitted with new "O" rings while the valve is under pressure in a fully open position.

C. Interior and exterior surfaces of all valves shall have a 100 percent solids thermoset or fusion bonded epoxy protective coatings, holiday-free in the waterway, which shall meet all requirements of AWWA C550. The epoxy coating shall not impart taste or odor to the water. The coating shall be a product acceptable to the NSF for use in potable water and shall be so listed in the most current NSF summary of approved products. The coating shall be applied and cured in strict conformance with the coating manufacturer's instructions. The valve manufacturer under controlled factory conditions shall apply the coatings and field application is strictly prohibited.

D. Valves shall open left and shall be as manufactured by Mueller or equal.

2.06 - TAPPING SLEEVES AND VALVES

A. Tapping sleeves and valves shall conform to the AWWA specifications for tapping sleeves and valves.

C. Tapping sleeves shall be mechanical joint, 2-part castings, flanged on the vertical centerline, and come complete with all joint accessories. The surface area of each flange shall be thoroughly machined, and the sleeve flanges shall be fitted with gaskets recommended by the manufacturer. Each gasket shall cover the entire surface area of each joint for the full length of the sleeve. Bolts used to assemble the sleeves shall pass directly through each flange and through each gasket. Bolts shall be properly spaced to insure uniform gasket pressure and compression.

D. Sleeve outlets shall have counter-bored flanges to insure proper centering of the tapping valve.

E. All tapping valves shall be flanged by mechanical joint and open left. Tapping sleeve valves shall be AWWA approved and shall meet all applicable requirements including test pressure and exterior coating as specified hereinbefore for resilient seated gate valves.

F. Prior to ordering tapping sleeves verify the circumference of the pipe on which each tapping sleeve is to be installed.

2.07 - VALVE BOXES AND COVERS

A. Valve boxes shall be cast iron, asphalt coated, adjustable sliding type with cast iron covers with a minimum 6-inch overlap is required between sliding sections. Valve box covers shall be drop type with the word "WATER" and a direction-to-open arrow plainly cast in relief on the top surface of the cover. Valve boxes shall be Buffalo Style #5663, with 24-inch top section and 30-inch bottom section.

B. Bell end of the lower sections shall in all cases be sufficiently large enough to fit over the stuffing boxes of the valves. The top section shall be at least 6-1/8-inches and have top flanges. The bottom section shall be at least 36-inches in length. The top section shall be at least 26-inches in length and have a plain bottom. The smallest inside dimension of the shaft shall not be less than 5-1/4 inches and shall have a belled base.

C. Upper section shall have a flange sufficiently strong enough to furnish the bearing for that section so that all weight or jolting from street traffic or the like shall not be transmitted to the valve.

D. Each valve box including cover shall weight at least 100 pounds.

E. No three-piece combinations shall be acceptable

2.08 - HYDRANTS

A. Hydrants shall be of the following type and manufacturer only. The Owner has standardized on this hydrant and therefore no substitutes are allowed.

1.	Make and Model	Mueller Co. A423 “Super Centurion 250”
2.	Type of Thread	National Standard
3.	Number of Outlets	2-1/2 inch hose connection (2 required)
		4-1/2 inch steamer connection (1 required)
4.	Diameter Valve Opening	5-1/4 inches
5.	Diameter of Barrel	8-1/2 inches
6.	Hub	Mechanical joint
7.	Direction of Opening	Open Left
8.	Depth of Bury	Street Level Shoulder Areas: 5-feet 6-inches
		Raised Sidewalk Areas: 6-feet 0-inches
9.	Color	Two coats of prime paint before shipment and once installed are to be cleaned and painted by the Contractor to match color of existing hydrants of the Owner

F. Hydrants shall be designed for one hundred fifty (150) pounds per square inch working pressure and shall conform in every respect to AWWA C502.

G. Hydrants shall be traffic model with dual drain ports and ductile iron retaining glands.

H. Hydrants shall have an oil reservoir to provide lubrication to all stem threads, bearing surfaces and O-rings each time the hydrant is operated.

I. Hydrant shall be marked with an arrow and the word "open" to indicate the direction to turn the stem to open the hydrant.

J. Hydrant barrel extensions shall be as recommended by the manufacturer of the hydrant and shall include all couplings, pins, flanges, gaskets, nuts and bolts necessary to provide a complete and workable installation. If more than one (1) type of extension is available, the Engineer shall approve the type to be provided.

K. Hydrants shall have hydrant markers with reinforced fiberglass shaft heavy duty spring mounted 4-foot long x 3/8-inch diameter. One bolt mounting.

2.09 - THRUST RESTRAINT GLANDS AND JOINTS

A. Thrust restraint glands shall be used on all mechanical joint fittings, valves and sleeves. The thrust restraint system shall incorporate individually activated gripping surfaces integral to the follower gland that makes up the mechanical joint.

B. Glands shall be manufactured of ductile iron conforming to ASTM A536. Gland dimensions shall be such that they can be used with standard mechanical joint bells and tee head bolts that conform to the latest revision of ANSI/AWWA A21.11/C111 and ANSI/AWWA A21.53/C153. Twist-off nuts, sized the same as tee-head bolts, shall be used to insure proper actuating of restraining devices. The mechanical joint restraint shall have a working pressure of at least 150 psi with a minimum safety factor of 2:1.

C. Glands shall be specifically designed for use with mechanical joint ductile iron pipe, fittings and valves. Glands shall be Series 1100 MEGALUG by EBBA Iron, Inc., Stargrip Series 3000 as manufactured by Star Pipe Products or equal.

D. Restraints for push-on joints shall be Stargrip Series 3100P as manufactured by Star Pipe Products, Series 1700 as manufactured by EBAA Iron or equal.

2.10 - WATER SERVICE MATERIALS

A. All water service materials, which shall include but is not limited to corporation cocks, curb stops, couplings, adapters, and fittings shall have compression type connections. Castings shall be sufficiently heavy to meet all service conditions without springing or leaking and be clean and free from roughness both inside and out. Waterways shall be smooth, full size and free from obstruction. All threads shall be cut sharp, clean and true. The Owner is standardized on the following Manufacturers specified herein.

B. Polyethylene tubing shall be furnished in accordance with the requirements of AWWA Standards C901. Tubing shall be 1-inch PE 3406, iron pipe size with a pressure class of 200 psi designed for buried service. Tubing shall be approved for use with potable water and shall be shall be NSF approved.

C. Corporation cocks shall be constructed of brass and meet the requirements of AWWA C800 and be for polyethylene tubing. The joint shall be a compression joint and the corporation shall be Model F1001-4 as manufactured by the Ford Meter Box Company. The Owner has standardized on this hydrant and therefore no substitutes are allowed.

D. Curb stops shall be constructed of brass and mee the requirements of AWWA C800 and be a ball-type design with compression joint. Curd stops shall be Model B66-44M as manufactured by the Ford Meter Box Company. The Owner has standardized on this hydrant and therefore no substitutes are allowed.

F. Service boxes shall be tar coated, cast iron, sliding type with 2 Hole Erie pattern cover, with a stationary rod to accommodate required bury depth. Covers shall be held in place with bronze bolts. Service box covers shall be have the word "WATER" cast into the cover.

2.11 - BLOWOFFS

A. Temporary and permanent blowoffs, to be used for disinfection and testing purposes, shall meet the requirements specified for water service materials and shall be constructed in accordance with the details included on the Contract Drawings and/or as directed by the Engineer.

2.12 - POLYETHYLENE ENCASEMENT

A. Polyethylene pipe encasement shall conform to requirements of AWWA C105, latest edition.

B. Virgin polyethylene shall conform to ANSI/ASTM D1248.

C. Minimum nominal thickness shall be 8 mils.

PART 3 - EXECUTION

3.01 - INSTALLATION OF PIPE, FITTINGS AND APPURTENANCES

A. Pipes shall be thoroughly cleaned before being installed. Particular attention shall be paid to the proper positioning of the rubber gaskets. Joining of pipe and fittings shall be done in accordance with the manufacturers written instructions.

B. Temporary watertight plugs shall be utilized at the end of each working day to prevent the intrusion of silt, debris and water into the pipeline. When working in areas with a high potential for flooding of the pipe from groundwater, streams, storm drains, sewers and/or other means, the temporary plug shall be used on each pipe length during installation.

C. In the event of flooding of the pipeline, all pipe laying shall cease until the pipeline has been thoroughly cleaned, as determined by the Engineer.

D. When joined together, pipeline shall form a smooth continuous line and grade on straight sections and on curved sections (both vertical and horizontal) shall have uniform deflections within the required limits and conforming in general to the line and profile of adjacent roadway or easement. Location of rubber rings shall be determined with a checking gauge before backfilling the pipe.

E. Pipe shall be joined and laid in accordance with the manufacturer's latest published instructions.

F. Pipe shall not be laid with deflection of more than one-half (1/2) the maximum deflection recommended by the manufacturer.

G. Backfill shall be placed on both sides of the pipe and compacted simultaneously with approved tamping bars for the full length of pipe. Bell holes shall be excavated as necessary to ensure that the pipe and not the pipe bells are bearing the weight of backfill and the traffic load.

H. Bells or other joints shall not be installed directly under existing utilities or structures. Use short or random lengths to avoid such conditions.

I. Pipe shall not be installed in areas where excavations have been carried below trench grade, or where groundwater conditions create unstable bottoms, until such time as the trench is excavated, refilled and compacted as specified.

3.02 - MECHANICAL JOINTS

A. Mechanical joints shall be installed with all required joint accessories, including gaskets, follower glands with drilled bolt holes, tee head bolts, and hexagonal nuts.

B. Torque wrenches shall be used to take up such joints. Wrenches shall be equipped with adjusting breakable tension gauge, set to break the tension at the tension loading recommended by the manufacturer. Mechanical joints shall be made so as to secure tight joints, every means being taken to secure this result.

3.03 - CUTTING OF PIPE

A. All cuts of ductile iron pipe shall be made with either an electric, pneumatic, or gasoline driven power saw. Blades shall be carbide tipped for cutting cement lined ductile iron pipe. Hydraulic cutters may be used provided the cement lining is not damaged by this method.

B. When lengths of pipe are field cut to provide for short lengths, the outside of the cut ends shall be tapered back about one-eight (l/8) inch at an angle of thirty (30) degrees with the centerline of the pipe and as recommended by the manufacturer before field cut pieces are installed.

3.04 - PIPE BLOCKING

A. Furnish and install wood blocking where required as directed by the Engineer.

B. Blocking shall be new spruce plank one (1) inch and two (2) inches in thickness. Blocks shall be bedded firmly and level across the bottom of the trench and when any block has been sunk too deeply additional blocking of suitable thickness shall be placed to bring the pipeline to the required grade.

C. Blocks shall be placed at a point 1/5th of the span from each joint. Each block shall be two (2) inch by four (4) inch with a length of four (4) inches larger than the diameter of the pipe. A sufficient quantity of wedges twelve (12) inches long of four (4) inch by four (4) inch fir shall be furnished to properly hold valves and special castings in place. A four (4) inch by four (4) inch timber shall be used to brace hydrant posts.

3.05 - CONNECTIONS TO EXISTING MAINS

A. Twenty-four (24) hours prior to connecting to any existing water main notify the water utility. Only the Owner’s personnel shall operate existing valves.

B. Make all taps, whether wet or dry and install the required sleeves, tees, couplings, adaptors, reducers, pipe nipples, jointing materials, and other fittings which may be required and make all joints watertight, as specified, where shown on the Contract Drawings and/or as approved by the Engineer. All existing materials removed shall remain the property of the Owner, as determined by the Owner. Legally dispose of all removed materials that the Owner does not want stockpiled.

C. The cutting, removal, plugging and bracing of parts of the existing water system in order to make necessary connections is included in the Work. The shutdown of the existing water system including any subsequent pumping, hand excavating, and time required by the Owner to effect tight closures of existing valves, and any reasonable changes that may be required by the Engineer or any other Work done hereunder shall be considered as an obligation to complete the Work.

D. All Work shall be coordinated with the Owner and such connections that may be required shall be made at such times and in such a manner as to cause as little interference in water service within the existing system as is practicable.

3.06 - INSTALLATION OF TAPPING SLEEVES AND VALVES

A. Pipe upon which a tapping sleeve is to be installed shall be thoroughly cleaned of all foreign matter with scraping tools and wire brushes, a minimum of six (6) inches each side of the sleeve.

B. Clean the flanged surface of the sleeve with a wire brush to remove any excess bituminous coating or burrs. The two (2) sections of the sleeve shall be lined up with care being taken to ensure that they are positioned in the same manner as received from the manufacturer.

C. Sufficient blocking and wedges shall be used to secure the sleeve once it has been leveled and positioned.

D. Sleeve bolts shall be alternatively tightened from the extreme end on one side to the extreme end of the opposite side, with approved torque wrenches, until all are securely tightened.

E. Flange bolts shall be tightened in a similar manner, with care being taken not to disturb the gasket.

F. Take care to ensure that the tapping machine is kept in leveled horizontal position and securely supported so as not to transmit any additional weight to the tapping valve.

3.07 - VALVE BOXES

A. Furnish and install valve boxes over each valve.

B. Valve boxes shall be cut with a wheel cutter, if necessary, to adjust them for height, where approved by the Engineer.

C. Valve boxes shall be properly adjusted over the operating nuts of valves and adjusted to the proper height to correspond to the roadway or ground surface. Operating nuts shall be centered in the valve boxes.

3.08 - ABANDONED VALVE BOXES

A. Upon completion of all Work and successful testing and disinfection of the new pipeline, close all existing valves designated by the Engineer on existing pipelines which have been cut and capped and/or are no longer to remain in service.

B. After closure, each valve box shall be removed, the void filled with gravel and then capped with grout prior to repaving.

3.09 - HYDRANT BRANCHES

A. Furnish and install hydrants on hydrant branches where shown on the Contract Drawings and/or as approved by the Engineer.

B. Each hydrant branch shall consist of the following:

1. Short Hydrant Branch - A valve anchoring tee with a 6-inch branch, 6-inch gate valve (mechanical joint), a 6-inch mechanical joint ductile iron pipe nipple of the required length and thrust restraint glands installed on the joints of all hydrants, valves and fittings. The base of hydrants shall be set on a concrete pad.

2. Long Hydrant Branch – A valve anchoring tee with an 8-inch branch, 8-inch gate valve (mechanical joint), 8-inch mechanical joint ductile iron pipe nipple of the required length, 8-inch by 6-inch reducer (mechanical joint), a 6-inch mechanical joint ductile iron pipe nipple of the required length and thrust restraint glands installed on the joints of all hydrants, valves and fittings. The base of hydrants shall be set on a concrete pad.

C. Hydrant barrel extensions shall be furnished and installed where necessary to provide a hydrant elevation acceptable to the Owner.

D. Construct hydrant drainage wells of one-half (1/2) cubic yard capacity of two (2) inch stone placed in the excavation below and around the hydrant bottom.

E. Hydrants shall be given two (2) coats of paint after installation of the same type and color of the existing hydrants of the Owner.

F. Existing Hydrants

1. Where shown on the Contract Drawings and/or directed by Engineer remove existing hydrants and stack them at a location selected by Owner within the municipal limits. Prior to removing any existing hydrants, the Contractor shall notify the local Fire Department and coordinate this Work with that agency.

2. For each hydrant to be removed and stacked close the branch valve, restrain valve if necessary, cut and cap branch, remove gate box, and remove hydrant. Legally dispose of any hydrant that the Owner decides not to accept.

3. Where shown on the Contract Drawings and/or directed by the Engineer, remove existing hydrants and reinstall them at locations designated by the Engineer. Prior to incorporating such hydrants into the Work, they shall be refurbished and repaired to the satisfaction of the Owner. Inspection and repair of existing hydrants shall be performed in accordance with the applicable procedures described in AWWA Manual M17, including, but not limited to, replacement of all gaskets, packing, seals and any other parts which show indication of wear, corrosion or incipient failure. Reinstallation of existing hydrants shall be performed with materials, and in the manner specified for new hydrants.

3.10 - SERVICE CONNECTIONS

A. Furnish and install all necessary water service materials required to complete the transfer of water services to the new pipeline(s) installed or required to abandon services replaced. The limit of work related to service connections shall be as approved by the Engineer and/or as follows:

1. If a complete transfer of a water service from the existing pipeline to the new pipeline is required, furnish and install all required materials and install the new service in the vicinity of the existing service to the property line. All connections to the customers' side of the curb stop are included as part of the Work.

2. If a portion of the existing water service, such as but not limited to the curb stop or service pipe, are to be reused, then furnish and install all other materials required to connect the new service materials to the existing materials.

3. If the existing pipeline from which services are being transferred is to remain in service at the completion of the Work, excavate down to each abandoned corporation cock and shut it off. Existing corporations to be abandoned shall only be shut off when approved by the Owner.

B. Service connection work shall only be initiated after the new pipeline has been successfully pressure and leakage tested, disinfected and approved for service by the Owner. Service connection work shall result in a minimum disruption of service to existing consumers.

C. Only "wet taps" shall be made on the new pipeline(s) unless written approval is obtained from the Engineer to use dry taps.

1. Pipe shall be tapped in accordance with the manufacturer's latest published recommendations in regard to but not limited to depth of tap and allowable sizes.

2. Drills and/or taps shall be inspected frequently for signs of wear. Do not exceed the number of taps specified by the manufacturer before reconditioning or replacing drills and/or taps. Service pipe shall be cut with approved wheel cutters only.

D. Prior to excavating for service connections, cut and stockpile all sod on established lawns, remove, replant and/or replace shrubs, hedges, fences and trees that are required to be removed or are damaged by the Work.

E. Equipment with rubber tires shall be used to excavate and backfill on established lawns.

F. Service pipe shall be installed to a minimum depth of five (5) feet and laid in a straight line wherever practicable to the structure to be serviced or to the point of termination of existing service. Install the service pipe beneath paved surfaces and sidewalks by jetting, jacking, boring or pulling the existing service pipe. Open cuts shall only be made when written approval is obtained from the Engineer.

3.11 - BLOWOFFS

A. Permanent blowoffs shall be furnished and installed as specified and/or where directed by the Engineer. Copper tubing shall be cut flush with the top of gate boxes.

3.12 - POLYETHYLENE ENCASEMENT

A. Ductile iron pipe and fittings shall be wrapped in polyethylene encasement where pipe depth is at or below normal groundwater level.

B. Ductile iron pipe and fittings installed within 5 feet of gas lines shall be wrapped in polyethylene encasement.

3.13 - CEMENT CONCRETE THRUST RESTRAINTS

A. Furnish and place cement concrete for thrust restraint, where restrained joint pipe cannot be used as directed by the Engineer.

B. Concrete shall be of proportions, one (l) part cement to two (2) parts sand and four (4) parts coarse aggregate.

C. Care shall be taken to ensure that all concrete thrust blocks bear against undisturbed trench walls, and not to encase flanges and bolts on mechanical joint fittings. Where unsuitable bearing material is encountered, excavate and place sufficient concrete ballast, with the approval of the Engineer, to offset the anticipated thrusts.

3.14 - OTHER MATERIALS

A. Furnish and install all necessary materials required for a complete installation as specified.

3.15 – CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 02605

TEMPORARY BY-PASS PIPING AND SERVICE CONNECTIONS

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PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes furnishing of all labor, tools, equipment, materials and performing all operations necessary for temporary by-pass piping of Municipal water and service connections as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

Note: Funding for this Bid Item is anticipated to be obtained at the Annual Town Meeting proposed to be held in May 2020. Therefore, performing the scope of work specified under this Bid Item is subject to this future appropriation and no payment will be made without written approval by the OWNER.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals shall include shop drawings showing complete fabrication and construction details, materials, weights, dimensions, clearances, anchorage details, piping and utility requirements. Submittals shall include at least the following:

1. Temporary by-pass pipe, fittings, valves, hydrants and service materials.
2. Provide a complete by-pass piping layout. Layout shall identify the location(s) and pipe diameter(s) of all pipe, hydrants and valves.

1.05 - PRODUCT HANDLING – Not Used

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

C. The Work of this section shall be coordinated with the Owner.

PART 2 - PRODUCTS

2.01 - MATERIALS

A. Each segment of the temporary by-pass piping system shall be fully adequate to withstand the normal working pressures experienced in the Owner’s existing water distribution system or 150 pounds per square inch whichever is greater.

B. All by-pass piping and appurtenances shall be watertight and of materials that do not cause objectionable taste or odor in the potable water system.

PART 3 - EXECUTION

3.01 - GENERAL

A. Each segment of the temporary by-pass piping system, including service connections, shall be flushed clean and disinfected in accordance with AWWA C651 and the Contract Documents, prior to incorporation into temporary use, as approved by the Engineer.

B. In general, temporary by-pass pipe shall be placed at the edge of traveled ways where it will cause the least obstruction and be least susceptible to damage. At roadway intersections the pipe shall be placed in a shallow trench and overlaid with temporary bituminous concrete surfacing as approved by the Owner. Temporary by-pass pipe that crosses driveway areas shall be covered with temporary bituminous concrete cold patch as approved by the Owner.

C. Temporary by-pass piping shall be provided with isolation valves spaced at 500-foot maximum intervals as approved by the Engineer. All temporary service connections shall have an isolation valve located at the connection to the temporary by-pass pipe.

D. Water for temporary by-pass piping service shall be taken from the nearest available fire hydrant(s) or as directed by the Engineer.

E. All temporary by-pass piping attachments to existing fire hydrants shall be made such that they can be easily removed to allow the fire hydrant to be used for fire fighting purposes. Provide a tee with a valve for each hose connection.

3.02 - INSTALLATION

A. Prior to the installation of any segment of temporary by-pass piping, notify the local Fire Department and coordinate with the Owner. Make modifications to the proposed layout of the temporary by-pass piping system as approved by the Owner.

B. The operation of all valves located in the existing water distribution system necessary for the isolation of each temporary by-pass piping segment shall be performed by the Owner.

C. Temporary fire hydrants shall come complete with individual control valves and include all necessary pipe, valves and fittings associated therewith as required by the local Fire Department and as approved by the Owner. In general, temporary hydrants shall be placed adjacent to the existing hydrants that are being removed from service.

D. Provide and maintain until removal of the temporary by-pass piping system, bituminous concrete cold patch or other material approved by the Engineer over each connecting coupling included in the temporary by-pass piping system.

3.03 - MAINTENANCE AND REMOVAL

A. Temporary by-pass piping systems shall be maintained in a safe and operative condition at all times (24 hours per day) during their use.

B. Temporary by-pass piping systems shall be protected against the potential for freezing conditions (November through March).

C. Each temporary by-pass piping system or independent segment thereof shall be removed from the Project immediately after the corresponding segment of permanent potable water distribution piping has been incorporated into the Owner’s distribution system as approved by the Owner.

D. Upon removal of the temporary by-pass piping system, all areas affected by its use shall be returned to a neat and orderly condition in every respect equal to or better than its original condition. Service connections connected to the temporary by-pass piping system shall be returned to normal service prior to removal of the temporary by-pass piping system.

E. For cleaning and lining projects, each permanent service connection shall be blown back to the permanent service distribution pipe from the service pipe connection at the water meter prior to the removal of the temporary service connection. If there is no water meter, the service line shall be blown back from a location approved by the Engineer.

3.04 – CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 02615

DUCTILE IRON PIPE AND FITTINGS

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PART 1 – GENERAL

1.01 - SCOPE

A. The Work of this section includes furnishing all labor, materials, tools and equipment necessary to provide Ductile Iron Pipe and Fittings as specified and/or as shown on drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

C. Provide and test ductile iron pipe, fittings and appurtenances as indicated and in compliance with Contract Documents.

D. Options:

1. For buried exterior pipelines provide push-on joint pipe.
    a. Provide restrained push-on pipe as specified
    b. Provide either restrained push-on joint fittings as specified and indicated or provide mechanical joint fittings with restraint system as specified herein
2. For piping exposed as in buildings and galleries, provide flanged or rigid-joint, grooved-coupled pipe and fittings.
3. Cast iron pipe and fittings are not acceptable.

1.02 – MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Pipe manufacturer’s technical specification and product data.
2. Certified shop and erection drawings. Contractor shall submit electronic files of the piping layout including the following.
    a. Pipe layouts in full detail.
    b. Location of hangers and supports.
    c. Location and type of anchors.
    d. Location of couplings and expansion joints.
    e. 1/2-inch = 1 foot-0 inch (1 mm = 25 mm) scale details of all wall penetrations and special fittings.
    f. Schedules of pipe, fittings, special castings, couplings, expansion joints and other appurtenances.
3. Certificates: Sworn certificates in duplicate showing compliance with material used and shop tests performed.
4. Catalog cuts and technical data for expansion joints, couplings, gaskets, pipe supports and other accessories.
5. Brochures and technical data on coatings and linings and proposed method of application.
6. Manufacturer's descriptive literature and technical data on insulation and proposed method of installation.
7. Material Certification
    a. Provide certification from the pipe and fittings manufacturer that the materials of construction specified are recommended and designed for the service conditions specified and indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and designed for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the Owner.
    b. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and designed for the service conditions specified and indicated.
    c. A copy of the contract mechanical process, civil and structural drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with “No changes required” or provide a statement that no changes are required.
    d. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.

8. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.

    a. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.

    b. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

1.05 – PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer’s written recommendations.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

C. Comply with the requirements specified in SECTION 01610, DELIVERY, STORAGE AND HANDLING.

D. During loading, transportation and unloading, prevent damage to pipes and fittings. Load and unload each pipe under control at all times. Under no circumstances will a dropped pipe be used unless inspected and accepted by Engineer. Place skids or blocks under each pipe in the shop and securely wedge pipe during transportation.

1.06 – DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents.

B. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

C. The design conditions and other pertinent requirements for the equipment specified in this section are indicated on the Contract Drawings.

D. Provide manufacturer's certification in writing, that materials meet or exceed minimum requirements as specified.

E. Inspect and test at foundry according to applicable standard specifications.

F. Owner reserves right to inspect and test by independent service at manufacturer’s plant or elsewhere at his own expense.

G. Visually inspect before installation.

H. Job Conditions - Coordinate dimensions and drillings of flanges with flanges for valves, pumps and equipment to be installed in the piping systems.

1.07 - REFERENCES

A. American Society of Mechanical Engineers (ASME)

1. ASME B16.1 - Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.

2. ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.

3. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings.

4. ASME B31.1 - Power Piping.

B. ASTM International (ASTM)

1. ASTM A240 - Specification for Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
2. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile.
3. ASTM A380 - Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment and Systems.
4. ASTM A530 - Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe.
5. ASTM A774 - Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
6. ASTM A778 - Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.

C. American Water Works Association (AWWA)

1. AWWA A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA A21.10 - Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water and Other Liquids.
3. AWWA A21.11 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe Fittings.
4. AWWA A21.15 - Flanged Ductile-Iron Pipe with Threaded Flanges.
5. AWWA A21.50 - Thickness Design of Ductile-Iron Pipe.
6. AWWA A21.51 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds, or Sand-Lined Molds, for Water or Other Liquids.
7. AWWA A21.53 - Ductile-Iron Compact Fittings, 3-in through 16-in. for Water and Other Liquids.

D. Fluid Sealing Association - Technical Handbook.

E. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - PIPE

A. Ductile Iron

1. Design conforming to AWWA A21.50.
2. Manufacture conforming to AWWA A21.15 or AWWA A21.51.
3. Thickness class, unless otherwise indicated or specified:
   a. Minimum Thickness Class 52.
   b. Minimum thickness Class 53 for use with threaded flanges.
   c. Minimum thickness Class 53 for use with flanged pipe.
   d. Minimum thickness for use with grooved couplings conforming to AWWA C606.

2.02 - PIPE FOR USE WITH COUPLINGS

A. As specified above except ends shall be plain.

B. With bolted split sleeve couplings, ends cast or machined at right angles to axis.

C. With grooved type coupling:

1. Ductile-Iron of thickness class specified above.
2. Grooved End dimensions conforming to AWWA C606 for flexible or rigid joints to suit joint requirements.

2.03 - FITTINGS

A. Provide fittings conforming to AWWA A21.10, at least Class 150 and match piping class.

B. Provide all bell push-on or mechanical-joint fittings unless otherwise indicated or specified.

C. Face and drill flanged fittings conforming to AWWA A21.10 except special drilling or tapping for correct alignment and bolting.

D. If flanged fittings are not available under AWWA A21.10 provide fittings conforming to ASME B16.1 in 125 lb. pressure class.

E. Provide standard base fittings where indicated.

F. Provide grooved-end fittings ductile-iron conforming to AWWA A21.10 for center-to-face dimensions.

1. End preparation for grooved-ends conforming to AWWA C606 for flexible or rigid joints as required by type of joint.

2.04 - NONSTANDARD FITTINGS

A. Acceptable design.

1. Same diameter and thickness as standard fittings.

2. Manufactured to meet requirements of same specifications as standard fittings except for laying length and types of ends.

2.05 - WALL CASTINGS

A. Provide size and type indicated and specified.

1. Piping 24-inches and Smaller: Mechanical Joint with specified restraint or Restrained Push-On.

B. Wall Castings: Conform to requirements of AWWA A21.10 or fabricate of Class 53 ductile iron pipe with screwed on flanges and welded on waterstop. Screwed on mechanical or push-on joints are not acceptable.

C. Provide water stop centered in wall. Weld water stops on in factory under controlled conditions to ensure adequate strength to permit waterstop to absorb thrust up to the pressure rating of the pipe.

Wall Castings with Annealed Ductile Iron Water Stops

Pipe Size	Waterstop Thickness, inches
4 inch-12 inch	0.50
14 inch-24 inch	0.75
30 inch-36 inch	1.00
42 inch-48 inch	1.25

Wall Castings with Fabricated Steel Water Stops

Pipe Size	Waterstop Thickness, inches
4 inch-16 inch	0.25
18 inch-24 inch	0.38
30 inch-36 inch	0.50
42 inch-48 inch	0.75
54 inch-64 inch	1.00

D. On flanged wall castings, provide space between the wall and flange to permit mounting the nuts on the flange bolts.

E. Flanged wall castings located with the flange flush with the wall are not acceptable.

F. Locate push-on joint wall castings with space between the bell and the wall to insert the follower bolts.

G. As an option, fabricated wall pipe of Schedule 40 Type 316L stainless steel may be substituted for wall castings specified above. Provide with waterstops of above dimensions and welded continuously on both sides of stop. Flanges of Type 316 stainless steel. Bolts for connection to buried pipe Type 316 stainless steel. Provide flange insulation gaskets, sleeves and washers for all flanges.

H. Testing: Factory pressure test all wall castings to pipe and joint pressure rating for a minimum of 5 minutes. No visible leakage is acceptable.

2.06 - ADAPTERS

A. Furnish and install for joining pipe of different types, unless solid sleeves indicated.

1. Provide ends conforming to above specifications for the correct type of joint, to receive adjoining pipe.

2. Joining two classes of pipe may be of lighter class provided annular space in bell-and-spigot type joints sufficient for jointing.

2.07 - JOINTS

A. Provide push-on joint and mechanical joint pipe with necessary accessories, conforming to AWWA A21.11.

1. Provide gasket composition designed for exposure to liquid within pipe.

B. Provide pipe flanges and accessories conforming to AWWA A21.15.

1. Provide flat faced flanges.

2. Provide 1/8-inch thick, full faced gaskets designed for exposure to liquid within pipe.

C. Provide restrained joint on pipe and fittings where indicated. Provide restrained joint which is:

1. Boltless

2. Capable of being deflected after assembly

3. Designs using set screws or requiring field welding are not acceptable.

4. Manufacturers:

a. American Cast Iron Pipe Co. Flex-Ring.

b. U.S. Pipe TR FLEX.

c. Clow Super-Lock.

2.08 - MECHANICAL JOINT FITTINGS – RESTRAINT SYSTEM

A. Provide restraint devices for pipe consisting of multiple gripping wedges incorporated into a follower gland meeting requirements of AWWA A21.10.

1. Mechanical joint restraint shall require conventional tools and installation procedures per AWWA C600, retaining full mechanical joint deflection during assembly and allowing joint deflection after assembly.

2. Provide actuation of the gripping wedges ensured with torque limiting twist off nuts.

3. Provide restraint devices Listed by Underwriters Laboratories (3 inch through 24 inch size) and Designed by Factory Mutual (3 inch through 12 inch size).

4. Gland body, wedges and wedge actuating components must be domestic manufactured in the USA.

B. Working Pressure Rating:

1. 16-inch (400 mm) and Smaller: 350 psi .
2. Minimum safety factor: 2 to 1.

C. Materials:

1. Gland body, wedges and wedge actuating components: Grade 65-45-12 ductile iron in accordance with ASTM A536.
2. Ductile iron gripping wedges: Heat treated, 370 to 470 BHN.
3. Provide three (3) test bars incrementally poured per production shift as per Underwriter's Laboratory (U.L.) specifications and ASTM A536. Testing for tensile, yield and elongation in accordance with ASTM E8.
4. Provide chemical and nodularity tests performed as recommended by the Ductile Iron Society, on a per ladle basis.
5. Provide an identification number consisting of year, day, plant and shift (YYDDD)(plant designation)(Shift number) cast into each gland body.
6. Record all physical and chemical test results such that they can be accessed via the identification number on the casting. Provide the Material Traceability Records (MTRs) available, in hard copy.
7. Provide coating for restraint devices consisting of the following:
    a. Process all wedge assemblies and related parts through a phosphate wash, rinse and drying operation prior to coating application.
    b. Coating: A minimum of two coats of liquid thermoset epoxy coating with heat cure to follow each coat.
    c. Surface pretreat all casting bodies with a phosphate wash, rinse and sealer before drying. The coating shall be electrostatically applied and heat cured. Coating: Polyester based powder to provide corrosion, impact and UV resistance.
    d. Coating system: MEGA-BOND by EBAA Iron, Inc.

D. Manufacturer:

1. EBAA Iron MEGALUG Series 1100
2. Or an acceptable equivalent.

2.09 - FLANGE ADAPTORS

A. Provide restrained flange adaptors for pipe consisting of multiple individual gripping wedges incorporated into a follower gland meeting requirements of AWWA A21.10.

1. Provide actuation of the gripping wedges ensured with torque limiting twist off nuts.
2. Provide restraint devices Listed by Underwriters Laboratories (3-inch through 12 inch size) and Designed by Factory Mutual (4-inch through 12-inch size).
3. Gland body, wedges and wedge actuating components must be domestic manufactured in the USA.

B. Joint Deflection capability:

1. 3-inch through 8-inch: 5 degrees

C. Provide flange adaptor to maintain seal with and 0.6 inch gap between end of pipe and mating flange

D. Working Pressure Rating:

1. 16-inch and Smaller: 350 psi
2. Minimum safety factor: 2 to 1.

E. Materials

1. Gland body, wedges and wedge actuating components: Grade 65-45-12 ductile iron in accordance with ASTM A536.
2. Ductile iron gripping wedges: Heat treated, 370 to 470 BHN.
3. Provide three (3) test bars incrementally poured per production shift as per Underwriter's Laboratory (U.L.) specifications and ASTM A536. Testing for tensile, yield and elongation in accordance with ASTM E8.
4. Provide chemical and nodularity tests performed as recommended by the Ductile Iron Society, on a per ladle basis.
5. Provide an identification number consisting of year, day, plant and shift (YYDDD)(plant designation)(Shift number) cast into each gland body.
6. Record all physical and chemical test results such that they can be accessed via the identification number on the casting. Provide the Material Traceability Records (MTRs) available, in hard copy.
7. Provide coating for restraint devices consisting of the following:
   a. Process all wedge assemblies and related parts through a phosphate wash, rinse and drying operation prior to coating application.
   b. Coating: A minimum of two coats of liquid thermoset epoxy coating with heat cure to follow each coat.
   c. Surface pretreat all casting bodies with a phosphate wash, rinse and sealer before drying. The coating shall be electrostatically applied and heat cured. Coating: Polyester based powder to provide corrosion, impact and UV resistance.
   d. Coating system: MEGA-BOND by EBAA Iron, Inc.

F. Manufacturer

1. EBAA Iron MEGAFLANGE Series 2100
2. Or an acceptable equivalent.

2.10 - FLEXIBLE CONNECTIONS

A. Use as specified or indicated:

1. Bolted split sleeve couplings
2. Grooved couplings
3. Expansion joints

2.11 - BOLTED SPLIT SLEEVE COUPLINGS

A. Provide in accordance with SECTION 15370, PROCESS PIPING AND APPURTENANCES.

B. Pressure rating at least equal to that of related pipeline.

C. Provide with gaskets of composition designed for exposure to liquid within pipe.

2.12 - GROOVED COUPLINGS

A. Conform to AWWA C606.

B. Minimum pipe wall thickness specified under "Pipe For Use With Couplings."

C. Where grooved couplings are indicated to provide for expansion or flexibility, cut pipe grooves to provide necessary expansion or flexibility.

D. Where grooved couplings are used instead of flanged joints, joint to be of rigid type with pipe grooves cut to bring pipe ends together. Beam strength of joint shall be equal to or greater than that of flanged joint.

2.13 - FILLING RINGS

A. Provide where necessary.

B. Materials, workmanship, facing, and drilling, conforming to 125 lb. ANSI (Class 125)

C. Suitable length with nonparallel faces and corresponding drilling, if necessary, for correct assembly of adjoining piping or equipment.

2.14 - CONNECTIONS – TAPPED

A. Provide service saddles for all taps for lines 24-inch and smaller.

1. Body: Ductile iron ASTM A395 or Bronze.

2. Straps and Hardware: Type 316 stainless steel.

2.15 - PIPE COATING

A. Outside of pipe and fittings within structures: Clean and apply one shop coat with a 3 to 5 mil DFT of moisture cured urethane.

B. Outside surfaces of castings to be encased in concrete: No coating.

C. Machined surfaces cleaned and coated with rust-preventative compound at shop.

D. Outside of buried pipe and fittings: Standard bituminous coating conforming to AN Standard.

2.16 – CEMENT LINING

A. Inside of pipe and fittings: Provide double thickness cement lining and bituminous seal coat conforming to AWWA A21.4.

2.17 - GASKETS, BOLTS, AND NUTS

A. Provide ring or full face synthetic rubber gaskets for flanged joints and neoprene faced phenolic for insulating gaskets in accordance with AWWA A21.11 and ASME B16.21.

1. 1/8 inch (3 mm) thick.

B. Make flanged joints with:

1. Bolts.

2. Bolt studs with nut on each end.

3. Studs with nuts where flange is tapped.

4. Plastic bolt sleeves and washers for insulating joints.

C. Number and size of bolts conform to same ANS as flanges.

D. Provide Type 316 stainless steel bolts, washers and nuts for all services:

PART 3 - EXECUTION

3.01 - VERIFICATION OF CONDITIONS – Not Used

3.02 - INSTALLATION

A. Visually inspect before installation.

B. Ensure pipelines parallel to building walls wherever possible. Install piping to accurate lines and grades. Where temporary supports are used, ensure rigidity to prevent shifting or distortion of pipe. Provide for expansion where necessary.

C. Pitch piping toward low points. Provide for draining low points.

D. Before assembly, remove dirt and chips from inside pipe and fittings.

E. Piping Support: Provide in accordance with SECTION 15056, PIPE SUPPORTS.

F. Pipe and Fittings:

1. Remove and replace defective pieces.
2. Clear of all debris and dirt before installing and keep clean until accepted.
3. Lay accurately to lines and grades indicated or required. Provide accurate alignment, both horizontally and vertically.
4. Provide firm bearing along entire length of buried pipelines.
5. Do not allow deflection of alignment at joints to exceed permissible deflection as specified below:
   a. For push-on joint or similar pipe, clean bell of excess tar or other obstruction and wipe out before inserting next pipe spigot. Shove new pipe into place until properly seated and hold securely until joint completed.
   b. Set castings to be encased in concrete accurately with bolt holes, if any, carefully aligned. Clean off rust and scale before setting.

PIPE DEFLECTION ALLOWANCES

Maximum permissible deflection, inches*		
Size of pipe, inches	Push-on joint	Mechanical joint
4	19	31
6	19	27
8	19	20
10	19	20
12	19	20
14	11	13-1/2
16	11	13-1/2
18	11	11
20	11	11
24	11	9
30	11	9
36	11	8
42	7-1/2	7-1/2
48	7-1/2	7-1/2
54	7-1/2	0

* Maximum permissible deflection for 20-feetlengths; for other lengths in proportion of such lengths to 20-feet.

G. Temporary Plugs: When pipe laying not in progress, close open ends of pipe with temporary watertight plugs. If water in trench, do not remove plug until danger of water entering pipe passed.

H. Appurtenances: Set valves, fittings and appurtenances as indicated.

3.03 - JOINTS AND COUPLINGS

A. Push-on Joints:

1. Insert gasket into groove bell. Apply thin film of nontoxic gasket lubricant over inner surface of gasket in contact with spigot end.
2. Insert chamfered end into gasket. Force pipe past it until it seats against socket bottom.

B. Bolted Joints

1. Remove rust-preventive coatings from machined surfaces.
2. Clean pipe ends, sockets, sleeves, housings, and gaskets and smooth all burrs and other defects.
3. Use torque wrench to tighten to correct range of torque not to exceed values specified below:

TORQUE RANGE VALUES

Nominal pipe size, in	Bolt diameter, in	Range of torque, ft-lb
3	5/8	40-60
4-24, incl.	3/4	75-90
30, 36	1	100-120
42, 48	1-1/4	120-150

C. Flanged Joint

1. Make up tight.
2. Do not put strain on nozzles, valves, and other equipment.
3. Bolt threads must fully engage the nuts. At a minimum the bolt must be flush with the nut and no more than 1/2-inch excess thread protruding from the nut.

D. Mechanical Joints

1. Wire brush surfaces in contact with gasket and clean gasket.
2. Lubricate gasket, bell, and spigot with soapy water.
3. Slip gland and gasket over spigot, and insert spigot into bell until seated.
4. Seat gasket and press gland firmly against gasket.
5. After bolts inserted and nuts made finger-tight, tighten diametrically opposite nuts progressively and uniformly around joint by torque wrench. Torque bolts to values specified above.

E. Flexible Joints

1. Clean and dry before assembly.
2. Place gaskets, rings, glands and followers in position in back of spigot ball.
3. Coat ball and socket with thin film of lubricant conforming to joint manufacturer's standards.
4. Insert ball and seat in socket. Seat gasket against ball.
5. Boltless joints:
    a. Assemble retainer rings and glands conforming to manufacturer's standard.
    b. Lock in place with lead strips.

F. Grooved Couplings

1. Clean grooves and other parts.
2. Coat ends of pipe and outside of gasket with soft soap or silicone and slip gasket over one pipe end.
3. Bring pipes to correct position and center gasket over pipe ends with lips against pipe.
4. Place housing sections, insert bolts and tighten nuts until housing sections in metal-to-metal contact.
5. After assembly and inspection and before backfilling, coat exterior surfaces of buried couplings, including bolts and nuts, with heavy-bodied bituminous mastic.

G. Tapped Connection

1. Drill and tap normal to longitudinal axis.
2. Drilled by skilled mechanics using proper tools.
3. Use only tapered threads.

H. Electrical Conductors

1. Install pipes so terminal strips are aligned.
2. Install jumper strips and tighten bolts.

3.04 – FIELD PAINTING

A. Provide in accordance with SECTION 09941, FIELD PAINTING.

3.05 - CLEANUP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment.

B. Spillage of lubricants used in servicing the system shall be cleaned from all equipment and concrete surfaces.

3.06 - MANUFACTURER'S FIELD SERVICES – Not Used

3.07 - MANUFACTURER'S TRAINING – Not Used

3.08 - LUBRICATION REQUIREMENTS

A. All lubricating oils required shall be provided as specified herein.

3.09 – SPARE PARTS – Not Used

3.10 - HANDLING AND CUTTING

A. Mark pipe and fittings "Rejected" and remove from site when cracked or has received a severe blow.

B. If permitted, cut on sound barrel at a point at least 12 inch from visible limit of crack, at Contractor's expense.

C. Machine cut with milling type cutters, knives, or saws. Snap cutters, torch, or hammer and chisel NOT ALLOWED. Examine for possible cracks.

D. Chamfer cut ends if used for push-on joints.

E. Do not cut glass lined pipes.

3.11 - FIELD TESTING

A. Provide in accordance with SECTION 09941, FIELD PAINTING.

B. Clean of all dirt, dust, oil, grease and other foreign material, before conducting pressure and leakage tests.

C. Pressure and Leakage Tests:

1. Conduct combined pressure and leakage test in pipelines.
2. Furnish and install temporary testing plugs or caps; pressure pumps, pipe connections, meters, gages, equipment, and labor.
3. Test when desired and comply with specifications.
4. Test pipelines in excavation or embedded in concrete before backfill or placing of concrete and test exposed piping before field painting.
5. Fill section of pipe with water and expel air. If hydrants or blowoffs are not available at high points for releasing air, make necessary taps and plug after test completion.
6. Maintain section full of water for 24 hours before conducting combined pressure and leakage test.

7. Conduct pressure and leakage test consisting of first raising water pressure (based on elevation of lowest point of section under test and corrected to gage location) to pressure in psi numerically equal to pipe pressure rating, but not more than 150 psi.

8. Maintain pressure and make leakage test by metering water flow into pipe. Acceptable results:

   a. Average leakage during test: less than 10 gallons per inch of diameter per 24 hours per mile.

   b. No visible leakage in joints.

9. If unable to achieve and maintain specified pressure for one hour with no additional pumping, section fails test.

10. If section fails pressure and leakage test, locate, uncover, and repair or replace defective pipe, fitting, or joint, at no additional expense and without time extension. Conduct additional tests and repairs until section passes test.

11. Modify test procedure only if permitted by Engineer.

3.12 - DISINFECTING AND FLUSHING

A. Disinfect potable water lines using procedures and materials conforming to AWWA C651.

B. Dosage to produce minimum 10 ppm after minimum of 24 hour contact period.

C. After treatment, flush with clean water until residual chlorine content less than 0.2 ppm.

D. Prevent contamination of water in existing water mains. Neutralize chlorine content of water used in disinfecting and flushing accordance with AWWA C651.

3.13 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 02620

INSULATION AND JACKETING

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1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 1
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PART 1 - GENERAL

1.01 - SCOPE

A. The work of this section includes furnishing all labor, equipment, materials, and accessories required to install pipe insulation and jacketing were indicated on the drawings and as specified herein.

B. Insulation and jacketing shall be applied to all pipe and fittings at the following locations:

1. Terminal Flushing Manhole with Combination Air Valve;
2. In-Line Flushing Manhole with Combination Air Valve;
3. Low Point Drain Manhole with Isolation Valves; and
4. Other locations as shown on the drawings.

C. Attention is directed to all sections within BIDDING REQUIREMENTS, CONTRACT FORMS AND CONDITIONS OF THE CONTRACT; all sections within OTHER DOCUMENTS; DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals shall include at least the following:

1. Shop Drawings, including all equipment and components

2. Brochures and/or Catalogue Cuts

3. Installation instructions

4. Certificate of Compliance

5. Manufacturer's Data

1.05 - PRODUCT HANDLING

A. All materials shall be shipped, stored, and handled and installed in such a manner as not to degrade quality, serviceability or appearance. The materials shall be stored in a clean, dry location free from construction dust, precipitation and excess moisture. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

C. Insulation and jacketing system shall be as manufactured by Urecon, LTD, or equal.

PART 2 - PRODUCTS

2.01 - MATERIALS

A. Insulation

1. General. The pipes and fittings shall be insulated by the Urecon "U.I.P"® void free insulation process, with an outer jacket as specified. Polymer coated, form fitting insulation kits shall be used to insulate elbows, tees and other fittings, according to the manufacturer's recommendations.
2. Pipe and Fitting Preparation. Pipes and fittings are to be cleaned of surface dust or dirt and treated, if necessary, to assure a positive bond of the foam to the entire pipe surface.
3. Insulation.
    a. Material: 141B HCFC Rigid polyurethane foam, factory applied.
    b. Insulation thickness: 50 mm (2 in.) for freeze protection.
    c. Density: (ASTM D1622) 35 to 46 kg/m3 (3 lbs/ft3).
    d. Water absorption: (ASTM D2842) 4% by volume.
    e. Closed cell content: (ASTM D2856) 90% minimum.
    f. Compressive strength: (ASTM D1621) up to 206 kPa (up to 30 lbs/in.2).
    g. Thermal conductivity: (ASTM C-518) 0.020 to 0.026 W/m°C. (0.14 to 0.17 Btu –in./ft2 – hr °F).
    h. Service temperature range: -45°C to 120°C (-49°F to + 250°F).
    i. Centering: +6.35 mm/ -0 mm (+250 / -0.0 mils).

C. Jacketing

1. Buried Applications
    a. The pipe and fittings shall be factory jacketed with a polyethylene jacket, UV inhibited.
    b. Minimum density of polyethylene jacket: 940 kg/m3 (58 lbs/ft3).
    c. Sealant: Butyl rubber.
    d. Jacket thickness: 1.27 mm (50 mils).
    e. Maximum elongation: (ASTM D638) 400% 6 month test.
    f. Service temperature range: -34°C to 82°C (-30°F to +180F).
    g. Water vapor transmission rate: (ASTM 0570-63) 3gm/m2 /24 hrs (0.02 g / 100 in2/24 hrs).
    h. Tensile strength: (ASTM G-14-17) 9.8 kg/cm (55 lbs/in.).
2. Exposed Exterior Applications
    a. The pipes and fittings shall be factory jacketed with a Spiwrap® 20 gauge, galvanized steel, 4 ply spiral lock seam jacket or equal.
    b. Insulation joint detail for pre-insulated pipes with Spiwrap® galvanized steel outer jacket for bridge crossing applications or equal.

D. Insulated pipe joints shall be completed with the use of pre-fabricated urethane half shells and a pre-rolled metal sheet of the same material and gauge as the Spiwrap® outer jacket or equal. The metal sheet shall overlap the insulation jacket by a minimum of 75 mm (3 inches). A circumferential bead of silicone caulking shall be applied to the overlap area of the Spiwrap® jacket prior to the installation of the metal sheet. The metal sheet shall be installed with the longitudinal seam in the 3 o'clock position to act as a drip edge and shall be secured with three stainless steel band assemblies.

E. Field installed insulation kits for pipe joints, valves, couplings, expansion joints and fittings shall consist of rigid polyurethane foam with a fully bonded polymer protective coating on all exterior surfaces, including ends. Kits to be supplied complete with silicone caulking for seams, stainless steel attachment straps, clips and heat shrink sleeves to seal between pipe and kits. In the case of metal jacketed pipe, insulation kits shall have outer form fitting covers of the same material as the pipe jacket.

PART 3 - EXECUTION

3.01 - INSTALLATION

A. The insulation and jacketing shall be applied to the pipe and fittings at the factory of the insulation company. The Contractor shall coordinate this work with pipe and insulation supplier. Contractor shall provide the piping (specified in other sections) to the insulation/jacketing company for application. Under no circumstances will the Contractor be allowed to field apply the insulation and jacketing, exclusive of pipe joints, valves and fittings. The Contractor shall install the preinsulated and prejacketed pipe and fittings in strict conformance with the insulator's recommendations.

3.02 - ACCEPTANCE

A. Upon completion all debris shall be removed from any areas involved with work under this section. Any unsealed seam or unsecured jacketing shall be completely repaired to the satisfaction of the Engineer or the entire section of insulation and jacketing shall be removed and replaced at no additional cost to the Owner.

3.03 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 02625

POLYVINYL CHLORIDE SEWER PIPE

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 1
1.03 - DEFINITIONS 2
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING 2
1.06 - DESIGN CRITERIA 2
PART 2 - PRODUCTS 3
2.01 - PIPE AND FITTINGS 3
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PART 3 - EXECUTION 3
3.01 - PIPE LAYING 3
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3.03 - LEAKAGE AND TESTING 4
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3.05 - VISUAL INSPECTION 6
3.06 - CLEANING 6
3.07 - CONTRACT CLOSEOUT 6

PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes furnishing all labor, materials, tools and equipment and performing all operations in connection with the construction of polyvinyl chloride (PVC) sewer lines, complete with chimneys, wyes, fittings, service connections, service connection cleanout/TV inspection port, and other related items, as specified herein and as shown on the drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals shall include shop drawings showing complete fabrication and construction details, materials, weights, dimensions, clearances, anchorage details, piping and utility requirements. Submittals shall include at least the following:

1. Pipe and fittings.

2. Gaskets.

1.05 - PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer’s written recommendations.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

PART 2 - PRODUCTS

2.01 - PIPE AND FITTINGS

A. Polyvinyl Chloride Pipe, couplings and fittings shall conform to the ASTM D3034, with an SDR of 35 unless otherwise shown on the Contract Drawings or ASTM F789. Joints for PVC pipe shall be push-on joints using permanently bonded elastomeric ring joints. Such joints shall be installed in accordance with the pipe manufacturer's written instructions. Any joint which is not properly made, shows signs of leakage or is in the opinion of the Engineer, defective in any way shall be redone to the satisfaction of the Engineer.

B. Wye Branches or Tees shall be of the same material and of the same class and type so as to be compatible to the pipe they are used with.

C. Pipe utilized for service connections and chimneys shall be 6 inches in diameter and be manufactured of PVC. PVC pipe shall conform to ASTM D3034, with an SDR of 35 or ASTM F789. Joints for PVC pipe shall be push-on using elastomeric ring gaskets.

D. Pipe and fittings for Type I Service Connections and Type II Gravity Service Connection/TV Inspection Ports shall be of the same material and of the same class and type so as to be compatible with the pipe they are used.

E. Caps for Type I Service Connections and Type II Gravity Service Connection/TV Inspection Ports shall be Model SMARTPlug equipped with a 3M electronic disc marker system as manufactured by GPK Products, Inc. or equal.

F. Backwater Check Valves shall be “Clean Check” as manufactured by Rectorseal or equal.

2.02 - CONCRETE

A. Concrete utilized for the encasement of chimneys or sewer pipes shall have a minimum compressive strength of 4,000 psi and conform to the specifications in DIVISION 3, CONCRETE.

2.03 - UNDERGROUND TAPE AND TRACER WIRE

A. Underground tape shall be a 5 mil, 3-inch wide silver metal detectable tape which permanently identifies the underground force main. The tape shall meet APWA requirements and use brown colored stripes with black print indicating “CAUTION BURIED PRESSURE LINE BELOW”.

B. Tracer wire shall be in accordance with SECTION 02890, TRACER WIRE.

PART 3 - EXECUTION

3.01 - PIPE LAYING

A. General

1. All pipe shall be laid with extreme care as to grade and alignment. Each pipe shall be laid so as to form a closed joint with the next adjoining pipe and to bring the inverts continuously to the required grade. In order to insure a minimum amount of movement or disturbance, no more than two lengths of pipe may be laid before backfilling to a minimum of 12 inches over the pipe.

2. Suitable coupling holes shall be excavated to provide ample space for making joints and to allow the pipe to have bedding along its entire length. After laying each length to the line and grade shown, the trench shall be backfilled to the midpoint of the pipe and the trench compacted with special care taken to ensure that compacted material is placed under the bell of the pipe. No walking upon or working over the pipe after it is laid will be permitted until it is covered with earth to a depth of at least 12 inches, except as may be necessary for proper compaction. All openings to the pipelines shall be satisfactorily protected to prevent the entrance of earth or water.

B. Laying Pipe

1. Excavations shall be made to accommodate the specified bedding material. All excavations shall be kept dry while pipe is being laid and until each joint and pipe has been viewed by the Engineer and approval given to commence backfilling operations. Any pipe, which is not laid to grade and alignment, shall be relaid to the satisfaction of the Engineer. No blocking shall be used. Pipe shall be installed in accordance with published recommendations of the pipe manufacturer.

2. The pipe shall be set with a laser beam. The laser beam projector shall be rigidly mounted with two-point suspension to its support platforms. This will assure that all ground equipment vibrations will be kept to a minimum and permit the laser beam to project itself coaxially through the center of the pipe. All units shall have equipment to control atmospheric conditions in the pipe that could affect the acceptable standard of construction. The alignment method selected must be shown to have worked satisfactorily on at lease three prior projects and competent, trained personnel shall operate laser. Establish centerline and offset stakes at each manhole, plus one intermediate centerline and offset stakes as a checkpoint between manholes. Laser aligning shall not be used to establish a continuous line in excess of 900 feet.

C. Installation of Wyes and Tees

1. At locations in the field as determined by the Engineer, provide 6-inch wye branches and/or tees. Watertight end caps shall be provided on all wyes and branches until the service is installed.

2. The depth of cover from the road surface to the top of the branch and the distance from the downstream manhole shall also be recorded. No wyes and tees shall be backfilled before the location measurements are taken.

D. Installation of Chimneys

1. Chimneys shall be located as directed by the Engineer and constructed in accordance with the details shown on the Contract Drawings.

2. Ends of the wye branch shall be capped with standard caps.

E. Service Connections

1. Service connections shall be provided in accordance with the applicable paragraphs of this section of these specifications at a slope of 1/4 inch per foot unless otherwise directed by the Engineer. The extreme end of the service connection shall be capped unless it is to be connected to an existing service.

2. Service connection cleanout/TV inspection ports shall be provided on each service connection at the property line. The service connection/TV inspection ports shall consist of all fittings required including but not limited to pipe, wyes, bends and caps. Service connection cleanout/TV inspection ports are not required for service connections which are less than 10 linear feet in length measured from the property line to the face of the building.

3. No service line shall be connected directly into a manhole unless otherwise directed by the Engineer.

4. All necessary adapters, reducers and the like shall be provided to connect to existing services.

5. A steel rod marker (1/2-inch in diameter by 2-foot-long) shall be installed at the end of capped lines for all locations. Refer to the “Typical Lateral Stub Connection” detail on the drawings.

6. All services lines shall be tied into a minimum of three points including, if possible, the permanent corners of the building which is to be served. The depth of cover from the ground surface to the top of the pipe at the cap shall be recorded. The depth and tie information shall be made part of the Project Record Documents.

3.02 - UNDERGROUND TAPE AND TRACER WIRE

A. Underground Tape shall be installed, centered, along the entire length of the sewer and services at a maximum depth of 18-inches below finished grade.

B. Tracer Wire shall be installed, centered, along the entire length of the sewer and services in accordance with SECTION 02890, TRACER WIRE.

3.03 - LEAKAGE AND TESTING

A. After the completed sewer line, including service connections has been provided, the trench has been backfilled and compacted to specification requirements, and manhole or joints showing noticeable streams or jets have been repaired and/or replaced, perform all tests.

B. Furnish all labor, materials and equipment necessary so that testing can be accomplished at the times and locations the Engineer deems necessary.

C. Test Procedure

1. Sewers not meeting the requirements stated herein shall be repaired as necessary at no cost to the Owner.
2. Low-Pressure Air Test. Utilize equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low-pressure air. The equipment shall be provided with an air regulator valve or air safety valve so set that the internal air pressure in the pipeline cannot exceed 8 psig.
3. The leakage test using low-pressure air shall be made on each manhole-to-manhole section of pipeline.
4. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested. Pneumatic plugs shall resist internal test pressure without requiring external bracing or blocking.
5. All air used shall pass through a single control panel.
6. Low-pressure air shall be introduced into the sealed line until the internal air pressure reaches 4 psig greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe at the time of the test. However, the internal air pressure in the sealed line shall not be allowed to exceed 8 psig.
7. At least 2 minutes shall be allowed for the air pressure to stabilize in the section under test. After the stabilization period, the low-pressure air supply hose shall be quickly disconnected from the control panel. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig (greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe) shall not be less than that shown in the following table:

Pipe diameter (inches)	**Time (minutes)**
6	4.0
8	5.0
10	6.5
12	7.5
14	9.0
15	9.5
18	11.5
Greater then 18	7.7 X Pipe Diameter (feet)

8. When the sewer section to be tested contains more than one size of pipe, the minimum allowable time shall be based on the largest diameter pipe in the section.

3.04 - ALLOWABLE PIPE DEFLECTION FOR PVC PIPE

A. Pipe installed under this specification shall have a maximum deflection of 5 percent at the time of testing. Such deflection is defined as the amount of vertical deformation (nominal inside diameter less the minimum vertical diameter when measured) multiplied by 100 and divided by the nominal diameter of the pipe.

B. Upon completion of a sewer section, including the placement and compaction of backfill, and the cleaning of the sewer, measure the amount of deflection in all of the sewer lines. This testing shall be done by the use of a deflectometer, calibrated television or photography, or a properly sized "go, no go" mandrel or sewer ball. The method of deflection testing shall have the written approval of the Engineer.

C. All sewer lines with a deflection angle of greater than 5 percent shall be repaired by re-bedding or replacement of the pipe.

3.05 - VISUAL INSPECTION

A. At the conclusion of the work, all pipelines shall be visually inspected by the Engineer to insure a straight and plumb alignment.

B. All pipelines which are not straight and plumb shall be removed and replaced at no cost to the Owner.

3.06 - CLEANING

A. At the conclusion of the work, thoroughly clean the sewers by flushing with water or other means to remove dirt, stones, and other material. Prior to acceptance, all pipelines shall be inspected for cleanliness and to be sure no sandbags, broken pipe or other obstructions exist.

B. Cleaning and television inspection is as specified in SECTION 02702, CLEANING AND TELEVISION INSPECTION OF SEWER LINES.

3.07 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 02629

POLYVINYL CHLORIDE LOW-PRESSURE SEWER PIPE

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 1
1.03 - DEFINITIONS 2
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING 2
1.06 - DESIGN CRITERIA 2
PART 2 - PRODUCTS 3
2.01 - MATERIALS 3
2.02 - CONCRETE 3
2.03 - UNDERGROUND TAPE AND TRACER WIRE 3
2.04 - ENGINEERED STAINLESS STEEL SERVICE LATERALS COMPONENTS – Not Used 3
PART 3 - EXECUTION 4
3.01 - GENERAL 4
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3.03 - THRUST BLOCKS 4
3.04 - UNDERGROUND TAPE AND TRACER WIRE 4
3.05 - SERVICE CONNECTIONS 5
3.06 - TESTING 5
3.07 - CONTRACT CLOSEOUT 5

PART 1 - GENERAL

1.01 - SCOPE

A. The work of this section includes furnishing all labor, tools, equipment and materials, and performing all operations in connection with the construction of polyvinyl chloride (PVC) low-pressure sewer pipe and pressure sewer pipe stubs, complete with fittings, and other related items, as specified herein and as shown on the drawings.

B. Attention is directed to all sections within BIDDING REQUIREMENTS, CONTRACT FORMS AND CONDITIONS OF THE CONTRACT; all sections within OTHER DOCUMENTS; DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Pipe and fittings.

2. Gaskets.

3. Underground Tape.

4. Gave Valves and Caps.

1.05 - PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

PART 2 - PRODUCTS

2.01 - MATERIALS

A. Buried Polyvinyl Chloride Pressure Sewer Pipe, couplings and fittings shall conform to ASTM 2241, with an SDR of 21. Joints for PVC pipe shall be push-on joints using permanently bonded elastomeric ring joints conforming to ASTM F477. Such joints shall be installed in accordance with the pipe manufacturer's written instructions. Any joint which is not properly made, shows signs of leakage or is in the opinion of the Engineer, defective in any way shall be redone to the satisfaction of the Engineer.

B. Exposed PVC pressure sewer pipe inside of all flushing/drain manholes shall be Schedule 80 flanged pipe. This piping, fittings and valves shall be insulated and jacketed.

C. Pipe utilized for service connections shall be 1-1/4-inches in diameter and be manufactured of PVC. Service pipe shall conform to ASTM 2241, with an SDR of 21. Joints for PVC pipe shall be push-on joints using permanently bonded elastomeric ring gaskets.

D. The Contractor has the option of substituting SDR 11 HDPE I.P.S. butt-fused pipe for the SDR 21 PVC gasketed pipe used for pressure main and services at no additional cost to the Owner. All couplings, fittings, adapters, valves, reducers, tees, and wyes shall be compatible with the type of pipe used. HDPE pipe shall be pressure rated for 200 psi and shall conform to ASTM D1248, ASTM D3350, ASTM D2239, and NSF-14. Compression fitting shall be brass and manufactured by Ford, or equal.

E. Service connection wye branches and/or tees shall be of the same material and of the same class and type so as to be compatible to the pipe they are used with. If wyes with a 1-1/4-inch branch and/or run size are not available in the material being used, the Contractor shall furnish and install 1-1/4-inch x 1-1/2-inch reducers and wyes with a 1-1/2-inch branch size or 1-1/2-inch x 1-1/2-inch wyes and 1-1/4-inch x 1-1/2-inch reducers (3) for each service connection.

H. Gate valves shall be iron body, bronze mounted and have solid wedges. The valves shall be designed for 150 psi working pressure.

I. Pipe and fittings utilized for gravity service connections shall be 6-inches in diameter and be manufactured of PVC. PVC pipe shall conform to ASTM D3034, with an SDR of 35 or ASTM F789. Joints for PVC pipe shall be push-on using elastomeric ring gaskets.

J. Caps for valves shall be Model SMARTPlug equipped with a 3M electronic disc marker system as manufactured by GPK Products, Inc. or equal.

K. Pipe and fittings using glued connections is not acceptable.

2.02 - CONCRETE

A. Concrete utilized for the encasement of chimneys or sewer pipes shall have a minimum compressive strength of 4,000 psi and conform to DIVISION 3, CONCRETE.

2.03 - UNDERGROUND TAPE AND TRACER WIRE

A. Underground tape shall be a 5 mil, 3-inch wide silver metal detectable tape which permanently identifies the underground force main. The tape shall meet APWA requirements and use brown colored stripes with black print indicating “CAUTION BURIED PRESSURE LINE BELOW”.

B. Tracer wire shall be in accordance with SECTION 02890, TRACER WIRE.

2.04 - ENGINEERED STAINLESS STEEL SERVICE LATERALS COMPONENTS – Not Used

PART 3 - EXECUTION

3.01 - GENERAL

A. Pressure sewer pipe shall be laid as shown on the drawings with a continuous slope between the high and low points as defined on the drawings.

B. Pressure sewer pipe and service connections shall be laid with a minimum cover of four feet.

C. The Contractor must adjust the installation depth of the low-pressure sewer to cross either over or under any existing utility while maintaining a minimum cover of four feet as well as meeting requirements set by MassDEP for separation of water mains and sewers and a minimum of 12-inch separation for other utilities, or as approved by utility Owner.

3.02 - LAYING PIPE

A. Excavations shall be made to accommodate the bedding material as specified in SECTION 02220, EARTH EXCAVATION, BACKFILL, FILL AND GRADING. All excavations shall be kept dry while pipe is being laid and until each joint and pipe has been viewed by the Engineer and approval given to commence backfilling operations. Any pipe which is not laid to grade and alignment shall be relaid to the satisfaction of the Engineer. No blocking shall be used. Pipe shall be installed in accordance with published recommendations of the pipe manufacturer.

B. All pressure sewer bends shall be 45 degrees or less.

C. Low-pressure pipe shall be laid as shown on the drawings with a continuous slope between the high and low points defined on the drawings.

D. Service Connections

1. Service connections shall be provided in accordance with the applicable paragraphs of this section of these specifications at a slope of 1/4-inch per foot unless otherwise directed by the Engineer. The extreme end of the service connection shall be capped unless it is to be connected to an existing service.

3. No service line shall be connected directly into a manhole unless otherwise directed by the Engineer.

4. All necessary adapters, reducers and the like shall be provided to connect to existing services.

5. Each service connection shall be provided with a gate value located at the Property Line.

6. An oak marker (1/2-inch in diameter by 2-foot long) shall be installed at the end of capped lines for all locations.

7. All services lines shall be tied into a minimum of three points including, if possible, the permanent corners of the building which is to be served. The depth of cover from the ground surface to the top of the pipe at the cap shall be recorded. The depth and tie information shall be made part of the Project Record Documents.

3.03 - THRUST BLOCKS

A. Concrete thrust blocks shall be placed at all pressure sewer bends 11-1/4 degrees and greater, at fittings and as designated by the Engineer, and shall conform to the details as shown herein.

3.04 - UNDERGROUND TAPE AND TRACER WIRE

A. Underground Tape shall be installed, centered, along the entire length of the low-pressure sewer and services at a maximum depth of 18-inches below finished grade.

B. Tracer Wire shall be installed, centered, along the entire length of the low-pressure sewer and services in accordance with SECTION 02890, TRACER WIRE.

3.05 - SERVICE CONNECTIONS

A. Pressure sewer service connections between the property line and the pressure sewer main in the street shall be 1-1/4-inch diameter PVC or HDPE pipe. Each service connection shall include a 1-1/4-inch ball valve with valve box at the property line as specified herein and as shown on the Drawings.

B. Any ledge encountered during installation of service pipe shall be removed to a point 4 feet beyond the end of the service pipe.

3.06 - TESTING

A. The low-pressure sewer pipe shall be tested in the presence of the Engineer, by water to a pressure equal to 2 times the total dynamic head of the Prefabricated Low-Pressure Sewage Pump Systems to which the low-pressure sewer pipe is attached, unless the test pressure is greater than the working pressure of the pipe. In that case the pipe shall be tested to the working pressure of the pipe. Testing shall conform to the requirements of the AWWA Standard C600. The Engineer shall provide the test pressure. This pressure shall be held for a period of at least 15 minutes, allowing a maximum pressure drop of 1 psi. Any defective work shown by this test shall be replaced at no additional cost to the Owner.

B. All equipment, labor, water, gauges, and the like for the testing of the low-pressure sewer pipe shall be supplied at no additional cost to the Owner.

C. The low-pressure sewer pipe shall be tested as part of the Sequence of Construction specified in SECTION 01030, SPECIAL REQUIREMENTS. Each section of low-pressure sewer pipe identified shall be pass the pressure test prior to moving onto the next section. Failure to comply with this requirement will result in no payment for work performed.

3.07 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 02630

HIGH DENSITY POLYETHYLENE FORCE MAIN

PART - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 2
1.03 - DEFINITIONS 2
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING 2
1.06 - DESIGN CRITERIA 3
PART 2 - PRODUCTS 3
2.01 - HIGH DENSITY POLYETHYLENE PIPE (HDPE) 3
2.02 - CONCRETE THRUST BLOCKS 3
2.03 - UNDERGROUND TAPE AND TRACER WIRE 3
PART 3 - EXECUTION 3
3.01 - GENERAL 3
3.02 - LAYING PIPE 3
3.03 - PIPE JOINING 4
3.04 - THRUST BLOCKS 4
3.05 - TESTING 4
3.06 - VISUAL INSPECTION 5
3.07 - CLEANING 5
3.08 - CONTRACT CLOSEOUT 5

PART - GENERAL

1.01 - SCOPE

A. The work of this section includes furnishing all labor, tools, equipment and materials, and performing all operations in connection with the construction of High Density Polyethylene (HDPE) force main, complete with fittings, and other related items, as specified herein and as shown on the drawings.

B. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. The HDPE force main shall be used as part of the SECTION 02150, HIGHWAY CROSSING (JACKING).

D. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. Measurement and payment for the work described in this section will be made under ITEM 22.- HIGHWAY CROSSING.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS. In addition, all submittals shall meet the requirements of ACI 301.

B. Submittals required under this section include, but are not limited to the following:

1. Manufacturer’s technical data containing information on new pipe and fittings.
2. Verifications from the pipe manufacturer of training in the proper method for handling and installing the new pipe.
3. Verifications of training by a pipe fusion equipment manufacturer that the operators have been fully trained in the use of the fusion equipment by an authorized representative of the manufacturer.

1.05 - PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit at no cost to the Owner.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

C. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

PART 2 - PRODUCTS

2.01 - HIGH DENSITY POLYETHYLENE PIPE (HDPE)

A. Polyethylene Plastic Pipe shall be high-density smooth wall polyethylene pipe and meet the following applicable requirements:

1. ANSI/AWWA Standard C 906 and ASTM D3350
2. PE 3408 (Iron Pipe Size).
3. SDR: 11.
4. Joints: Butt Fusion.

B. The Contractor shall install pipe made of virgin materials. Pipe manufactured with recycled polyethylene materials is not allowed.

C. The new pipe shall be homogeneous throughout and shall be free of visible, cracks, holes, foreign material, blisters, or other deleterious faults.

2.02 - CONCRETE THRUST BLOCKS

A. Concrete shall have a minimum compressive strength of 4,000 psi and conform to the specifications in DIVISION 3, CONCRETE.

2.03 - UNDERGROUND TAPE AND TRACER WIRE

A. Underground tape shall be a 5 mil, 3-inch wide silver metal detectable tape which permanently identifies the underground low-pressure sewer and service pipes. The tape shall meet APWA requirements and use brown colored stripes with black print indicating “CAUTION BURIED PRESSURE LINE BELOW”.

B. Tracer Wire shall be accordance with SECTION 02890, TRACER WIRE.

PART 3 - EXECUTION

3.01 - GENERAL

A. Force main shall be laid as shown on the drawings with a continuous slope between the high and low points defined on the drawings.

3.02 - LAYING PIPE

A. Excavations shall be made to accommodate the bedding material as specified in the DIVISION 2, SITE WORK. All excavations shall be kept dry while pipe is being laid and until each joint and pipe has been viewed by the Engineer and approval given to commence backfilling operations. Any pipe, which is not laid to grade and alignment, shall be relaid to the satisfaction of the Engineer. No blocking shall be used. Pipe shall be installed in accordance with published recommendations of the pipe manufacturer.

B. Force main shall be laid as shown on the drawings with a continuous slope between the high and low points defined on the drawings.

C. Allowable Deflection for HDPE Pipe:

1. Pipe installed under this specification shall have a maximum deflection of 5 percent at the time of testing. Such deflection is defined as the amount of vertical deformation (nominal inside diameter less the minimum vertical diameter when measured) multiplied by one hundred and divided by the nominal diameter of the pipe.

2. Upon completion of each force main, including the placement and compaction of backfill, and the cleaning of the force main, the Contractor shall measure the amount of deflection in all of the force mains. This testing shall be done by the use of a deflectometer, calibrated television or photography, or a properly sized "go, no go" mandrel or sewer ball. The method of deflection testing shall have the written approval of the Engineer.

3. All force main lines with a deflection angle of greater than 5 percent shall be repaired by re-bedding or replacement of the pipe.at no cost to the Owner.

E. Underground Tape shall be installed, centered, along the entire length of the force main at a maximum depth of 18-inches below finished grade.

F. Tracer Wire shall be installed, centered, along the entire length of the force main at a maximum depth of 24-inches below finished grade.

3.03 - PIPE JOINING

A. The HDPE shall be assembled and joined at the site using the butt-fusion method to provide a leak proof joint. Threaded or solvent-cement joints and connections are not permitted. Fusion shall be pre-formed by technicians certified by a manufacturer or pipe fusion equipment.

B. The butt-fused joint shall be true alignment and shall have uniform rollback beads resulting from the use of proper temperature and pressure. The joint shall be allowed adequate cooling time before removal of pressure. The fused joint shall be watertight and shall have tensile strength equal to or greater than that of the pipe. All joints shall be subject to acceptance by the Owner prior to insertion.

C. The Contractor shall cut out and replace defective joints at no additional cost to the Owner. Any section of the pipe with a gash, blister, abrasion, nick, scar or other fault greater in depth than ten percent (10%) of the wall thickness (ASTM 585) shall not be used and must be removed from the site.

D. Terminal sections of pipe that are joined within the insertion pit shall be connected with a mechanical coupling, Electro Fusion Couplings or a non-shear restraint coupling.

E. The internal weld bead formed during the butt-fusing process shall be mechanically removed in accordance with the pipe manufacturer’s specifications.

3.04 - THRUST BLOCKS

A. Concrete thrust blocks shall be placed at all force main bends 11-1/4 degrees and greater, at fittings and as designated by the Engineer, and shall conform to the drawings.

3.05 - UNDERGROUND TAPE AND TRACER WIRE

A. Underground Tape shall be installed, centered, along the entire length of the force main at a maximum depth of 18-inches below finished grade.

B. Tracer Wire shall be installed, centered, along the entire length of the force main in accordance with SECTION 02890, TRACER WIRE.

3.06 - TESTING

A. The force main shall be tested in the presence of the Engineer, by water to a pressure equal to 2 times the total dynamic head of the pump (estimated at 110 feet) to which the force main is attached, unless the test pressure is greater than the working pressure of the pipe. In that case the pipe shall be tested to the working pressure of the pipe. The Engineer shall provide the test pressure. This pressure shall be held for a period of at least 15 minutes, allowing a maximum pressure drop of 5 psi. Any defective work shown by this test shall be replaced at no additional cost to the Owner.

B. All equipment, labor, water, gauges, and the like for the testing of the force main shall be supplied at no cost to the Owner.

3.07 - VISUAL INSPECTION

A. At the conclusion of the work, all pipelines shall be visually inspected by the Engineer to insure a straight and plumb alignment.

B. All pipelines which are not straight and plumb shall be removed and replaced at no cost to the Owner.

3.08 - CLEANING

A. At the conclusion of the work, the Contractor shall thoroughly clean the sewer lines by flushing with water or other means to remove dirt, stones, and other material. Prior to acceptance, all pipelines shall be inspected for cleanliness and to be sure no sandbags, broken pipe or other obstructions exist.

B. Cleaning and television inspection is as specified in SECTION 02702, CLEANING AND TELEVISION INSPECTION OF SEWER LINES.

3.09 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 02631

POLYVINYL CHLORIDE SEWER FORCE MAIN

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 2
1.03 - DEFINITIONS 2
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING 2
1.06 - DESIGN CRITERIA 3
PART 2 - PRODUCTS 3
2.01 - POLYVINYL CHLORIDE PIPE (PVC) 3
2.02 - CONCRETE THRUST BLOCKS 3
2.03 - UNDERGROUND TAPE AND TRACER WIRE 3
PART 3 - EXECUTION 3
3.01 - GENERAL 3
3.02 - LAYING PIPE 3
3.03 - THRUST BLOCKS 4
3.04 - UNDERGROUND TAPE AND TRACER WIRE 4
3.05 - TESTING 4
3.06 - VISUAL INSPECTION 4
3.07 - CLEANING 4
3.08 - CONTRACT CLOSEOUT 4

PART 1 - GENERAL

1.01 - SCOPE

A. The work of this section includes furnishing all labor, tools, equipment and materials, and performing all operations in connection with the construction of polyvinyl chloride (PVC) force main, complete with fittings, and other related items, as specified herein and as shown on the drawings.

B. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Manufacturer’s technical data containing information on new pipe and fittings.
2. Verifications from the pipe manufacturer of training in the proper method for handling and installing the new pipe.

1.05 - PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit at no cost to the Owner.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

C. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

PART 2 - PRODUCTS

2.01 - POLYVINYL CHLORIDE PIPE (PVC)

A. Polyvinyl Chloride Pipe, couplings and fittings shall conform to ASTM 2241, with an SDR of 21 unless otherwise shown on the drawings. The Owner has standardized on this pipe, couplings and fittings and therefore no substitutes are allowed.

B. Joints for PVC pipe shall be push-on joints using permanently bonded elastomeric ring joints conforming to ASTM F477. Such joints shall be installed in accordance with the pipe manufacturer's written instructions. Any joint which is not properly made, shows signs of leakage or is in the opinion of the Engineer, defective in any way shall be redone to the satisfaction of the Engineer.

2.02 - CONCRETE THRUST BLOCKS

A. Concrete shall have a minimum compressive strength of 4,000 psi and conform to the specifications in DIVISION 3, CONCRETE.

2.03 - UNDERGROUND TAPE AND TRACER WIRE

A. Underground tape shall be a 5 mil, 3-inch wide silver metal detectable tape which permanently identifies the underground force main. The tape shall meet APWA requirements and use brown colored stripes with black print indicating “CAUTION BURIED PRESSURE LINE BELOW”.

B. Tracer wire shall be in accordance with SECTION 02890, TRACER WIRE.

PART 3 - EXECUTION

3.01 - GENERAL

A. Force main shall be laid as shown on the drawings with a continuous slope between the high and low points defined on the drawings.

3.02 - LAYING PIPE

A. Excavations shall be made to accommodate the bedding material as specified in the DIVISION 2, SITE WORK. All excavations shall be kept dry while pipe is being laid and until each joint and pipe has been viewed by the Engineer and approval given to commence backfilling operations. Any pipe, which is not laid to grade and alignment, shall be relaid to the satisfaction of the Engineer. No blocking shall be used. Pipe shall be installed in accordance with published recommendations of the pipe manufacturer.

B. Force main shall be laid as shown on the drawings with a continuous slope between the high and low points defined on the drawings.

C. Allowable Deflection for PVC Pipe

1. Pipe installed under this specification shall have a maximum deflection of 5 percent at the time of testing. Such deflection is defined as the amount of vertical deformation (nominal inside diameter less the minimum vertical diameter when measured) multiplied by one hundred and divided by the nominal diameter of the pipe.

2. Upon completion of each force main, including the placement and compaction of backfill, and the cleaning of the force main, the Contractor shall measure the amount of deflection in all of the force mains. This testing shall be done by the use of a deflectometer, calibrated television or photography, or a properly sized "go, no go" mandrel or sewer ball. The method of deflection testing shall have the written approval of the Engineer.

3. All force main lines with a deflection angle of greater than 5 percent shall be repaired by re-bedding or replacement of the pipe.at no cost to the Owner.

3.03 - THRUST BLOCKS

A. Concrete thrust blocks shall be placed at all force main bends 11-1/4 degrees and greater, at fittings and as designated by the Engineer, and shall conform to the drawings.

3.04 - UNDERGROUND TAPE AND TRACER WIRE

A. Underground Tape shall be installed, centered, along the entire length of the force main at a maximum depth of 18-inches below finished grade.

B. Tracer Wire shall be installed, centered, along the entire length of the force main in accordance with SECTION 02890, TRACER WIRE.

3.05 - TESTING

A. The force main shall be tested in the presence of the Engineer, by water to a pressure equal to 2 times the total dynamic head of the pump (estimated at 110 feet) to which the force main is attached, unless the test pressure is greater than the working pressure of the pipe. In that case the pipe shall be tested to the working pressure of the pipe. The Engineer shall provide the test pressure. This pressure shall be held for a period of at least 15 minutes, allowing a maximum pressure drop of 5 psi. Any defective work shown by this test shall be replaced at no additional cost to the Owner.

B. All equipment, labor, water, gauges, and the like for the testing of the force main shall be supplied at no cost to the Owner.

3.06 - VISUAL INSPECTION

A. At the conclusion of the work, all pipelines shall be visually inspected by the Engineer to insure a straight and plumb alignment.

B. All pipelines which are not straight and plumb shall be removed and replaced at no cost to the Owner.

3.07 - CLEANING

A. At the conclusion of the work, the Contractor shall thoroughly clean the sewer lines by flushing with water or other means to remove dirt, stones, and other material. Prior to acceptance, all pipelines shall be inspected for cleanliness and to be sure no sandbags, broken pipe or other obstructions exist.

B. Cleaning and television inspection is as specified in SECTION 02702, CLEANING AND TELEVISION INSPECTION OF SEWER LINES.

3.08 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 02675

HYDROSTATIC TESTING AND DISINFECTION

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 2
1.03 - DEFINITIONS 2
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING 3
1.06 - DESIGN CRITERIA 3
PART 2 - PRODUCTS 3
2.01 - MATERIALS 3
PART 3 - EXECUTION 3
3.01 - GENERAL 3
3.02 - FLUSHING 4
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3.05 - DISINFECTION 6
3.06 - FINAL FLUSHING 7
3.07 - PROCEDURES FOR DISINFECTING TAPPING SLEEVES 8
3.08 - BACTERIOLOGICAL TESTS 8
3.09 - RE-DISINFECTION 8
3.10 - CHLORINATION PROCEDURES WHEN CUTTING INTO OR REPAIRING EXISTING PIPELINE(S) 8
3.11 - CONTRACT CLOSEOUT 9

PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes the furnishing of all labor, tools, materials and equipment and performing all operations necessary for the flushing, pressure testing, leakage testing and disinfection of potable water pipeline(s) as specified herein and as required to complete the Work.

B. The Work of this section shall be coordinated with the Owner. Use of water will only be as approved by the Owner. All work shall be in accordance with this specification, AWWA C600 and AWWA C651. Where conflicts appear between these specifications and AWWA C600 and AWWA C651 the more stringent requirement shall apply. All flushing, pressure and leakage testing and chlorinating shall be done by the Contractor in the presence of the Engineer.

C. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

Note: Funding for this Bid Item is anticipated to be obtained at the Annual Town Meeting proposed to be held in May 2020. Therefore, performing the scope of work specified under this Bid Item is subject to this future appropriation and no payment will be made without written approval by the OWNER.

B. In addition, the following conditions apply:

1. If sufficient manpower and equipment are not provided to prosecute this phase of the Work, the Owner reserves the right to engage an independent contractor to perform the flushing, testing, and disinfection Work. The cost for this Work will be deducted from payments due the Contractor, and it shall not place any claims against the Owner, Engineer or said independent contractor, for any leaks, damages to public or private property, production loss and/or profits, incurred by this Work.

2. If the leakage test is declared a failure by the Engineer, the Contractor shall at its own expense locate and make repairs as necessary, until the leakage is within the specified allowance. All costs associated with additional testing shall be borne by the Contractor.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals shall include shop drawings showing complete fabrication and construction details, materials, weights, dimensions, clearances, anchorage details, piping and utility requirements. Submittals shall include at least the following:

1. Sampling Procedure.
2. Certified Lab Documentation.
3. Analysis Results.

1.05 - PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer's written recommendations.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

C. All products and materials shall conform to the applicable standards of ANSI and AWWA and/or as specified herein.

PART 2 - PRODUCTS

2.01 - MATERIALS

A. Each temporary blow-off, sample tap, and/or pressure tap shall consist of a corporation cock, Type K copper tubing and a curb stop, each of not less than one (1) inch diameter.

B. A pumping unit or proportionate feeder suitable for delivering a chlorine solution to the isolated pipeline(s) shall be provided. The unit used shall prevent chlorine solution from flowing back into the existing water system.

C. Chlorine solution for disinfecting pipeline(s) and appurtenances shall be made from either liquid sodium hypochlorite, or solid calcium hypochlorite, which shall conform to AWWA B300 Standard for Hypochlorites.

PART 3 - EXECUTION

3.01 - GENERAL

A. Flushing, testing and disinfection of pipeline(s) shall closely follow the pipe laying work. As the pipeline is installed, it shall be tested approximately every one thousand (1,000) feet, or between in-line isolation valves, whichever is less, as directed by the Engineer. Should a designated section of pipeline fail to be flushed, tested, and disinfected as specified, the pipe laying work shall be suspended until this Work is completed.

B. All flushing, testing and disinfection shall be done in the presence of the Engineer. The method of disinfection shall be the Continuous Feed Method of a chlorine solution as described hereinafter. Consult with the Owner and Engineer to identify acceptable location(s) for the discharge of the heavily chlorinated water that will result from the disinfection procedure.

C. Final acceptance of each segment of pipeline tested will be based on successful (negative) results of bacteriological testing. Location(s) for sampling shall be as directed by the Engineer.

D. The Contractor, with the assistance of the Owner, shall fill each new pipeline section as slowly as practicable so as not to cause dirty water and serious pressure drops within the existing water system. Vent air from the new pipeline(s) during the filling process.

E. Make taps on the new pipeline(s) where directed by the Engineer necessary to properly complete the hydrostatic and disinfection Work. After successful completion of the Work, with the authorization of the Owner, remove all temporary sampling tubing and blow-offs. The remaining corporation(s) shall be plugged and protected from damage by backfilling as approved by the Engineer.

3.02 - FLUSHING

A. All new pipeline(s), and existing pipeline(s) that have been drained and cut-into for making new connections, shall be thoroughly flushed prior to pressure and/or leakage testing and final disinfection.

B. Flushing shall be accomplished through partial opening and closing of valves, hydrants, and blow offs under expected line pressure as necessary to obtain the required scouring velocity. Flow velocities shall not be less than 2.5 feet per second in each pipeline section that is being flushed.

C. The size and number of hydrant outlets or pipeline taps to provide the required flow (at 40 psi residual pressure) is as follows. Minimum required flow and opening(s) diameter to flush pipeline segments based on 40-psi residual pressure in the pipeline.

Pipe Diameter (Inches)	**Flow to Produce 2.5 fps Minimum Velocity in Pipe (GPM)**	**Minimum Size of Taps on Pipe (Inches)**	**Outlet Openings**	
			Number	Size (Inch)
4	100	15/16	1	2-1/2
6	220	1-3/8	1	2-1/2
8	390	1-7/8	1	2-1/2
10	610	2-5/16	1	2-1/2
12	880	2-13/16	1	2-1/2
16	1,565	3-5/8	2	2-1/2

1. If less than a 40-psi residual pressure is available in the pipeline, with the size tap shown above, then a larger number of taps or hydrant outlets will be required, as directed by the Engineer.

2. The length of time for flushing, at or above the minimum allowable velocity shall be computed to allow a minimum of three (3) times the total volume of water stored in the pipeline segment being flushed to waste.

3.03 - PRESSURE TESTING

A. All new pipeline(s), or any valved section(s) thereof shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure that will exist at the point of testing, or 150 psi, whichever is greater. Test pressures shall meet the following requirements.

1. Be of at least 2.5-hour duration.

2. Be not less than 1.25 times the expected system working pressure at the highest point along the test section.

3. Not exceed pipe or thrust-restraint design pressures.

4. Not vary by more than plus or minus 5-psi for the duration of the test.

5. Not exceed two (2) times the rated pressure of valves or hydrants when the pressure boundary includes closed butterfly valves, gate valves and/or hydrants. Valves shall not be operated in either direction at differential pressures greater than the rated pressures.

B. Air Removal. Following flushing, and before applying the specified test pressure, air shall be completely expelled from the pipeline segment being tested. After all air has been expelled, the air blowoffs shall be closed, and the test pressure applied.

C. Pressure Test. Each valved section of pipeline shall be slowly raised to the specified test pressure for two separate periods. The first period shall be for fifteen (15) minutes, after which the pressure in the test section shall be allowed to drop slowly back to system pressure. The pressure shall then be slowly raised again to the specified test pressure and maintained for 2-1/2 hours. The test pressure shall be based on the elevation of the lowest point of the pipeline in the test section and shall be corrected to the elevation of the test gauge, as directed by the Engineer. The test pressure shall be applied by means of a pump connected to the pipeline, in a manner satisfactory to the Engineer, and which will prevent any backflow into the existing water system.

D. Examination. Any exposed pipe, fittings, valves, hydrants and joints shall be carefully examined during the test. Any damaged or defective pipe, fittings, hydrants, or valves discovered following, or as a result of the pressure test shall be repaired or replaced with sound material. If faulty materials are removed and replaced, the pressure testing procedure shall be repeated until satisfactory to the Engineer.

3.04 - LEAKAGE TEST

A. Leakage testing shall be conducted concurrently with the pressure test.

B. Leakage Defined. Leakage shall be defined as the quantity of water that must be pumped into the new pipeline or any valved section thereof, to maintain pressure within plus or minus 5-psi of the specified test pressure, after the pipeline(s) have been filled with water and all air has been expelled. Leakage shall be recorded to the nearest one-tenth (0.10) of a gallon, by means of a calibrated test meter. Drawdown may be measured in a calibrated barrel, as approved by the Engineer. All records and charts shall become the property of the Engineer. Employ qualified personnel for all testing. Leakage testing shall not be measured as a drop in pressure over a specified period of time.

C. Allowable Leakage.

1. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$L = \frac{SD(P^{0.5})}{133{,}200}$ where: L = allowable gallons of leakage per hour (GPH)

S = the length of pipe tested (feet)

D = the nominal pipe diameter (inches)

P = the average test pressure during the test (psi)

2. The leakage formula is based on an allowable leakage of 11.65 gallons per day, per mile of pipe, per inch (nominal) of pipe diameter, at a pressure of 150-psi.

3. The allowable leakage in GPH per 1,000 feet of pipe at various pressures and pipe diameters are shown below:

Test Pressure (PSI)	Pipe Diameter (Inches)										
	6	8	10	12	16	20	24	30	36	42	48
450	0.95	1.27	1.59	1.91	2.55	3.18	3.82	4.78	5.73	6.69	7.64
400	0.90	1.20	1.50	1.80	2.40	3.00	3.60	4.50	5.41	6.31	7.21
350	0.84	1.12	1.40	1.69	2.25	2.81	3.37	4.21	5.06	5.90	6.74
300	0.78	1.04	1.30	1.56	2.08	2.60	3.12	3.90	4.68	5.46	6.24
275	0.75	1.00	1.24	1.49	1.99	2.49	2.99	3.73	4.48	5.23	5.98
250	0.71	0.95	1.19	1.42	1.90	2.37	2.85	3.56	4.27	4.99	5.70
225	0.68	0.90	1.13	1.35	1.80	2.25	2.70	3.38	4.05	4.73	5.41
200	0.64	0.85	1.06	1.28	1.70	2.12	2.55	3.19	3.82	4.46	5.09
175	0.59	0.80	0.99	1.19	1.59	1.98	2.38	2.98	3.58	4.17	4.77

Test Pressure (PSI)	Pipe Diameter (Inches)										
	6	8	10	12	16	20	24	30	36	42	48
150	0.55	0.74	0.92	1.10	1.47	1.84	2.21	2.76	3.31	3.86	4.41
l25	0.50	0.67	0.84	1.01	1.34	1.68	2.01	2.52	3.02	3.53	4.03
100	0.45	0.60	0.75	0.90	1.20	1.50	1.80	2.25	2.70	3.15	3.60

Notes: If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size. When testing against closed metal-seated valves, an additional leakage shall be allowed per closed valve of 0.0078 gallons per hour per inch of nominal valve diameter. When hydrants are located in test sections they shall remain closed. Zero (0) leakage will be allowed on pipeline segments that cross bridges or carrier pipes located in jackings or borings.

D. Acceptance shall be determined on the basis of allowable leakage. If the test of any pipeline segment discloses leakage greater than that specified, the source of leakage shall be located and repaired as necessary to ensure that the allowable leakage is within the specified parameters.

1. All visible leaks are to be repaired regardless of the amount of leakage.

2. All pipeline segments shall be pressure and leakage tested in the presence of the Engineer, in order to qualify for acceptance.

3.05 - DISINFECTION

A. The method of disinfection shall be by the Continuous Feed Method of a chlorine solution as described hereinafter, and as approved by the Engineer.

B. Continuous Feed Method of Chlorine Solution. The continuous feed method consists of the following steps:

1. Upon completion of pipeline installation, fill pipeline(s) with potable water, and remove all air from high spots and/or pockets.

2. Flush the completed pipeline(s) in accordance with the requirements specified herein to remove particulates. Following the filling and flushing of the pipeline(s) and before chlorination, complete all hydrostatic testing as specified.

3. Fill the pipeline(s) with chlorinated potable water, having an initial concentration of 25-mg/L free chlorine residual. After a 24-hour period, there shall be a minimum of 10-mg/L free chlorine residual in the pipeline(s). Water from the existing distribution system or other approved source of supply shall be made to flow at a constant measured rate, into the new pipeline(s). In the absence of a meter, the rate may be approximated by methods such as placing a pilot gauge in the discharge or measuring the time to fill a container of known volume.

4. At a point not more than 10 feet downstream from the beginning of the new pipeline(s), water entering the new pipeline shall receive a dose of chlorine solution fed at a constant rate such that the water in the pipeline(s) will have not less than 25-mg/L free available chlorine. To assure that this concentration is achieved, measure chlorine concentration at regular intervals along the pipeline(s), using approved chlorine test kits, or as otherwise described in AWWA M12 - Simplified Procedures for Water Examination.

C. The amount of chlorine required to obtain a concentration of 25-mg/L per 100 feet of various diameter pipes is as follows:

1. Chlorine required to obtain a concentration of 25 mg/L per 100 feet.

	Sodium Hypochlorite Solution (Gallons per 100 feet)				Calcium Hypochlorite (Ounces)
Pipe Diameter (Inches)	**5% Available Chlorine**	**10% Available Chlorine**	**12-1/2% Available Chlorine**	**15% Available Chlorine**	**65% Available Chlorine**
4	0.03	0.02	0.02	0.01	0.32
6	0.08	0.04	0.03	0.03	0.75
8	0.13	0.07	0.06	0.05	1.30
10	0.20	0.10	0.09	0.07	2.10
12	0.28	0.15	0.12	0.10	2.95
16	0.50	0.25	0.22	0.17	5.30
20	0.80	0.40	0.34	0.28	8.40
24	1.15	0.60	0.50	0.40	12.00

2. Prior to injection of a chlorine solution into the section of pipeline being disinfected, the above quantities may be diluted into a known quantity of potable water in order to meet the requirements of the chemical feed equipment. The entire solution shall be injected into the section of pipeline being disinfected at a feed rate that ensures that the residual chlorine concentration is a minimum of 25 mg/L. The chlorine concentration within the pipeline being disinfected shall not exceed 50 mg/L without written approval of the Owner.

3. The quantities shown above are based on concentrations of available chlorine by volume. Extended or improper storage may have caused a loss of available chlorine.

4. For concentrations of 50 mg/L double the quantities listed.

D. During the application of chlorine, valves shall be closed to prevent strong chlorine solution in the new pipeline(s) from flowing into the existing system. Chlorine application shall continue until the entire pipeline(s) is filled with water having 25 mg/L of free available chlorine. The chlorinated water shall be retained in the pipeline(s) for at least 24 hours, during which time all valves and hydrants in the section(s) being treated shall be operated, in order to disinfect the appurtenances. At the end of this 24-hour period, all portions of the pipeline(s) being tested shall have a free available chlorine residual of at least 10 mg/L. If less that 10 mg/L free available chlorine residual is measured, the pipeline(s) shall be reflushed and the entire disinfection procedure repeated.

E. Chlorine solutions shall be applied to the pipeline(s) with chemical feed pump(s) designed for feeding chlorine solutions. Feed lines shall be of such material and strengths as to safely withstand corrosion caused by the concentrated chlorine solutions, and also the maximum pressures that may be created by the pump(s). All connections shall be checked for tightness before the solution is applied to the pipeline.

3.06 - FINAL FLUSHING

A. After the specified retention period, the heavily chlorinated water shall be flushed from the pipeline until chlorine measurements show the concentration in water leaving the pipeline is no higher than that generally prevailing in the water distribution system.

B. Arrangements shall be made with the Owner to flush the pipeline(s) of chlorinated water. Great care shall be exercised in the selection of the rate of flow and the discharge point(s), in order prevent damage to public or private property.

C. The Owner shall approve the environment to which the chlorinated water is to be discharged. If it is determined by the Owner that the chlorinated discharge will cause damage to the environment, a reducing agent shall be applied to the water to thoroughly neutralize the chlorine residual remaining in the water. If necessary, state, federal, and/or local regulatory agencies shall be contacted to ascertain if there are any special provisions for the disposal of the heavily chlorinated water. No chlorinated water shall be discharged directly into designated wetland areas or water bodies.

3.07 - PROCEDURES FOR DISINFECTING TAPPING SLEEVES

A. Before a tapping sleeve is installed, the exterior of the pipeline to be tapped shall be thoroughly cleaned, and the interior surface of the sleeve and valve shall be washed with a one (1) percent chlorine solution.

3.08 - BACTERIOLOGICAL TESTS

A. Standard Conditions. Twenty-four hours after final flushing and before a pipeline is placed in service, water samples shall be collected twice (24 hours apart) at each sampling point designated by the Engineer and tested for bacteriological quality in accordance with "Standard Methods for the Examination of Water and Wastewater". Water samples shall show the absence of coliform organisms and background bacteria. A standard heterotrophic plate count may be required at the option of the Engineer at no additional cost to the Owner. Water samples shall be taken at points at least every 1,000 feet along the pipeline, plus one (1) sample from the end of each test section and at least one (1) sample from each branch line.

B. Special Conditions. If, during construction, trench water has entered the pipeline, or if in the opinion of the Engineer excessive quantities of dirt or debris has entered the pipeline, bacteriological samples shall be taken at intervals of approximately 200 feet and shall be identified as to location. Samples shall be taken of water that has stood in the pipeline for at least 24 hours after final flushing has been completed.

C. Sampling Procedure. Samples for bacteriological analysis shall be collected, in the presence of the Engineer, in sterile bottles treated with sodium thiosulfate. No hose or fire hydrant shall be used in the collection of samples. A corporation cock shall be installed in the pipeline with a copper tube gooseneck assembly. After samples have been collected, the gooseneck assembly shall be removed. The Contractor shall sample twice (24 hours apart) at each location designated by the Engineer.

D. The Owner shall deliver all samples to a State approved laboratory for bacterial analysis. Only after each consecutive sample is approved shall the pipeline(s) be incorporated into the water distribution system. In the event that positive reports of contamination are received, the pipeline(s) shall be flushed and disinfected as many times as may be necessary to obtain approved (negative) results at no additional cost to the Owner.

3.09 - RE-DISINFECTION

A. If the initial disinfection fails to produce satisfactory bacteriological samples, the pipeline(s) shall be reflushed and resampled. If check samples show the presence of coliform organisms, then the pipeline(s) shall be re-disinfected by the continuous feed method of chlorination, until satisfactory results are obtained.

B. High velocities in the existing system, resulting from flushing the new pipeline(s), may disturb sediment that has accumulated in the existing water system. When check samples are taken, the Contractor shall sample water entering the new pipeline(s).

3.10 - CHLORINATION PROCEDURES WHEN CUTTING INTO OR REPAIRING EXISTING PIPELINE(S)

A. The following procedures apply when pipeline(s) are wholly or partially dewatered. After the appropriate procedures have been completed, the pipeline(s) may be returned to service prior to completion of bacteriological testing, in order to minimize the time customers are out of service. Leaks or breaks that are repaired with clamping devices while the pipeline(s) are full of water under pressure present little danger of contamination and require no disinfection.

1. Trench Treatment. When an old pipeline is opened, either by accident or on purpose. Liberal quantities of hypochlorite tablets shall be applied to open trench areas to lessen the danger from pollution.

2. Swabbing with Hypochlorite Solution. The interior of all pipe and fittings used in making a repair (particularly couplings and sleeves) shall be swabbed or sprayed with a one (1) percent chlorine solution before they are installed.

3. Flushing. If valve and hydrant locations permit thorough flushing toward the work location from both directions, it shall be done. Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water is eliminated.

4. Slug Chlorination. Where practical in addition to the procedures above, a section of pipeline in which the break is located shall be isolated. All service connections shall be shut off, and the section flushed and chlorinated by the slug method, whereby the dose may be increased to as much as 300-mg/L, and the contact time reduced to as little as one (1) hour. After chlorination, flushing shall be resumed and continued until discolored water is eliminated and the water is free of noticeable chlorine odor.

5. Bacteriological samples shall be taken after repairs. If the direction of flow is unknown, samples shall be taken on each side of the pipeline break. If positive samples are recorded, daily sampling shall be continued until two (2) consecutive negative samples are recorded.

3.11 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 02702

CLEANING AND TELEVISION INSPECTION OF SEWER LINES

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PART 1 - GENERAL

1.01 - SCOPE

A. The work of this section includes the furnishing of all labor, materials and equipment required to clean, televise, and video tape the existing and/or new sewer lines during high groundwater conditions as determined by the Owner/Engineer, unless specified otherwise/directed by the Owner/Engineer.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and Payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Contractor's description of all equipment to be used.
2. Contractor's description of its proposed methodology.
3. The Contractor shall submit a typed written report including television inspection logs for all work performed. These logs at a minimum should include: stationing, location of reference points, point of entry of service connections via a clock system, observed running leaks, observed continuously running service connections, bad joints, sags in pipes, and other evidence of potential problems.
4. Color DVDs and Inspection Logs.

1.05 - PRODUCT HANDLING – Not Used

1.06 - DESIGN CRITERIA

A. The work covered by this specification shall be in accordance with the best practice of the industry. The specifications call attention to certain features but do not purport to cover all details entering into the required work.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION

3.01 - CLEANING

A. Cleaning shall be accomplished with high pressure hydraulic cleaning equipment or mechanical cleaning equipment followed by hydraulic cleaning.

1. "Light Cleaning" as used in these specifications, shall be equivalent to 1 to 2 passes of the hydraulic jet through the sewer lines.
2. “Moderate Cleaning” as used in these specifications shall be equivalent to 3 to 4 passes of the hydraulic jet through sewer lines.
3. “Heavy Cleaning” as used in these specifications shall be equivalent to more than 4 passes of the hydraulic jet through the sewer lines or use of mechanical equipment to remove debris, including substantial root mass, to render the line clean.

B. For existing sewer lines, each method shall be able to remove sufficient material to render the sewer line capable of handling 95 percent of its original design capacity. Each method shall also include root removal using equipment appropriate for the conditions.

C. For new sewer lines, each method shall be able to remove sufficient material to render the sewer line capable of handling 100 percent of its design capacity.

D. Equipment

1. Mechanical equipment shall be equipped with a belt booster clutch or overload clutch so that the pipe will not be damaged. No equipment of a direct drive type shall be permitted.
2. High pressure hydraulic equipment shall not operate under a "head of water" unless written approval is obtained from the Engineer.
3. High pressure hydraulic cleaning equipment shall be capable of producing flows from a fine spray to a solid stream and shall have a selection of two or more high pressure nozzles (approximately 2,000 pounds per square inch).
4. Satisfactory precautions shall be taken to protect the sewer lines at all times. All workmen shall be experienced and skilled in the use of the equipment used.

E. Disposal of Debris

1. All sludge, dirt, sand, gravel, roots, grease and other debris resulting from the cleaning operation shall be placed in a suitable container and legally disposed of by the Contractor.
2. No sewage or materials removed from the sewer shall be dumped or pumped into the streets or into water courses, ditches, catch basins or other drains or sewers.
3. The Contractor shall use suitable equipment to ensure that no solids are permitted to go downstream.

3.02 - COLOR TELEVISION INSPECTION

A. General

1. The television camera used for the inspection shall be a 360-degree pan and tilt camera specifically designed and constructed for inspection of sewer lines.
2. Lighting for the camera shall be suitable to allow a clear picture for the entire periphery of the pipe. The camera shall be operative in 100 percent humidity conditions and have a minimum of 600 line-resolutions. Picture quality and definition shall be to the complete satisfaction of the Engineer and if unsatisfactory, the equipment shall be removed and replaced with equipment of satisfactory quality.

B. Sewer Lines

1. The inspection shall be done one section at a time and the section being inspected shall be suitably isolated from the remainder of the sewer system as required.
2. The camera shall be moved through the line in either direction at a uniform slow rate by means of cable winches located at manholes on each side of section being televised.
3. Means of communications shall be set up between the two winches and the monitor control. Photographic pictures shall be taken of the television monitor when directed by the Engineer.

C. Service Connections

1. Existing (If Applicable) - The Contractor shall video tape the entire length of each service connection in order to identify defects that may exist in the lines. This inspection shall occur after the connection has been made by adding a cleanout to each service connection located at the property line.
2. New - The Contractor shall video tape the entire length of each service connection from the main line to the cleanout to each service connection located at the property line.

3.03 - FLOW CONTROL – Not Used

3.04 - REPORTS

A. Television, inspection logs and cleaning logs cleaning logs shall be furnished to the Engineer.

B. Television inspection of the entire line shall be recorded on DVD. Where deficiencies and leaks are noted, the camera shall be stopped to observe the condition, information recorded and photographs taken as directed by the Engineer. Three copies of color video tapes shall be provided.

C. Television inspection logs shall be prepared and shall include identification of the section of pipe and pipe size. Records shall also include location of reference points, point of entry of service connections via a clock system, observed running leaks, observed continuously running service connections, bad joints, sags in pipes, and other evidence of potential problems. Three copies of inspection logs shall be provided.

D. Cleaning logs shall be prepared and shall include identification of the section of pipe and pipe size. Three copies of inspection logs shall be provided.

3.05 - CLEAN-UP

A. The Contractor shall be responsible for the legal disposal of removed materials and general clean-up of the work area as approved by the Engineer.

3.06 - FINAL ACCEPTANCE

A. Final acceptance of the sewer line cleaning shall be made upon completion of the television inspection as approved by the Engineer.

B. Final acceptance is based on the existing sewer's ability to carry 95 percent of its original design capacity and based on the new sewer's ability to carry 100 percent of its design capacity.

3.07 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 02722

SPECIAL MANHOLES

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PART 1 - GENERAL

1.01 - SCOPE

A. The work under this section includes the furnishing of all labor, materials, tools and equipment necessary to construct precast concrete special manholes as follows:

1. Terminal Flushing Manhole with Combination Air Valve
2. In-Line Flushing Manhole with Combination Air Valve
3. Low Point Drain Manhole with Isolation Valves

Precast concrete special manholes shall include bases complete with steps, frames and covers, fittings, valves, piping and supports/restraints as specified herein and as shown on the drawings

B. Attention is directed to all sections within BIDDING REQUIREMENTS, CONTRACT FORMS AND CONDITIONS OF THE CONTRACT; all sections within OTHER DOCUMENTS; DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Precast concrete manholes.
2. Frames and covers.
3. Horizontal joint sealing material.
4. Pipe connections.
5. Manhole steps.
6. Manhole Encapsulation System.
7. Valves, Piping and Fittings.

1.05 - PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

C. All Special Manholes shall be provided with: (a) Type 316 Stainless Steel pipe and valve supports; and (b) Type 316 Stainless Steel lateral and vertical Thrust Restraints. Supports shall be sized to withstand the weights of the pipes and valves. Thrust Restraints shall be sized to withstand the maximum working pressure of the pipelines. Supports and Thrust Restraints shall be designed and installed as to not interfere with the operation of the components located within the Special Manholes.

PART 2 - PRODUCTS

2.01 - PRECAST CONCRETE FOR SPECIAL MANHOLES

A. Precast reinforced concrete sections shall conform to the applicable requirements of ASTM C478. Sections and bases shall have a minimum wall thickness of the dimensions shown on the Contract Drawings. Unless otherwise detailed on the drawings all sections shall be of precast concrete.

B. Unless otherwise shown on the Contract Drawings manholes shall be five-foot in diameter feet and shall have a minimum inside height of seven feet.

C. The exterior of all manholes shall be factory coated with one coat of Tnemec Series 161 Fascure to prevent moisture migration.

D. All lifting holes and areas of the factory coating that have been compromised shall be filled and/or patched with mortar and coated with one coat of Tnemec Series 161 Fascure to prevent moisture migration.

E. The entire interior surfaces (walls, floor and ceiling) of precast manholes identified (see table) shall be coated with a high build epoxy.

Manhole Number	Location	Drawing Number	Remarks
SMH F-04-24	Center Place	02 C-109	LPS Terminal Flushing Manhole
SMH F-04-49	Cove Road	02 C-110	LPS Terminal Flushing Manhole
SMH D-05-12	Old County Road	03 C-115	LPS Terminal Flushing Manhole
SMH E-04-02	Cottage Street	03 C-117	LPS Terminal Flushing Manhole
SMH E-05-08	North Cottage Street	03 C-117	LPS Terminal Flushing Manhole

Coating schedule to be as follows:

1. Surface Preparation: CIP Concrete to be prepared per SSPC SP #13 Standard with ICRI CSP #5 profile.
2. Lining System
   a. Concrete Surfacer: Tnemec Series 218 Mortar-Clad at 1/16-inch thickness.
   b. Finish: Series 434 PermaShield polyamine epoxy mortar at 125.0 mils dft.

2.02 - HORIZONTAL JOINTS

A. Horizontal joints between sections of manholes, unless otherwise specified herein, shall be sealed with a self-sealing butyl rubber based flexible joint sealant in rope form.

B. Sealant material shall be Kent-Seal No. 2 as manufactured by Hamilton-Kent Mfg. Co., Kent, Ohio; C-S146 as manufactured by Concrete Products Supply Co. Div., Press Seal Gasket Corp., Fort Wayne, Indiana; Ram-Nek as manufactured by K.T. Snyder Co., Inc., Houston, Texas, or equal. Sealant shall be installed in accordance with the manufacturers written instructions.

2.03 - MANHOLE STEPS

A. Manhole steps shall be of steel reinforced copolymer polypropylene conforming to ASTM C478, cast-in-place or installed utilizing inserts approved by the Engineer.

B. All steps shall be 12-inches on center with abrasive step surface and safety edge, drop front design, 1-inch diameter and 16-inches wide. Metal items embedded in concrete shall be painted with a zinc chromate primer.

2.04 - PIPE CONNECTIONS

A. Premolded elastomeric sealed joints shall be used at the joints between the pipe and sewer manhole sections. Premolded elastomeric sealed joints shall be A-Lok, Res-Seal, Press-Wedge II, Lock Joints Flexible Manhole Sleeve, Kor-N-Seal Joint Sleeve, or equal.

2.05 - MANHOLE COVERS AND FRAMES

A. Manhole frames and covers shall be in accordance with the detail shown on the drawings. The Owner has standardized on this manhole frame and cover and therefore no substitutes are allowed.

B. Bolted and gasketed manhole frames and covers shall be in accordance with the detail shown on the drawings. The Owner has standardized on this manhole frame and cover and therefore no substitutes are allowed. The following manholes shall be furnished with bolted and gasketed manhole frames and covers.

Manhole Number	Location	Drawing Number	Remarks
SMH F-04-24	Center Place	02 C-109	LPS Terminal Flushing Manhole
SMH F-04-49	Cove Road	02 C-110	LPS Terminal Flushing Manhole
SMH D-05-12	Old County Road	03 C-115	LPS Terminal Flushing Manhole
SMH E-04-02	Cottage Street	03 C-117	LPS Terminal Flushing Manhole
SMH E-05-08	North Cottage Street	03 C-117	LPS Terminal Flushing Manhole

2.06 - BRICK

A. Brick shall conform to ASTM C32 and shall be new, water struck, first quality, whole, sound brick.

B. For tables and inverts, Type SS shall be used with cement mortar (no lime).

2.07 - MORTAR

A. Mortar shall be composed of one-part Portland cement to two parts sand with 20 percent hydrated lime.

B. Portland cement shall conform to the requirements of ASTM C150. Sand shall conform to the requirements of ASTM C144. Hydrated lime shall conform to the requirements of ASTM C207.

2.08 - WATER

A. Water shall be clean, fresh and free from organic matter, oil, acid, alkali or deleterious substances.

2.09 - BEDDING MATERIAL

A. Bedding material under manholes shall conform to the requirements of pipe bedding material as specified in SECTION 02220, EARTH EXCAVATION, BACKFILL, FILL AND GRADING.

2.10 - CONCRETE

A. Concrete for floor fillings, encasements, and similar items shall be as specified in DIVISION 3, CONCRETE.

2.11 - COMBINATION AIR VALVE – Not Used

2.12 - IN-LINE FLUSHING / FORCE MAIN DRAIN MANHOLES

A. In-line Flushing / Force main drain manholes shall be located as shown on the drawings and shall be of precast construction to the dimensions detailed. Manholes shall include a precast concrete manhole and all pipes, fittings, and valves necessary for draining purposes as shown on the drawings.

2.13 - VALVES

A. Gate valves shall be iron body, bronze mounted and have solid wedges. The valves shall be designed for 150 psi working pressure.

B. Exterior surfaces of all valves shall be coated with a minimum of three applications of an approved bituminous solution, on a rust-casting, prior to shipment. Body ring shall be free of any bitumastic solution. Valve interiors shall have a two-part thermoset for fusion bonded epoxy protective coating system and meet all requirements of AWWA C550.

2.14 - CARBON ODOR CONTROL UNIT

A. Manholes identified (see table) shall be provided with a compact, modular canister designed granular activated carbon odor control unit. Unit shall be designed to use the positive pressure generated inside the manholes to push the contaminated air up through the unit. The contaminated air shall be absorbed by the carbon, allowing clean air to vent through the manhole cover into the atmosphere.

Manhole Number	Location	Drawing Number	Remarks
SMH F-04-24	Center Place	02 C-109	LPS Terminal Flushing Manhole
SMH F-04-49	Cove Road	02 C-110	LPS Terminal Flushing Manhole
SMH D-05-12	Old County Road	03 C-115	LPS Terminal Flushing Manhole
SMH E-04-02	Cottage Street	03 C-117	LPS Terminal Flushing Manhole
SMH E-05-08	North Cottage Street	03 C-117	LPS Terminal Flushing Manhole

B. One carbon spare odor control unit shall be provided for each manhole identified. Three spare carbon canisters/bags shall be provided for each manhole identified.

C. Carbon odor control units shall be Sweet Street as manufactured by Continental Carbon Group, Odoreater CC Manhole Insert as manufactured by Parson Environmental Products, Inc. or equal.

2.15 - MANHOLE ADJUSTING RINGS – Not Used

2.16 - MANHOLE ENCAPSULATION SYSTEM

A. All manholes shall be installed with an external manhole encapsulation system that seals: (1) the interface between the precast concrete manhole and the frame and cover and (2) all manhole joints which are located below groundwater.

B. The manhole encapsulation system shall be designed to prevent leakage of water into the manhole and shall be either one of the following:

1. The manhole encapsulation system shall be a heat shrinkable wraparound sleeve system and shall have an overall thickness of 0.100-inches with a minimum width of 12-inches. The manhole encapsulation shall be “Wrapid Seal Manhole Encapsulation System” as manufactured by Canusa, A Division of Shaw Pipe Resources or equal.

2. The manhole encapsulation system shall be a rubber sleeve made of EPDM (Ethylene Propylene Diene Monomer) rubber with a minimum thickness of 65 mils with a minimum width of 12-inches. Each unit shall have a 2-inch wide mastic strip on the top and bottom edge of the rubber wrap. The mastic shall be non-hardening butyl rubber sealant, with a minimum thickness of ¼-inch. The manhole encapsulation shall be “Infi-Shield Seal Wrap” as manufactured by Sealing System, Inc. or equal.

PART 3 - EXECUTION

3.01 - PRECAST REINFORCED CONCRETE

A. Precast reinforced concrete structures shall be installed as shown on the drawings. Precast sections shall be installed so that entire structure is vertically plumb and the steps are in a true line. All erection holes shall be filled solid with non-shrinking grout. The top uppermost precast section shall be set at a grade that will allow for the installation of a minimum of two courses and a maximum of five courses of brick and mortar prior to setting the cast iron frame and cover. The Contractor shall furnish and use suitable slings, hooks and cables for the proper handling of the sections.

B. Surfaces of sewer pipe to be bonded to cast in place concrete bases shall be cleaned of all dust, dirt, grease, laitance, and loose or spalling concrete and given, where applicable, a coat of bonding compound in conformance with the sealant or gasket manufacturer’s recommendations.

3.02 - MANHOLE COVERS AND FRAMES

A. If overlay pavement is required by the Owner, the covers and frames shall be set 1/4-inch below the finish grade of the roadway utilizing cement mortar to hold the frame in place, as detailed.

B. The temporary roadway surface elevation shall be maintained and the frames and covers shall be set 3/4-inch above the grade of the temporary resurfacing utilizing either cement mortar or bituminous concrete to hold the frame in place. A slope, constructed of bituminous concrete pavement, shall be placed around the entire grate, frame and cover for a distance of 6-inches from the grate, frame and cover.

C. Any voids created in the road gravel or pavement when raising the grate, frame and cover from its temporary elevation to its permanent elevation shall be filled with concrete.

3.03 - VACUUM TEST

A. Vacuum tests shall be made and observed by the Engineer on each manhole.

B. Preparation for Testing

1. The test shall be made after the manhole had been assembled in place, all lifting holes and horizontal joints shall be filled and pointed with an approved non-shrinking mortar, but prior to filling and pointing the horizontal joints.

2. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test. All pipes and other openings into the manhole shall be suitably plugged and plugs braced to prevent blow out.

3. The test may be conducted before backfilling around the manhole.

C. Test Procedures

1. The Contractor shall take any and all steps necessary to assure the Engineer that the water table is below the invert of the manhole throughout the test. Any and all measures necessary by the Contractor to lower the ground water table below the invert of the manhole will be at the Contractor's cost. The vacuum test shall be based on the following criteria:

a. Manhole test pressures and time shall be as follows:

(1) Initial test pressure, 10-inches Hg (i.e., 20-inch absolute).

(2) Test time, 1-inch Hg drop to 9-inch Hg in 2 minutes minimum allowable, for 0 to 10 foot deep manholes; 2-1/2 minutes minimum allowable for 10 foot to 15 foot deep manholes; 3 minutes minimum allowable for manholes greater than 15 foot in depth.

2. If the pressure drop exceeds 1-inch Hg in 2 minutes the manhole shall be repaired on the outside and retested.

3. If a manhole fails to meet a 1-inch Hg drop in 1 minute after repair, the manhole shall be water exfiltration tested and repaired as necessary.

D. Testing using either air or water shall be done whenever possible prior to backfilling to assist in locating leaks. Joint repairs by parging are to be done on the outside of the manhole. Vacuum testing draws together the joint and applies high pressure to the elastomeric joint material. Properly placed and sized elastomeric joint material must be used to avoid leakage or to enable sections to be separated if necessary to affect a repair.

3.04 - MANHOLE ADJUSTING RINGS – Not Used

3.05 - MANHOLE ENCAPSULATION SYSTEM

A. The external manhole encapsulation system shall be installed in accordance with the manufacturer’s instructions. All surfaces shall be free of dirt, sharp points and preheated to remove moisture.

B. The Contractor’s personnel shall be trained by the manufacturer in the proper method of application of the external manhole encapsulation system. The Contractor shall have the manufacturer’s field service representative present during the application of external manhole encapsulation system on the first two manholes installed.

3.06 - VISUAL INSPECTION

A. At the conclusion of the work, all manholes shall be visually inspected by the Engineer to insure a straight and plumb alignment.

B. All manholes that are not straight and plumb shall be removed and replaced.

3.07 - CLEANUP

A. Upon completion, of all construction and testing, and prior to final acceptance all debris shall be removed from manholes and the tables cleaned.

3.08 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 02725

MANHOLES, CATCH BASINS, HANDHOLES, AND PULL BOXES

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PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes furnishing all labor, materials, tools and equipment necessary to construct precast concrete manholes, catch basins, handholes, and pull boxes including bases complete with inverts, tables, steps, frames, grates and covers, mancatchers, fittings, piping and concrete encasements for drop manholes as specified herein and as shown on the Contract Drawings

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals shall include shop drawings showing complete fabrication and construction details, materials, weights, dimensions, clearances, anchorage details, piping and utility requirements. Submittals shall include at least the following:

1. Precast concrete manholes, catch basins, handholes and pull boxes.
2. Frames, covers, and grates.
3. Horizontal joint sealing material.
4. Pipe connections.
5. Manhole steps.
6. Manhole Encapsulation System.

1.05 - PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer's written recommendations.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

PART 2 - PRODUCTS

2.01 - PRECAST SECTIONS FOR MANHOLES

A. Precast reinforced concrete sections for drain manholes, sewer manholes, valve manholes, chemical or process manholes, (hereinafter referred to as "manholes") and catch basins, shall conform to the applicable requirements of ASTM C478. Sections and bases shall have a minimum wall thickness of the dimensions shown on the Contract Drawings. Unless otherwise detailed on the Contract Drawings all sections shall be of precast concrete. Flat top sections to be substituted for conical sections of manholes and catch basins in areas of low cover shall be indicated in submittals and shall conform to the requirements for precast concrete sections for handholes.

B. Unless otherwise shown on the Contract Drawings manholes shall be 4-foot in diameter for pipe up to 24-inches in diameter unless the angle between two 24-inch pipes is less than 120 degrees. In such cases and when the size of the pipe is less than 36-inches a 5-foot inside diameter manhole shall be used. Where the pipe is 36-inches in diameter or greater, the diameter of the structure shall be as shown on the Contract Drawings.

C. Exterior surfaces of all precast manholes shall be given one shop coat of bituminous waterproofing.

D. All lifting holes and areas of the factory coating that have been compromised shall be filled and/or patched with mortar and coated with one coat of bituminous waterproofing.

E. Inter surfaces (walls, floor and ceiling of manholes) precast manholes (See table) shall be coated from the bottom to the top with a high build epoxy.

Manhole Number	Location	Drawing Number	Remarks
SMH E-05-11	Old County Road	03 C-115	LPS Discharge
SMH F-04-25	Center Place	02 C-109	LPS Discharge
SMH E-04-02	Cottage Street South Orleans Road	03 C-117 03 C-116	LPS Discharge
SMH F-04-32	Cove Road South Orleans Road	02 C-110 02 C-106	LPS Discharge
SMH F-04-47	Old Colony Way	01 C-108	PS No. 2 FM Discharge
SMH F-04-48	Old Colony Way	01 C-108	PS No. 2 FM Discharge
SMH E-04-06	South Orleans Road	02 C-106	PS No. 3 FM Discharge
SMH F-04-34	South Orleans Road	02 C-106	PS No. 3 FM Discharge

Coating schedule to be as follows:

1. Surface Preparation: CIP Concrete to be prepared per SSPC SP #13 Standard with ICRI CSP #5 profile.
2. Lining System
   a. Concrete Surfacer: Tnemec Series 218 Mortar-Clad at 1/16-inch thickness.
   b. Finish: Series 434 PermaShield polyamine epoxy mortar at 125.0 mils dft.

2.02 - HORIZONTAL JOINTS

A. Horizontal joints between sections of manholes, unless otherwise specified herein, shall be sealed with a self-sealing butyl rubber based flexible joint sealant in rope form. Sealant material shall be Kent-Seal No. 2 as manufactured by Hamilton-Kent Mfg. Co., Kent, Ohio; C-S146 as manufactured by Concrete Products Supply Co. Div., Press Seal Gasket Corp., Fort Wayne, Indiana; Ram-Nek as manufactured by K.T. Snyder Co., Inc., Houston, Texas. Sealant shall be installed in accordance with the manufacturers written instructions.

B. Horizontal joints between sections of precast concrete drain manholes and catch basins shall be mortared with mix specified herein.

2.03 - MANHOLE STEPS

A. Manhole steps shall be of steel reinforced copolymer polypropylene conforming to ASTM C478, cast-in-place or installed utilizing inserts approved by the Engineer.

B. All steps shall be 12-inches on center with abrasive step surface and safety edge, drop front design, 1-inch diameter and 16-inches wide. Metal items embedded in concrete shall be painted with a zinc chromate primer.

2.04 - PRECAST SECTIONS FOR ELECTRICAL MANHOLES, HANDHOLES, AND PULL BOXES

A. Refer to DIVISION 16, ELECTRICAL.

2.05 - PIPE CONNECTIONS

A. Premolded elastomeric sealed joints shall be used at the joints between the pipe and sewer manhole sections. Premolded elastomeric sealed joints shall be A-Lok, Res-Seal, Press-Wedge II, Lock Joints Flexible Manhole Sleeve, or Kor-N-Seal Joint Sleeve.

B. Mortar shall be used between pipe and structure in the storm drainage systems. Mortar mix shall be as specified herein.

C. Manholes shall be manufactured with knockout panels for future pipe connections/ extensions at the locations shown on the Contract Drawings.

2.06 - MANHOLE FRAMES AND COVERS

A. Manhole frames and covers shall be in accordance with the detail shown on the drawings. The Owner has standardized on this manhole frame and cover and therefore no substitutes are allowed.

B. Bolted and gasketed manhole frames and covers shall be in accordance with the detail shown on the drawings. The Owner has standardized on this manhole frame and cover and therefore no substitutes are allowed. The following manholes shall be furnished with bolted and gasketed manhole frames and covers.

Manhole Number	Drawing Number	Manhole Number	Drawing Number
SMH G-03-01	01 C-101	SMH D-04-03	03 C-110
SMH H-03-02	01 C-101	SMH D-04-04	03 C-110
SMH G-03-20	01 C-105	SMH D-05-08	03 C-110
SMH G-03-16	01 C-110	SMH D-05-09	03 C-110
SMH G-03-01	01 C-109	SMH D-05-10	03 C-110
SMH G-04-07	02 C-101	SMH D-04-01	03 C-111
SMH F-04-23	02 C-102	SMH D-05-11	03 C-111
SMH D-04-06	03 C-108	SMH E-05-01	03 C-111
SMH D-04-07	03 C-108	SMH E-05-02	03 C-111
SMH D-05-04	03 C-109	SMH E-05-03	03 C-111
SMH D-05-05	03 C-109	SMH E-05-04	03 C-111
SMH D-04-02	03 C-110		

2.07 - BRICK

A. Brick shall conform to ASTM C32 and shall be new, water struck, first quality, whole, sound brick.

B. For tables and inverts, Type SS shall be used with cement mortar (no lime).

2.08 - MORTAR

A. Mortar shall be composed of one-part Portland cement to two parts sand with 20 percent hydrated lime.

B. Portland cement shall conform to the requirements of ASTM C150. Sand shall conform to the requirements of ASTM C144. Hydrated lime shall conform to the requirements of ASTM C207.

2.09 - WATER

A. Water shall be clean, fresh and free from organic matter, oil, acid, alkali, or deleterious substances.

2.10 - BEDDING MATERIAL

A. Bedding material under structures herein shall be as detailed and as specified in SECTION 02220, EARTH EXCAVATION, BACKFILL, FILL AND GRADING.

2.11 - CONCRETE

A. Concrete for tables, inverts, paved invert fillings, encasements, floor fillings and similar items shall be as specified in DIVISION 3, CONCRETE.

2.12 - POLYVINYL CHLORIDE PIPE

A. Polyvinyl Chloride pipe for drop manhole connections shall conform to ASTM D3034 and shall be SDR35.

2.13 - MID LEVEL PLATFORM

A. All manholes with a depth of 20-feet or greater from rim to invert shall have installed at the midpoint of the manhole a mid-level platform. The mid-level platform shall be installed in accordance with the details on the Contract Drawings.

2.14 - MANHOLE ADJUSTING RINGS – Not Used

2.15 - MANHOLE ENCAPSULATION SYSTEM

A. All manholes shall be installed with an external manhole encapsulation system that seals: (1) the interface between the precast concrete manhole and the frame and cover and (2) all manhole joints which are located below groundwater.

B. The manhole encapsulation system shall be designed to prevent leakage of water into the manhole and shall be either one of the following:

1. The manhole encapsulation system shall be a heat shrinkable wraparound sleeve system and shall have an overall thickness of 0.100-inches with a minimum width of 12-inches. The manhole encapsulation shall be "Wrapid Seal Manhole Encapsulation System" as manufactured by Canusa, A Division of Shaw Pipe Resources, Riser-Wrap as manufactured by Pipeline Seal and Insulator, Inc. or equal.

2. The manhole encapsulation system shall be a rubber sleeve made of EPDM (Ethylene Propylene Diene Monomer) rubber with a minimum thickness of 65 mils with a minimum width of 12-inches. Each unit shall have a 2-inch wide mastic strip on the top and bottom edge of the rubber wrap. The mastic shall be non-hardening butyl rubber sealant, with a minimum thickness of ¼-inch. The manhole encapsulation shall be "Infi-Shield Seal Wrap" as manufactured by Sealing System, Inc. or equal.

2.16 - CARBON ODOR CONTROL UNIT

A. Manholes identified (see table) shall be provided with a compact, modular canister designed granular activated carbon odor control unit. Unit shall be designed to use the positive pressure generated inside the manholes to push the contaminated air up through the unit. The contaminated air shall be absorbed by the carbon, allowing clean air to vent through the manhole cover into the atmosphere.

Manhole Number	Location	Drawing Number	Remarks
SMH E-05-11	Old County Road	03 C-115	LPS Discharge
SMH F-04-25	Center Place	02 C-109	LPS Discharge
SMH E-04-02	Cottage Street South Orleans Road	03 C-117 03 C-116	LPS Discharge
SMH F-04-32	Cove Road South Orleans Road	02 C-110 02 C-106	LPS Discharge
SMH F-04-47	Old Colony Way	01 C-108	PS No. 2 FM Discharge
SMH F-04-48	Old Colony Way	01 C-108	PS No. 2 FM Discharge
SMH E-04-06	South Orleans Road	02 C-106	PS No. 3 FM Discharge
SMH F-04-34	South Orleans Road	02 C-106	PS No. 3 FM Discharge

B. One carbon spare odor control unit shall be provided for each manhole identified. Three spare carbon canisters/bags shall be provided for each manhole identified.

C. Carbon odor control units shall be Sweet Street as manufactured by Continental Carbon Group, Odoreater CC Manhole Insert as manufactured by Parson Environmental Products, Inc. or equal.

PART 3 - EXECUTION

3.01 - PRECAST REINFORCED CONCRETE STRUCTURES

A. Precast Reinforced Concrete Structures shall be installed as shown on the Contract Drawings and at a maximum spacing of 300 linear-feet. Precast sections shall be installed so that the entire structure is vertically plumb and the steps are in a true line. All erection holes and horizontal joists shall be filled solid with non-shrinking grout. The top uppermost precast section shall be set at a grade that will allow for the installation of a minimum of two courses and a maximum of five courses of manhole adjusting rings prior to setting the cast iron frame and cover. Furnish and use suitable slings, hooks and cables for the proper handling of the sections.

B. Surfaces of sewer pipe to be bonded to cast-in-place concrete bases shall be cleaned of all dust, dirt, grease, laitance, and loose or spalling concrete and given, where applicable, a coat of bonding compound in conformance with the sealant or gasket manufacturer's recommendations.

C. Tables and inverts shall be constructed of brick and concrete for sewer manholes, and of concrete for drain manholes as shown on the Contract Drawings. The size and shape of the invert shall accurately conform to the adjoining sewer or drains pipes. Any change in size or direction shall be even and as gradual as possible. Concrete floor filling for chemical or process pullbox sumps shall be as shown on the details.

D. Knockout panels for future sewer extensions shall be manufactured into precast manhole, as specified above, at the locations shown on the Contract Drawings. Stubs shall not be used.

3.02 - MANHOLE COVERS AND FRAMES

A. In paved surfaces, grates, covers and frames shall be set 1/4-inch below the finish grade of the roadway utilizing cement mortar to hold the frame in place, as shown of the Contract Drawings.

B. The temporary roadway surface elevation shall be maintained and the grates, frames, and covers shall be set 3/4-inch above the grade of the temporary resurfacing utilizing either cement mortar or bituminous concrete to hold the frame in place. A slope, constructed of bituminous concrete pavement, shall be placed around the entire grate, frame and cover for a distance of 6-inches from the grate, frame and cover.

C. Any voids created in the road gravel or pavement when raising the grate, frame and cover from its temporary elevation to its permanent elevation shall be filled with concrete.

3.03 - DROP CONNECTIONS

A. Drop connections shall be installed for manholes, which have invert elevation differences greater than 3-feet. No exterior drop connections are allowed.

B. Drop connections for manholes shall be constructed utilizing polyvinyl chloride pipe, elastomeric sealed joints, and Type 316 stainless steel mounting hardware and materials. Drops shall be constructed in accordance with the Contract Drawings.

C. The size of the drop piping shall be 8-inches when the size of the sewer main is less than 24-inches. When the sewer main is equal to or larger than 24-inches, the drop piping shall be 12-inches in diameter.

3.04 - LEAKAGE TESTS

A. Leakage tests shall be made and observed by the Engineer on each sewer manhole. The test shall be an exfiltration, infiltration test or vacuum test made as described below:

1. Preparation for Testing

   a. After the manhole has been assembled in place, all lifting holes and horizontal joints shall be filled and pointed with a non-shrinking mortar. The test shall be made prior to placing the tables and invert and before filling and pointing the horizontal joints.

   b. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test. All pipes and other openings into the manhole shall be suitably plugged and plugs braced to prevent blow out.

2. Backfilling

   a. The test may be conducted before backfilling around the manhole.

   b. There will be adjustment in the leakage allowance for unknown causes including, but limited to, leaking plugs and absorption. It will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete.

3. The Contractor has the option of test method depending upon the actual field conditions. The following are acceptable test methods:

   a. If the measured ground water table is above the highest joint in the manhole, and if there is not leakage into the manhole as determined by the Engineer, the Contractor may perform an infiltration or vacuum test as described herein.

   b. If the measured ground water table height is lower than the invert of the manhole, the Contractor may perform an exfiltration or a vacuum test.

3.05 - TEST PROCEDURES

A. Infiltration Test

1. The manhole interior shall be visually inspected. The manhole shall be considered acceptable for use when no infiltration of ground water is observed on the interior surfaces of the manhole.

B. Exfiltration Test

1. The manhole shall be filled with water to the top of the cone section. If the excavation has not been backfilled and observation indicates no visible leakage, that is, no water visibly moving down the surface of the manhole, the manhole shall be considered satisfactorily watertight.

2. If the test as described above is unsatisfactory as determined by the Engineer or if the manhole excavation has been backfilled the test shall be continued. A period of time may be permitted, if the Contractor so wishes, to allow for absorption.

3. At the end of this period, the manhole shall be refilled to the top of the cone, if necessary, and the measuring time of at least 8 hours shall begin. At the end of the test period, the manhole shall be refilled to the top of the cone, measuring the volume of water added. This amount shall be extrapolated to a 24-hour rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed 1 gallon per vertical foot for a 24-hour period.

4. If the test fails, but the leakage does not exceed 3 gallons per vertical foot per day, repairs shall be made in accordance with industry standard repair methods as to bring the leakage within the allowable rate of 1 gallon per vertical foot per day. If the leakage exceeds 3 gallons per vertical foot per day, it shall be the Contractor's responsibility to uncover the manhole as necessary and to disassemble, reconstruct or replace it as required, at no cost to the Owner. The manhole shall then be retested.

C. Vacuum Test

1. If the vacuum test is performed in lieu of the infiltration or exfiltration test the Contractor shall take any and all steps necessary to assure the Engineer that the water table is below the invert of the manhole throughout the test. Any and all measures necessary by the Contractor to lower the ground water table below the invert of the manhole will be at the Contractor's expense. The vacuum test shall be based on the following criteria:

   a. Manhole test pressures and time shall be as follows:

      (1) Initial test pressure, 10-inches Hg (i.e., 20-inch absolute).

      (2) Test time, 1-inch Hg drop to 9-inch Hg in 2 minutes minimum allowable, for 0 to 10-foot-deep manholes; 2-1/2 minutes minimum allowable for 10 foot to 15 foot deep manholes; 3 minutes minimum allowable for manholes greater than 15 foot in depth.

   b. If the pressure drop exceeds 1-inch Hg in 2 minutes the manhole shall be repaired and retested.

   c. If a manhole fails to meet a 1-inch Hg drop in 1 minute after repair, the manhole shall be water exfiltration tested and repaired as necessary.

   d. Testing using either air or water shall be done whenever possible prior to backfilling to assist in locating leaks. Joint repairs by parging are to be done on both outside and inside of the joint to ensure a permanent seal. Vacuum testing draws together the joint and applies high pressure to the elastomeric joint material. Properly placed and sized elastomeric joint material must be used to avoid leakage or to enable sections to be separated if necessary to affect a repair.

3.06 - MANHOLE ADJUSTING RINGS – Not Used

3.07 - MANHOLE ENCAPSULATION SYSTEM

A. The external manhole encapsulation system shall be installed in accordance with the manufacturer’s written instructions. All surfaces shall be free of dirt, sharp points and preheated to remove moisture.

B. The Contractor’s personnel shall be trained by the manufacturer in the proper method of application of the external manhole encapsulation system. The Contractor shall have the manufacturer’s field service representative present during the application of external manhole encapsulation system on the first two manholes encapsulated.

3.08 - VISUAL INSPECTION

A. At the conclusion of the work, all manholes, catch basins, handholes and pull boxes shall be visually inspected by the Engineer to insure a straight and plumb alignment.

B. All manholes, catch basins, handholes and pull boxes that are not straight and plumb shall be removed and replaced.

3.09 - CLEANUP

A. Upon completion, of all construction and testing, and prior to final acceptance all debris shall be removed from manholes and the tables cleaned.

3.10 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 02735

FLOW CONTROL OF SEWER LINES

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 1
1.03 - DEFINITIONS 1
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING 2
1.06 - DESIGN CRITERIA 2
PART 2 - PRODUCTS - Not Used 2
PART 3 - EXECUTION 2
3.01 - GENERAL 2
3.02 - CLEAN-UP 3
3.03 - CONTRACT CLOSEOUT 3

PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to control the flow of wastewater in the sewer lines as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to all sections within BIDDING REQUIREMENTS, CONTRACT FORMS AND CONDITIONS OF THE CONTRACT; all sections within OTHER DOCUMENTS; DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals shall include shop drawings showing complete fabrication and construction details, materials, weights, dimensions, clearances, anchorage details, piping and utility requirements. Submittals shall include at least the following:

1. Contractor's description of all equipment to be used.
2. Contractor's description of his proposed methodology.

1.05 - PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer’s written recommendations.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

B. Contractor shall use by-pass pumps and power sources with sound proofing for minimal disturbance (less than 85 db).

C. Contractor shall provide secondary containment for any type of fuel used for power sources. Secondary containment shall be sized for at least 150 percent of the total fuel supply.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.01 - GENERAL

A. When the depth of flow in the sewer line is above the maximum allowable set forth for the type of work being performed in the applicable section(s) of these specifications, one or more of the following methods of flow control shall be used:

1. Plugging or Blocking
    a. A sewer line plug shall be inserted into the sewer line(s) at a manhole upstream from the section in which the work is to be performed.
    b. The plug shall be so designed that all or any portion of the sewage flow can be released.

2. Pumping and Bypassing

   a. When pumping/bypassing is required, the Contractor shall supply the necessary pumps, conduits and other equipment to divert the flow of sewage around the section in which work is to be performed. The Contractor shall be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system.

   b. Bypass pumping shall only be performed during working hours. The gravity sewers shall be reconnected at the end of each work day.

B. The Contractor shall conduct its work so as to not cause excessive surcharging of the sewerage system and shall not cause damage to the sewerage system, its connections and/or apparatus. Any damage caused by the Contractor's operations shall be repaired to the complete satisfaction of the Engineer and at no additional cost to the Owner.

3.02 - CLEAN-UP

A. The Contractor shall be responsible for the legal disposal of removed materials and general clean-up of the work area as approved by the Engineer.

3.03 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 02736

TEMPORARY CONNECTIONS

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 1
1.03 - DEFINITIONS 2
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING 2
1.06 - DESIGN CRITERIA 2
PART 2 - PRODUCTS 3
2.01 - MATERIALS 3
PART 3 - EXECUTION 3
3.01 - PIPE LAYING 3
3.02 - TEMPORARY BYPASS 3
3.03 - TEMPORARY SERVICE CONNECTIONS 4
3.04 - CONTRACT CLOSEOUT 4

PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes furnishing all labor, materials, tools and equipment and performing all operations in connection with the temporary connections, as specified herein and as shown on the drawings.

B. Provide, disinfect, and maintain temporary potable water bypass pipe, connections, and services as indicated and as specified and later remove temporary facilities.

C. Have readily available sufficient additional quantity of bypass pipe, connections of suitable sizes to replace or supplement the temporary facilities in event these prove inadequate in any way.

D. Perform all appurtenant work including but not limited to excavation and backfilling, constructing ramps at driveways and other access ways, replacement of temporary and permanent pavement, restoration of public and private property.

E. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals shall include shop drawings showing complete fabrication and construction details, materials, weights, dimensions, clearances, anchorage details, piping and utility requirements. Submittals shall include at least the following:

1. Before commencing work, submit for Engineer's review and approval, proposed layout plan and operations schedule for installing and removing temporary bypasses, connections and services.

2. Submit for Engineer's review and approval, a list of materials with sizes for temporary bypass, connect-ions and services.

3. Quality Assurance documents.

1.05 - PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer’s written recommendations.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

C. Quality Assurance

1. Use only materials that are suitable for potable water transmission and distribution.
2. Provide temporary connections capable of withstanding service pressure of 150 psi.
3. Take water for temporary connections from Owner's nearest available hydrants remaining in service.

D. Safety Requirements

1. Prevent contamination of contiguous potable water distribution system and services.
2. Coordinate and cooperate with Owner's water utility and fire department to maintain water distribution and fire protection capability.
3. Take all necessary precautions for public safety.
4. See SECTION 01500, TEMPORARY FACILITIES regarding water supply for Contractor's operations.

PART 2 - PRODUCTS

2.01 - MATERIALS

A. Provide pipe, fittings, hoses, connections, valves suitable for potable water service at 250 psi and as approved by Engineer.

PART 3 - EXECUTION

3.01 - PIPE LAYING

A. Furnish, install, maintain and later remove devices necessary to ensure public safety as required and as approved.

B. Install, operate, maintain, test, disinfect and remove temporary facilities including bypass, connections, laterals, customer services and customer connections and temporary fire hydrants as indicated on drawings, as specified and as approved by Engineer.

C. Make installation suitable for temporary potable water service pressures to 150 psi without leakage.

D. Do not operate Owner's or user's valves, stops and hydrants without Engineer's permission for specific valves, stops and hydrants.

E. Test temporary facilities in presence of Engineer before taking Owner's water main out of service.

F. Disinfect temporary facilities to meet Engineer's approval and in accordance with SECTION 02675, HYDROSTATIC TESTING AND DISINFECTION prior to placing such temporary facilities in service.

G. Make attachments and connections to fire hydrants and fire protection systems in a manner which can be easily and quickly removed to permit use of fire hydrants and fire protection systems for fire fighting purposes.

H. Notify in writing the Owner and the Owner's water utility and fire department 48 hours in advance of connect-ing and disconnecting temporary and permanent facilities so that representatives of Owner's water utility and fire department may be present at installation or removal of permanent and temporary connections and to permit Owner to inform customers and users as Owner deems necessary.

I. Do not install temporary bypass, connections and customer services across streets except as permitted by Engineer.

J. Connect to the temporary bypass water mains that are to remain in service as indicated and approved by Engineer.

K. After water mains are returned to service, remove temporary facilities not required for remaining work and restore and clean up affected areas to the approval of the Engineer.

3.02 - TEMPORARY BYPASS

A. Provide bypass not less than sizes indicated on drawings and in any case not less than 2-in. diameter.

B. Lay bypass out of traveled way in manner to protect the bypass from damage.

C. Where bypass is approved to cross streets and street intersections, lay in trench and place temporary pavement over bypass except as permitted otherwise in writing by the Engineer.

D. Where bypass crosses driveways and similar access ways to properties, construct suitable ramp to allow driving and passing over pipe except where Engineer requires bypass be laid in trench with temporary pavement over bypass.

E. Keep existing fire hydrants in service by making appropriate connections to bypass or by installing and maintaining temporary fire hydrants adjacent to each existing fire hydrant affected by work until restored to service.

F. Provide each temporary fire hydrant with individual valve control.

G. Provide temporary fire hydrants with fire hose connections compatible with existing fire hydrant hose connections as approved by the Engineer.

H. Satisfactorily flush existing hydrants, to which bypass is connected for water supply, prior to making connections to prevent stagnant or discolored water from entering bypass.

I. If bypass proves inadequate for temporary service, replace or supplement bypass as appropriate to provide adequate temporary service, including replacement with larger diameter bypass, as approved by the Engineer.

3.03 - TEMPORARY SERVICE CONNECTIONS

A. Furnish, install, maintain and later remove temporary service connections from the bypass to each building and service supplied by water main to be removed from service.

B. Lay temporary connections out of traveled and access ways where possible.

C. Temporary service connections ramped or in trench where directed and approved by the Engineer.

D. Provide temporary service connections equal to or larger size than permanent service connections.

E. Install and maintain pressure regulators for temporary services where necessary.

F. Install and remove temporary service connections and back clean permanent services at times when work can be observed by the Engineer and other representatives of the Owner.

G. Coordinate and cooperate with service user, Owner's water utility and fire department, to assure minimum disturbance to fire protection system and other special and automated uses.

H. Make temporary service connections to user service line, sill cock, or other convenient and reasonable points and acceptable to the Engineer.

3.04 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 02890

TRACER WIRE

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 1
1.03 - DEFINITIONS 1
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING 2
1.06 - DESIGN CRITERIA 2
PART 2 - PRODUCTS 2
2.01 - GENERAL 2
2.02 - TRACER WIRE 2
2.03 - CONNECTORS 3
2.04 - TERMINATION/ACCESS 3
2.05 - GROUNDING 3
PART 3 - EXECUTION 4
3.01 - INSTALLATION 4
3.02 - PROHIBITED PRODUCTS AND METHODS 4
3.03 - TESTING 5
3.04 - CONTRACT CLOSEOUT 5

PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes furnishing all labor, materials, tools and equipment necessary to provide tracer wire as specified and/or as shown on the drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT C-700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT C-700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Brochures and/or Catalogue Cuts including materials of construction, dimensions, minimum submergence requirements, etc.
2. Shop Drawings, including all equipment and components
3. Installation instructions
4. Manufacturer's Data

1.05 - PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer’s written recommendations.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents.

B. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

PART 2 - PRODUCTS

2.01 - GENERAL

A. All trace wire and trace wire products shall be domestically manufactured in the U.S.A.

B. All trace wire shall have HDPE insulation intended for direct bury, green color coated per APWA standard for a sewer utility being marked.

2.02 - TRACER WIRE

A. Open Trench - Trace wire shall be #12 AWG Copper Clad Steel, High Strength with minimum 450 lb. break load, with minimum 30 mil HDPE insulation thickness.

B. Directional Drilling/Jacking/Boring - Trace wire shall be #12 AWG Copper Clad Steel, Extra High Strength with minimum 1,150 lb. break load, with minimum 30 mil HDPE insulation thickness.

2.03 - CONNECTORS

A. All mainline trace wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector. At Crosses, the four wires shall be joined using a 4-way connector. Use of two 3-way connectors with a short jumper wire between them is an acceptable alternative.

B. Direct bury wire connectors shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion and shall be installed in a manner so as to prevent any uninsulated wire exposure.

C. Non locking friction fit, twist on or taped connectors are prohibited.

2.04 - TERMINATION/ACCESS

A. All trace wire termination points must utilize an approved trace wire access box (above ground access box or grade level/in-ground access box as applicable), specifically manufactured for this purpose.

B. All grade level/in-ground access boxes shall be appropriately identified with “sewer” cast into the cap and be color coded.

C. A minimum of 2 ft. of excess/slack wire is required in all trace wire access boxes after meeting final elevation.

D. All trace wire access boxes must include a manually interruptible conductive/connective link between the terminal(s) for the trace wire connection and the terminal for the grounding anode wire connection.

E. Grounding anode wire shall be connected to the identified (or bottom) terminal on all access boxes.

F. Gravity Sewers and Force Mains - Trace wire must terminate at grade level/in- ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway as approved by the Engineer.

G. Long-runs of Force Main, in excess of 500 linear feet. Trace wire access must be provided with a grade level/in-ground trace wire access box, located at the edge of the road right-of- way, and out of the roadway as approved by the Engineer. The grade level/in-ground trace wire access box shall be delineated using a minimum 48-inch polyethylene marker post, color coded green per APWA standard for the specific utility being marked.

2.05 - GROUNDING

A. Trace wire must be properly grounded at all dead ends/stubs

B. Grounding of trace wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of 20ft of #14 red HDPE insulated copper clad steel wire connected to anode (minimum

C. 1.5 lb.) specifically manufactured for this purpose and buried at the same elevation as the utility.

D. When grounding the trace wire at dead ends/stubs, the grounding anode shall be installed in a direction 180 degrees opposite of the trace wire, at the maximum possible distance.

E. When grounding the trace wire in areas where the trace wire is continuous and neither the mainline trace wire or the grounding anode wire will be terminated at/above grade, install grounding anode directly beneath and in-line with the trace wire. Do not coil excess wire from grounding anode. In this installation method, the grounding anode wire shall be trimmed to an appropriate length before connecting to trace wire with a mainline to lateral lug connector.

F. Where the anode wire will be connected to a trace wire access box, a minimum of 2 ft. of excess/slack wire is required after meeting final elevation.

PART 3 - EXECUTION

3.01 - INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner. The Contractor shall unpack all items and dispose of all unwanted packing materials.

B. Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, proper locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.

C. Trace wire systems must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.

D. Any damage occurring during installation of the trace wire must be immediately repaired by removing the damaged wire and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.

E. Trace wire shall be installed at the bottom half of the pipe and secured (taped/tied) at 5’ intervals.

F. Trace wire must be properly grounded as specified.

G. Trace wire on all service laterals/stubs must terminate at an approved trace wire access box located directly above the utility, at the edge of the road right-of-way, but out of the roadway. (See Trace wire Termination/Access)

H. At all mainline dead-ends, trace wire shall go to ground using an approved connection to a drive-in magnesium grounding anode rod, buried at the same depth as the trace wire. (See Grounding)

I. Mainline trace wire shall not be connected to existing conductive pipes. Treat as a mainline dead- end, ground using an approved waterproof connection to a grounding anode buried at the same depth as the trace wire.

J. All service lateral trace wires shall be a single wire, connected to the mainline trace wire using a mainline to lateral lug connector, installed without cutting/splicing the mainline trace wire.

K. In occurrences where an existing trace wire is encountered on an existing utility that is being extended or tied into, the new trace wire and existing trace wire shall be connected using approved splice connectors and shall be properly grounded at the splice location as specified.

L. A mainline trace wire must be installed, with all service lateral trace wires properly connected to the mainline trace wire, to ensure full tracing/locating capabilities from a single connection point.

M. Lay mainline trace wire continuously, by-passing around the outside of manholes/structures on the North or East side.

N. Trace wire on all sanitary service laterals must terminate at an approved trace wire access box color coded green and located directly above the service lateral at the edge of road right of way.

3.02 - PROHIBITED PRODUCTS AND METHODS

A. The following products and methods are:

1. Uninsulated trace wire;
2. Trace wire insulations other than HDPE;
3. Trace wires not domestically manufactured;
4. Non locking, friction fit, twist on or taped connectors;
5. Brass or copper ground rods;
6. Wire connections utilizing taping or spray-on waterproofing;
7. Looped wire or continuous wire installations, that has multiple wires laid side-by-side or in close proximity to one another;

8. Trace wire wrapped around the corresponding utility;
9. Brass fittings with trace wire connection lugs;
10. Wire terminations within the roadway, i.e. in valve boxes, cleanouts, manholes, etc.; and
11. Connecting trace wire to existing conductive utilities.

3.03 - TESTING

A. All new trace wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by the contractor, engineer and facility owner as applicable, prior to acceptance of ownership.

B. This verification shall be performed upon completion of rough grading and again prior to final acceptance of the project.

C. Continuity testing in lieu of actual line tracing shall not be accepted.

3.04 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700 – CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 03100

CONCRETE FORMWORK

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PART 1 – GENERAL

1.01 - SCOPE

A. Provide design and furnish materials for fabricating, erecting and removing formwork, false work and shoring for cast-in-place concrete as shown on the contract drawings and specified herein for a complete installation. The use of stay-in-place forms is expressly prohibited.

B. Use formwork to cast all cast-in-place concrete structures.

C. Provide and remove all formwork for architectural, civil, mechanical, and electrical work as shown on the drawings or specified under specified under those disciplines.

D. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification section number and title and Drawing numbers and titles.

1. Layout of panel joints and tie hole pattern for architectural formwork.
2. Form Ties: Submit data sheets for form ties proposed for use.
3. Form Ties-Tapered Through-Bolts: Proposed method of sealing and patching form tie holes.
4. ANSI/NSF 61 Certification that form release agents proposed for use in structures to contain potable water are non-toxic and have no adverse effect on the quality or appearance of potable water.

1.05 - PRODUCT HANDLING

A. Comply with the requirements of SECTION 01610, DELIVERY, STORAGE AND HANDLING.

B. Contractor shall arrange deliveries of materials and equipment in accordance with construction Progress Schedule, coordinate to avoid conflict with Work and conditions at Project site.

C. Materials shall be delivered to the site in an undamaged condition and at such intervals as will avoid delay in the work.

D. Material shall be stored and protected in a clean, properly drained location. Material shall be kept off the ground under a weather-tight covering permitting good air circulation. Formwork materials shall be stored on dry wood sleepers, pallets, platforms or other appropriate supports which have slope for positive drainage. Materials shall be protected from distortion, excessive stresses, corrosion and other damage. Materials shall not be stored on the structure in a manner that might cause distortion or damage to the supporting structure.

1.06 - DESIGN CRITERIA

A. Design formwork in conformance with methodology of ACI 347R for anticipated loads, lateral pressures, depth of concrete placement and rate of concrete placement. Design shall consider any special requirements due to the use of self consolidating, plasticized and/or retarded set concrete. All forms and shoring shall be designed at the contractor's expense.

B. Qualifications

1. Formwork Designer: Formwork, false work, and shoring design shall be by an engineer licensed in the state where the Project is located.

C. Quality Assurance

1. Comply with requirements in SECTION 01400, QUALITY ASSURANCE and as specified.

2. Design of Formwork

a. The Contractor shall assume responsibility for the design, engineering and construction of formwork. Forms shall be designed to produce concrete members identical in shape, lines and dimensions to members shown on the Contract Documents.

b. When high range water reducer (superplasticizer) is used in concrete mix or when self consolidated concrete is specified, forms shall be designed for full hydrostatic pressure per ACI 347.

c. The formwork shall be designed for the loads and lateral pressures in accordance with ACI 347 and wind loads as specified by the local building code.

d. Construction and contraction joints, openings, offsets, keyways, recesses, moldings, chamfers, blocking, screeds, bulkheads, waterstops, anchorages, inserts, and other features shall be provided.

e. Formwork shall be designed to be readily removable without impact, shock, or damage to 'green' concrete surfaces and adjacent materials.

f. The maximum panel deflection shall be L/360 of the span between structural members.

3. Unless otherwise specified herein, formwork shall be constructed so that the concrete surfaces will conform to the tolerance limits as given in ACI 117.

4. Materials, fabrications and workmanship found defective shall be promptly removed and replaced and new acceptable work shall be provided in accordance with Contract requirements at no additional cost to the owner.

1.07 - REFERENCES

A. American Concrete Institute (ACI):

1. 117/117R: Standard Tolerances for Concrete Construction and Materials.
2. 309.2R: Identification and Control of Visible Effects of Consolidation on Formed Concrete Surfaces.
3. 318/318R: Building Code Requirements for Structural Concrete and Commentary.
4. 347: Guide to Formwork for Concrete.
5. 350/350R: Code Requirements for Environmental Concrete Structures and Commentary.

B. Engineered Wood Association (APA)

C. National Institute of. Product Standards and Technology

1. Voluntary Product Standard PS 1 Structural Plywood

D. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - LUMBER

A. Lumber used in form construction shall be Douglas fir, No. 2 grade, S4S, Standard Grading and Dressing Rules No. 16, West Coast Lumber Inspection Bureau; or Southern Yellow Pine, No. 2, S4S, Standard Grade Rules Southern Pine Inspection Bureau. Boards shall be 6 inches or more in width.

2.02 - PLYWOOD

A. Only grade-marked plywood conforming to APA shall be provided.

B. Plywood used in form construction shall be Grade B-B, Class 1 plyform, mill-oiled, and sanded on both sides in conformance with U.S. Product Standard PS 1 Structural Plywood.

C. Thickness shall be sized to maintain alignment and surface smoothness, but not less than 5/8-inch thick.

2.03 - STEEL FORMS

A. Commercial grade sheets not less than 16 gage shall be provided.

B. Stock material that is free from warps, bends, kinks, cracks, and rust or other matter that could stain the concrete shall be provided.

2.04 - FORM MATERIAL LOCATIONS

A. Wall Forms and Underside of Slabs and Beams:

1. Materials: Plywood, hard plastic finished plywood or steel in new and undamaged condition, of sufficient strength and surface smoothness to produce specified finish.

B. Column Forms:

1. Rectangular Columns: As specified for walls.
2. Circular Columns: Fabricated steel or fiber reinforced plastic with bolted together sections or spirally wound laminated fiber form internally treated with release agent for height of column.

C. All Other Forms: Materials as specified for wall forms.

D. Rustication Grooves and Chamfer Strips: Nonabsorbent material, compatible with form surface, fully sealed on all sides prohibiting loss of paste or water between the two surfaces.

2.05 - FORM TIES

A. Locate form ties on exposed surfaces in a uniform pattern. Place form ties so they remain embedded in the concrete except for a removable portion at each end. Form ties shall have conical or spherical type inserts with a maximum diameter of 1 inch. Construct form ties so that no metal is within 1 1/2 inches of the concrete surface when the forms, inserts, and tie ends are removed. Do not use wire ties. Ties shall withstand all pressures and maintain forms within acceptable deflection limits.

B. Flat bar ties for panel forms shall have plastic or rubber inserts having a minimum depth of 1 1/2 inches and sufficient dimensions to permit patching of the tie hole.

C. Tapered form ties shall be tapered through-bolts or through-bolts that utilize a removable tapered sleeve.

D. Water Stop Ties: For water-holding structures, basements, pipe galleries, and accessible spaces below finish grade, furnish one of the following:

1. Integral steel water stop 0.103-inch thick and 0.625 inch in diameter tightly and continuously welded to tie.

2. Neoprene water stop 3/16-inch thick and 15/16 inch in diameter whose center hole is one-half diameter of tie, or molded plastic water stop of comparable size.

E. Elastic Vinyl Plug:

1. Design and size of plug shall allow insertion with tool to enable plug to elongate and return to original length and diameter upon removal forming watertight seal.

2. Manufacturer:

a. Dayton Superior; A58 Sure Plug.

b. Or equal.

F. Mechanical EPDM Rubber Plug:

1. Mechanical plug for taper tie

2. Manufacturers:

a. Sika Greenstreak, St. Louis, MO; X-Plug

b. Or equal.

3. Friction fit plugs will not be allowed.

2.06 - BOND BREAKER

A. Bond breaker shall be a V.O.C.-compliant nonstaining type that will provide positive bond prevention.

B. Manufacturers:

1. Edoco Burke; Clean Lift 90 W.B..

2. Nox-Crete, Inc.; Silcoseal 97EC.

3. Or equal.

2.07 - FORM LINERS

A. Form liners shall be provided as shown on documents.

B. Products:

1. Dura-Tex; Symons Corporation.

2. Or equal.

2.08 - RUSTICATIONS

A. Rustications shall be provided as shown on documents.

B. Products:

1. Rustications; Symons Corporation.

2. Or equal.

2.09 - FORM CAULKING

A. Form caulking shall be a one-component, gun-grade silicone sealant that is capable of producing flush, watertight and non-absorbent surfaces and joints. Sealant shall be compatible with the type of forming material and concrete ingredients used.

B. Products:

1. Series 1200 Construction Caulking; GE Silicones.

2. Dow Corning 999-A; Dow Corning Co..

3. Or equal.

2.10 - CHAMFER STRIPS

A. Provide 3/4-inch by 3/4-inch chamfer strips milled from clear, straight-grain pine, surfaced each side or extruded vinyl type with or without nailing flange unless otherwise shown on the Contract Documents.

2.11 - INSERTS

A. Provide galvanized cast steel or galvanized welded steel inserts, complete with anchors to concrete and fittings such as bolts, wedges and straps.

2.12 - DOVETAIL ANCHOR SLOTS

A. Provide dovetail anchor slots manufactured from 22 gage, galvanized steel with removable felt or polyurethane.

2.13 - FORM RELEASE AGENT

A. Form release agent shall not bond with, stain, or adversely affect concrete surfaces and shall not impair subsequent treatments of concrete surfaces. Form release agent shall be a ready-to-use water-based material formulated to reduce or eliminate surface imperfections and containing no mineral oil or organic solvents.

B. Certified as meeting the requirement of ANSI/NSF 61 for contact with potable water.

C. Manufacturers and Products:

1. BASF; MBT, Rheofinish 211.

2. Cresset Chemical Company; Crete-Lease 20-VOC.

3. Unitex Chemicals; Farm Fresh.

4. Symons Corporation: Magic Kote

5. Or equal.

PART 3 - EXECUTION

3.01 - FORM TOLERANCES

A. Comply with the requirements of ACI 117 for tolerances for formed surfaces except as specified in Table 03100-1.

TABLE 03100-1	
Vertical alignment (plumbness)	1/4 inch in any 10 feet and 1 inch maximum for entire length
Variation in the lines and surfaces of foundation mats, base slabs and walls	1/4 inch in any 10 feet and 1 inch max. for entire length
Variation from the level or from the grades indicated on the drawings	1/4 inch in any 10 feet
Variation of the linear building lines from established position in plan	1/2 inch in any 20 feet and 1 inch maximum for entire length
Variation of distance between walls	1/4 inch in any 10 feet and 1 inch maximum for entire length and height
Variation in the sizes and locations of sleeves, floor openings and wall openings	Minus 1/4 inch Plus 1/2 inch
Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls	Minus 1/4 inch Plus 1/2 inch
Offset between adjacent panels of formwork facing material	1/2 inch (ACI 117 Class C finish).
Offset between adjacent panels of formwork facing material for exposed surfaces where appearance is of importance	1/8 inch (ACI 117 Class A finish).

B. Tolerances are not cumulative

C. Where equipment is to be installed, comply with manufacturer's tolerances if more restrictive than above.

D. Failure of the forms to produce the specified concrete surface and surface tolerance shall be grounds for rejection of the concrete work. Rejected work shall be repaired or replaced at no additional cost to the Owner.

3.02 - PREPARATION

A. Clean form surfaces to be in contact with concrete of foreign material prior to installation. Tape, gasket, plug, and/or caulk joints, gaps, and apertures in forms so that the joint will remain watertight and withstand placing pressures without bulging outward or creating surface irregularities.

B. Coat form surfaces in contact with concrete with a form release agent prior to form installation.

C. Keep form coatings off steel reinforcement, items to be embedded, and previously placed concrete.

D. Steel Forms: Apply form release agent to steel forms as soon as they are cleaned to prevent discoloration of concrete from rust.

E. Form liners for architectural concrete finish shall be installed in accordance with the manufacturer’s recommendations.

3.03 - ERECTION AND INSTALLATION

A. Forms shall be constructed in accordance with ACI 347 to required dimensions, plumb, straight and mortar tight. Forms shall be substantial, properly braced, and tied together to maintain position and shape and to resist all pressures to which they may be subject. Unless otherwise indicated on the Contract Documents, formwork shall be constructed so that the concrete surfaces will conform to the tolerance limits in ACI 117 and herein specified.

B. Provide means for holding adjacent edges and ends of form panels tight and in accurate alignment to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete.

C. Provide one cleanout and inspection opening 12 inches wide by 18 inches high every 7 feet at the bottom of each lift of forms.

D. Provide exterior corners of concrete members with chamfers as specified.

E. Provide means for removing forms without injury to the surface of finished concrete.

F. Do not embed any form-tying device or part thereof other than metal in the concrete.

G. Locate large end of taper tie on the "wet" side of the wall.

H. Use only form or form-tying methods that do not cause spalling of the concrete upon form stripping or tie removal.

I. Form surfaces of concrete members except where placement of the concrete against the ground is shown in the drawings or as indicated below. The dimensions of concrete members shown in the drawings apply to formed surfaces, except where otherwise indicated. Add 2 inches of concrete where concrete is placed against trimmed undisturbed ground in lieu of forms. Placement of concrete against the ground shall be limited to footings and other nonexposed concrete and only where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing.

J. Provide openings with continuous keyways and water stops. Provide a slight flare to facilitate grouting and the escape of entrained air during grouting. Provide formed openings with additional reinforcement as shown in the typical structural details. Reinforcing shall be at least 2 inches clear from the opening surfaces and encased items.

K. Set anchor bolts and other embedded items accurately before placing concrete and hold securely in position until the concrete is placed and set. Check special castings, channels, or other metal parts that are to be embedded in the concrete prior to and again after placing concrete. Check nailing blocks, plugs, and strips necessary for the attachment of trim, finish, and similar work prior to placing concrete.

3.04 - PROTECTION

A. During installation, the forms shall not be used as a storage platform nor as a working platform until the forms have been permanently fastened in position.

3.05 - PIPES AND WALL CASTINGS CAST IN CONCRETE

A. Install wall castings, wall flanges, and wall anchors before placing concrete. Do not weld, tie, or otherwise connect the wall castings or anchors to the reinforcing steel.

B. Pipes or wall castings located below operating water level shall have water stop ring collars and shall be cast in place. Do not block out such piping and grout after the concrete section is cast unless permitted, authorized or directed by the Engineer. Pipes fitted with thrust rings shall be cast in place.

3.06 - REMOVAL OF FORMS

A. Forms shall be removed in accordance with ACI 347 recommendations without damage to concrete and in a manner to ensure complete safety to the structure. Forms, form ties and bracing shall not be removed without specific permission of the Contractor's Registered Professional Engineer.

B. The following table indicates the minimum allowable time after the last cast concrete is placed before forms, shoring, or wall bracing may be removed; during which the air surrounding the concrete is above 50 degrees F.

TABLE 03100-2	
Sides of footings and encasements; Walls; Vertical sides of slabs, beams, girders; Columns; Similar members not supporting loads.	24 hours
Bottom forms of slabs, beams, and girders; and shoring for slabs, beams, and girders with immediate reshoring.	Until concrete strength reaches 70 percent specified 28-day strength
Bottom forms of slabs, beams, and girders; and shoring for slabs, beams, and girders without reshoring	Until concrete strength reaches specified 28-day design strength

C. Removal times will be increased if the concrete temperature following placement is permitted to drop below 50 degrees F.

D. Do not remove supports and reshore.

3.07 - PATCHING OF TAPERED TIE HOLES

A. Clear tie hole of all loose debris with a taper tie void brush and flush debris from tie hole with air or water.

B. Install plug from larger tie hole end in accordance with manufacturer’s instructions using an insertion tool as recommended by the manufacturer.

C. Fill each side of hole with mortar. Apply mortar to the "wet" side of the wall first. Consolidate mortar solidly into the hole.

3.08 - CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 03200

CONCRETE REINFORCEMENT

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PART 1 – GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide Concrete Reinforcement as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

C. Provide concrete reinforcement as indicated and specified including:

1. Reinforcement bars.
2. Welded wire reinforcement.
3. Reinforcement accessories.

D. Provide concrete reinforcement for architectural, civil, mechanical, and electrical work as shown on the drawings or specified under those disciplines.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Submit bar lists and placing drawings for all reinforced concrete and masonry structures in accordance with SECTION 01300, SUBMITTALS.
2. Detail reinforcement in conformance with ACI 315.
3. Clearly indicate bar sizes, spacing, locations, quantities and total weight of reinforcement steel and wire reinforcement, bending schedules, and supporting and spacing devices. Show joints, with applicable joint reinforcement and waterstops.
4. Coordinate bar splicing and placement with Contractor’s concrete placing schedule and joint locations. Do not add or delete joints without permission from the Engineer.
5. Show wall reinforcement in elevation. Show entire elevation of wall from top to bottom and end to end. Do not show partial elevations. Show all dowels, joints and pockets in walls.
6. Show slab reinforcement in plan view. Show all dowels, joints, openings and recesses in slabs.
7. Show location and size of all penetrations greater than 12-inches in diameter or least dimension of the opening with the corresponding added reinforcement around the penetrations.
8. Clearly show marking for each reinforcement item.
9. Indicate locations of reinforcement bar cut-offs, splices and development lengths.

C. Submit certified copies of mill test reports of reinforcement analysis dated within the last three months for each shipment of reinforcement with specific lots in shipments identified.

D. Chemical composition of reinforcement steel: Ladle analysis indicating percentage of carbon, phosphorous, manganese and sulfur present in steel.

E. Where mechanical couplers are required or permitted to be used to splice reinforcement steel, submit Manufacturer's literature that contains instructions and recommendations for installation for each type of coupler used; certified test reports that verify the load capacity of each type and size of coupler used; and Shop Drawings that show the location of each coupler with details of how they are to be installed in the formwork.

F. Unless otherwise acceptable to the Engineer, each submittal shall include reinforcement only for a single structure or part thereof. Shop drawings depicting multiple structures on the same sheet are not acceptable.

1.05 - PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer's written recommendations.

B. Keep reinforcement steel free from mill scale, rust, dirt, grease or other foreign matter.

C. Ship and store reinforcement steel with bars of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing the same "mark" designations as those shown on the submitted placing drawings.

D. Store reinforcement steel off the ground, protected from moisture and kept free from dirt, oil or other injurious contaminants.

1.06 - DESIGN CRITERIA

A. Do not fabricate reinforcement until shop and placement drawings have been reviewed and accepted by the Engineer.

B. Perform concrete reinforcement work in accordance with CRSI Manual of Practice and ACI 315**.**

C. An independent testing agency accepted by Engineer shall visually inspect and test reinforcing steel welds in accordance with AWS D1.4/D1.4M.

D. An independent testing agency accepted by Engineer shall inspect each mechanical coupler and verify each component is installed in accordance with Manufacturer's instructions and ICC Evaluation Services Report or equivalent code agency report.

1.07 - REFERENCES

A. ASTM International (ASTM)

1. ASTM A184 - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
2. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
3. ASTM A616 - Standard Specification for Rail-Steel Deformed and Plain Bars for Concrete Reinforcement.
4. ASTM A617 - Standard Specification for Axle-Steel Deformed and Plain Bars for Concrete Reinforcement.
5. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
6. ASTM A1064/A1064M - Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

B. American Concrete Institute (ACI)

1. ACI 301 - Standard Specification for Structural Concrete.
2. ACI 315 - Details and Detailing of Concrete Reinforcement.
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI 350 - Building Code Requirements for Environmental Engineering Concrete Structures

C. Concrete Reinforcing Steel Institute (CRSI)

1. CRSI Manual of Standard Practice.

2. CRSI Placing Reinforcing Bars.

D. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.08 - INSPECTION AND TESTING

A. In no case shall any reinforcement steel be covered with concrete until the installation of the reinforcement has been observed by the Engineer and the Engineer's authorization to proceed with the concreting has been obtained. The Engineer shall be given a minimum of 48 hours prior notice of the readiness of placed reinforcement for observation. The forms shall be kept open until the Engineer has finished observations of the reinforcement steel.

B. Provide Engineer with access to fabrication plant to facilitate inspection of reinforcement. Notify Engineer of commencement and duration of shop fabrication, in sufficient time to allow for proper inspection.

PART 2 - PRODUCTS

2.01 -REINFORCEMENT STEEL

A. Reinforcement Steel: ASTM A615/A615M, 60 ksi yield grade; deformed billet steel bars.

B. Reinforcement Steel to be Welded: ASTM A706/A706M, 60 ksi yield strength; deformed low-alloy steel bars.

C. Reinforcement Steel Plain Bar and Rod Mats: ASTM A704/A704M, ASTM A1064, Grade 60; steel bars or rods, unfinished.

D. Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A1064.

E. Reinforcement shall be clean and free from loose mill scale, dirt, grease, oil, form release agent, dried concrete or any material reducing bond with concrete.

F. Welded Wire Reinforcement:

1. Provide welded wire reinforcement conforming to ASTM A1064 in flat sheets.

2. Provide deformed welded wire reinforcement conforming to ASTM A1064 in flat sheets.

3. Provide support bars and reinforcement bar supports as specified herein to obtain the concrete cover indicated.

2.02 - ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage annealed type.

B. Chairs, Bolsters, Bar Supports, and Spacers: sized and shaped for strength and support of reinforcement during concrete placement including load bearing pad on bottom of base slabs and slabs on grade to prevent puncturing the vapor retarder.

C. Special Chairs, Bolsters, Bar Supports, and Spacers Adjacent to Weather Exposed Concrete Surfaces: plastic coated steel, stainless steel or plastic type; size and shape as required.

D. Provide 3-inch by 3-inch plain precast concrete blocks, precast concrete doweled blocks or concrete brick for support of bottom reinforcement in foundation mats, base slabs, footings, pile caps, grade beams and slabs on grade. Provide block thickness to produce concrete cover of reinforcement as indicated.

E. Mechanical Couplers

1. Reinforcement Tension Bar Splicers:

a. Cadweld or Lenton rebar splicers by Erico Products, Inc. and Dayton Barsplice, Inc., or equal.

b. DB-SAE splicer system by Richmond Screw Anchor Company, Inc., C2D rebar flange coupler by Williams Form Engineering Corporation and Lenton Form Saver by Erico Products, Inc., or equal.

c. Develop minimum 125 percent of yield capacity of bars spliced in tension when tested as assembly in accordance with ASTM A370 and A615.

F. Reinforcement Compression Bar Splicers:

1. Manufacturers: G-Loc splicers by Gateway Building Products Division

2. Speed-Sleeve by Erico Products, Inc.

G. Provide epoxy for grouting reinforcement bars specifically formulated for such application for the moisture condition, application temperature, and orientation of the hole to be filled. Epoxy grout shall meet the requirements in SECTION 03600, GROUT.

2.03 - FABRICATION

A. Fabricate concrete reinforcement in accordance with CRSI Manual of Standard Practice, ACI 315 and ASTM A184/A184M.

B. Weld reinforcement in accordance with AWS D1.4 only when permitted by the Engineer.

C. Locate reinforcement splices not indicated on Drawings, at point of minimum stress.

D. Cold bend bars. Do not straighten or rebend bars.

E. Do not heat reinforcement steel to bend or straighten.

F. Bend bars around a revolving collar having a diameter of not less than that recommended by ACI 318.

G. Cut bar ends that are to be butt spliced, or threaded by saw cutting. Terminate such ends in flat surfaces within 1-1/2 degrees of a right angle to the axis of the bar.

PART 3 - EXECUTION

3.01 - INSTALLATION

A. Place, support and secure reinforcement against displacement. Do not deviate from required position. Place reinforcement a minimum of 2 inches clear of any metal pipe or fittings.

B. Do not displace or damage vapor retarder.

C. Position dowels accurately. Rigidly support, align and securely tie dowels normal to the concrete surface before concrete placement. Setting dowels into wet concrete is prohibited.

D. Position wall dowels projecting from base slabs on grade with templates or guides held in place above the concrete placement line. Position the templates to obtain the required clearance between the dowels and the face of the walls.

E. Bars additional to those indicated that may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position shall be provided by the Contractor at no additional cost to the Owner.

F. Do not extend continuous reinforcement or other fixed metal items through expansion joints. Provide 2 inches clearance from each face of expansion joint.

G. Provide additional reinforcement bars to support top reinforcement in slabs. Do not shift reinforcement bars from positions in upper layers to positions in lower layers as a substitute for additional support bars.

H. Support reinforcement steel in accordance with CRSI “Placing Reinforcement Bars” with maximum spacing of 4-feet-0-inches.

I. Tie reinforcement steel at intersections in accordance with CRSI “Placing Reinforcement Bars”:

1. Maximum tie spacing for footings, walls and columns: every third intersection or 3 feet.

2. Maximum spacing for slabs and other work: every fourth intersection or 3 feet.

3. Tie a minimum of 25 percent of all intersecting bars in foundation mats, base slabs, footings, pile caps, slabs on grade and elevated slabs.

4. Secure all dowels in place before placing concrete.

5. Tie wires shall be bent away from the forms and from finished concrete surfaces in order to provide the required concrete coverage.

J. Locate reinforcement to avoid interference with items drilled in later, such as concrete anchors.

K. Extend welded wire reinforcement to within 2 inches of edges of slab or section. Lap sheets at least 12 inches or two wire spaces, whichever is greater, at ends and edges and wire tightly together. Stagger end laps.

L. Unless shown otherwise on Drawings, place welded wire reinforcement in slabs on grade between the upper third point and mid-point of slab. Placing welded wire reinforcement on the subgrade and pulling it up during concrete placement is not permitted.

M. Support welded wire reinforcement placed over the ground on wired concrete blocks spaced not more than 3 feet on centers in any direction.

N. Support welded wire reinforcement placed over horizontal forms on slab bolsters spaced not more than 30 inches on center.

O. Mechanical coupler systems may be substituted for dowels at Contractor's option when permitted by Engineer.

P. Provide additional reinforcement bars to support ties and stirrups in beams where top reinforcement is not continuous.

Q. Securely support and tie reinforcement steel to prevent movement during concrete placement.

R. Unless otherwise shown on the Drawings or permitted by the Engineer, do not bend reinforcement bars that project from in-place concrete.

S. Do not weld reinforcement steel bars (including tack welded) either during fabrication or erection. Immediately remove bars that have been welded, including tack welds, without such permission from the work.

T. Reinforcement steel interfering with the location of other reinforcement steel, conduits or embedded items may be moved up to 3 inches. Make greater displacement of bars to avoid interference only with the permission of the Engineer. Do not cut reinforcement to install inserts, conduits, mechanical openings or other items without the prior permission from the Engineer.

U. Setting bars and welded wire reinforcement on layers of fresh concrete as the work progresses or adjusting reinforcement during the placement of concrete is prohibited.

V. Provide and place safety caps on all exposed ends of vertical reinforcement that pose a danger to injury or life safety.

3.02 - REINFORCEMENT AROUND OPENINGS AND PENETRATIONS

A. Accommodate placement of formed openings and penetrations.

B. Unless specific additional reinforcement around openings and penetrations is shown on the Drawings, provide additional reinforcement steel on each side of opening or penetration equivalent to one half of the cross-sectional area of the reinforcement steel interrupted by an opening or penetration. The bars shall have sufficient length to be fully developed at each end beyond the opening or penetration.

C. Refer to details on Drawings for additional diagonal bars around openings or penetrations and bar extension length on each side of openings or penetrations.

3.03 - SPLICING OF REINFORCEMENT

A. Splices may be used to provide continuity due to bar length limitations. Do not splice reinforcement that is detailed to be continuous in the Drawings.

B. Provide tension lap splices at all laps in compliance with ACI 318. Class A splices may be used when 50 percent or less of the bars are spliced within the required lap length. Use Class B splices at all other locations.

C. Except as otherwise indicated on the Drawings, stagger splices in circumferential reinforcement in circular walls using Class B tension splices. Do not splice adjacent bars within the required lap length.

D. Make splices for reinforcement in tension tie members, with a full mechanical splice and staggered at least 30 inches.

E. Make splices in column spiral reinforcement, when necessary, by a lap of 1-1/2 turns.

F. Reinforcement shall be continuous through construction joints.

G. Reinforcement may be spliced at construction joints provided that entire lap is placed within only one concrete placement.

3.04 - ACCESSORIES

A. Provide accessories such as chairs, chair bars and the like in sufficient quantities and strength to adequately support the reinforcement and prevent its displacement during the erection of the reinforcement and the placement of concrete.

B. Use precast concrete blocks where the reinforcement steel is to be supported over soil.

C. Provide stainless steel bar supports or steel chairs with plastic tips where the chairs are set on forms for a concrete surface that will be exposed to weather, high humidity or liquid (including bottom of slabs over liquid containing areas) unless otherwise noted on contract documents.

D. Do not use metal chairs, ferrous clips, nails, etc. that extend to the surfaces of the concrete. Do not use stones, brick or wood block supports.

E. Do not use alternate methods of supporting top steel in slabs, such as steel channels supported on the bottom steel or vertical reinforcement steel fastened to the bottom and top mats unless permitted by the Engineer.

F. Mechanical Couplers:

1. Couplers that are located at a joint face can be a type that can be set either flush or recessed from the face as indicated.

2. Seal couplers during concrete placement to completely eliminate concrete or cement paste from entering.

3. Recess couplers intended for future connections a minimum of 1/2 inch from the concrete surface. After the concrete is placed, plug the coupler with plastic plugs that have an O-ring seal and the recess filled with sealant to prevent any contact with water or other corrosive materials.

4. Unless indicated otherwise, provide mechanical coupler spacing and size to match the spacing and size of the reinforcement indicated for the adjacent section.

3.05 - FIELD QUALITY CONTROL

A. Remove reinforcement with kinks or bends not shown on shop or placement drawings. Remove such reinforcement from job site and replace with new fabricated steel. Do not field bend of reinforcement unless reinforcement is indicated or specified to be field bent.

B. Protect reinforcement from rusting, deforming, bending, kinking and other injury. Clean in-place reinforcement that has rusted, or been splattered with concrete using sand or water blasting prior to incorporation into the Work.

3.06 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 03250

CONCRETE JOINTS AND ACCESSORIES

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PART 1 - GENERAL

1.01 - SCOPE

A. This section describes materials, testing, and installation of concrete joints and accessories as specified and as shown on contract drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification section number and title and Drawing numbers and titles.

1. Manufacturer's printed data and application instructions for specified materials and locations where materials are to be used.
2. Submit one sample of each type of water stop.
3. Submit layouts for joints.
4. Certification that materials used within the joint system are compatible with each other.

1.05 - PRODUCT HANDLING

A. Comply with the requirements of SECTION 01610, DELIVERY, STORAGE AND HANDLING.

B. Transport, handle and deliver materials to the job site in the manufacturer's sealed bags, unopened containers or banded pallets.

C. Store materials off the ground on a platform or skids and protect with covers from snow, rain and ground splatter.

D. Store expansion joint compounds in a dry location where they cannot freeze.

E. Store plastic products under cover in a dry location, out of direct sunlight.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns.

B. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

C. Quality Assurance

1. Comply with requirements in SECTION 01400, QUALITY ASSURANCE and as specified.
2. Do not add, relocate or omit joints without written permission from the Engineer.
3. Reject material exceeding expiration date for use.
4. Clean concrete surfaces to receive expansion joint compound in accordance with the printed instructions of the joint compound manufacturer.
5. In structures to contain potable water, use joint materials that are ANSI/NSF 61 approved for contact with potable water.

1.07 - REFERENCES

A. ASTM International (ASTM):

1. A276: Standard Specification for Stainless Steel Bars and Shapes.
2. C920: Specification for Elastomeric Joint Sealants
3. C1193: Guide for Use of Joint Sealants
4. D1752: Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

B. Environmental Protection Agency (EPA):

1. 40 CFR 59: National Volatile Organic Compound Emission Standards for Consumer and Commercial Products.

C. Corps of Engineers:

1. CRD-C 572: Specifications for Polyvinylchloride Waterstop.

D. Federal Specifications:

1. TT-S-00230C: Sealing Compound: Elastomeric Type, Single Component

E. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.08 - MANUFACTURER'S SERVICES

A. Prior to joint preparation for joints receiving sealant materials, require joint manufacturer's technical representative to demonstrate, on site, joint preparation, priming, and sealant materials application for the Contractor's personnel performing joint work.

PART 2 - PRODUCTS

2.01 - ELASTOMERIC JOINT SEALANT

A. Federal Specification TT-S-00230C Type 1, Class A, single component, cold applied, pourable, polyurethane.

1. Products:
   a. Euclid Chemical Corp; Eucolastic 1
   b. Mameco ; Vulkem 45
   c. Or equal.

2.02 - JOINT SEALANT FOR CONCRETE STRUCTURES

A. Joint sealant shall be a multipart, gray, nonstaining, nonsagging, gun grade polyurethane sealant, which cures at ambient temperature to a firm, flexible, resilient, tear-resistant rubber. Sealant shall comply with ASTM C920, Type M, Grade P, Class 25 for horizontal joints and Grade NS, Class 25 for vertical joints and be recommended by the manufacturer for continuous immersion in water. Troweling of sealants into joints will not be permitted. Sealant shall meet requirements in Table 03250-1.

TABLE 03250-1

Characteristic or Parameter	Technical Requirements
Pot life	1 to 3 hours
Hardness	35 Shore A, +/- 5
Elongation	650 percent, ASTM D412
Tensile strength	200 psi, ASTM D412
Peel strength on concrete	No adhesion loss at 25 pounds
Temperature service range	40 to 167 degrees F
Immersion in water	Continuous

B. Products:

1. Tremco; Vulkem 227 or Vulkem 245 (for Type M, Grade P, Class 25)
2. Sika Corporation; Sikaflex-2CNS (for Grade NS, Class 25), Sikaflex-2CSL
3. Or equal.

C. For applications on walls and surfaces inclined more than 30 degrees from the horizontal, use multi-component chemical resistant polysulfide sealant conforming to ASTM C920, Type M, Grade NS, Class 25.

1. Sonneborn ; Sonolastic Two-part
2. Tamms; Hornflex-L
3. DuPont; Cormax PSC
4. Or equal.

2.03 - EPOXY JOINT SEALANT

A. 100 percent solids per ASTM D1259, two-part epoxy with an instantaneous Shore D hardness of 50 to 65 per ASTM D2240.

1. Metzger-McGuire Co.; MM80 or Edge Pro50
2. Euclid Chemical Corp. ; Euco700
3. Or equal.

2.04 - BACKING ROD FOR EXPANSION JOINTS

A. Provide an extruded closed-cell polyethylene foam rod. The rod shall be 1/4-inch larger in diameter than the joint width. Where possible, provide full-length sections for the joint; minimize splices.

1. Industrial Systems Department; Minicel backer rod
2. Hercules, Inc.; Plastic Products Group
3. Or equal.

2.05 - BOND BREAKER TAPE

A. Provide an adhesive-backed glazed butyl or polyethylene tape that will adhere to the premolded joint material or concrete surface. The tape shall be the same width as the joint. The tape shall be compatible with the sealant.

2.06 - PREFORMED CONTROL JOINT

A. One-piece, flexible, PVC joint former.

1. Vinylex Corp.; Kold-Seal Zip-Per Strip KSF-150-50-50

2. Or equal.

B. One-piece steel strip with preformed groove

1. Burke Concrete Accessories, Inc.; Keyed Kold Retained Kap

2. Or equal.

C. Provide the preformed control joint material in full-length unspliced pieces.

2.07 - PREMOLDED JOINT FILLER FOR PAVEMENTS AND SLABS

A. Joint filler shall be preformed, nonextruded type constructed of closed-cell neoprene conforming to ASTM D1752, Type I

B. Bituminous-type preformed expansion joint filler conforming to ASTM D994.

2.08 - PREMOLDED JOINT FILLER FOR LIQUID CONTAINMENT STRUCTURES

A. Self-expanding cork per ASTM D1752, Type III.

B. Sponge Rubber per ASTM D1752, Type I. Preformed, nonextruded type constructed of closed-cell neoprene.

2.09 - EXPANSION JOINT DOWELS

A. Stainless steel bar dowels conforming to ASTM A276, Type 316.

B. Thoroughly grease expansion joint dowels prior to placing adjoining (2nd placement) wall or slab concrete.

2.10 - STYROFOAM FILLER BLOCK

A. Styrofoam filler blocks for future construction and expansion joints.

1. Products:

a. Dow Chemical Company; Styrofoam SM brand

b. Or equal.

2.11 - VOC LIMITS FOR SEALANTS, AND SEALANT PRIMERS

A. VOC limits for sealants, and sealant primers to comply with content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24), or applicable state and local codes containing more stringent requirements.

2.12 - BOND BREAKER FOR JOINT COMPOUNDS

A. Provide polyethylene tape.

PART 3 - EXECUTION

3.01 - JOINTS

A. Make joints only at locations shown on the contract drawings or as permitted by the Engineer. Any addition or relocation of construction joints proposed by the Contractor, must be submitted to the Engineer for written permission.

B. Relocate additional joints where they least impair strength of the member. In general, locate joints within the middle third of spans of slabs, beams and girders. If a beam intersects a girder at the joint, offset the joint a distance equal to twice the width of the member being connected. Locate joints in walls and columns at the underside of floors, slabs, beams or girders and at tops of footing or floor slabs.

C. Cast slabs and beams monolithically without horizontal joints unless specifically indicated on the drawings.

D. Do not use horizontal joints within foundation mats, base slabs, footings, pile caps, slabs on grade or elevated beams and slabs.

E. Provide joints in concrete fills and toppings at the same location as the joints in the supporting concrete.

F. Provide waterstops in all wall and slab joints in liquid containment structures and at locations shown on the contract Drawings. Do not provide metal waterstops unless permitted by Engineer.

G. Construction Joints

1. Provide flat ribbed waterstops at construction joints where shown on contract drawings and specified herein.

2. Allow 72 hours between placements of adjacent slabs.

3. Where joint key ways are shown on contract drawings form keyways by beveled strips or boards placed at right angles to the formed face. Except where otherwise shown on contract drawings or specified, keyways shall be at least 1-1/2 inches in depth over at least 25 percent of the width of the section.

4. After the placement has been completed to the construction joint and the concrete has hardened, thoroughly clean the entire surface of the joint of surface laitance, loose concrete, foreign material, and expose clean aggregate by sandblasting or waterblasting the surface of construction joints before placing the new concrete. Cover horizontal construction joints with mortar. Spread uniformly and work thoroughly into irregularities of the surface. The water-cement ratio of the mortar in place shall not exceed that of the concrete to be placed, and the consistency of the mortar shall be suitable for placing and working.

5. In case of emergency, place additional construction joints. (An interval of 45 minutes between two consecutive batches of concrete shall constitute cause for an emergency construction joint.)

H. Contraction Joints:

1. Do not use of control joints in liquid contain structures.

2. Provide 6-inch, center-bulb waterstop at contraction joints where shown on contract drawings and specified herein.

3. Where specifically noted on the Drawings, coat the concrete surface with a bond breaker prior to placing new concrete against it. Avoid coating reinforcement or waterstops with bond breaker at these locations.

4. Full contraction joints

a. Do not extend reinforcement or other embedded items bonded to the concrete (except stainless steel dowels bonded on only one side of joint) continuously through any expansion joint.

b. Where shown on contract drawings provide stainless steel expansion joint dowels. Secure stainless steel dowels tightly in forms with rigid ties. Orient dowels to permit joint movement.

5. Partial contraction Joints

a. Extend every other bar of reinforcement steel through partial contraction joints or as indicated on the drawings.

I. Control Joints:

1. Do not use of control joints in liquid containment structures.
2. Locate control joints as shown on the Contract Drawings.
3. Form control joints with control joint inserts or sawcuts.
4. For sawcutting:
   a. Using early entry saws, saw joints in slabs before the formation of uncontrolled cracking (i.e., cracking that occurs at locations other than construction, control, or contraction joints) and as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling, or tearing.
   b. Fill saw cut to full depth with elastomeric joint sealant for joints not exposed to vehicular traffic. Fill joints to full depth with epoxy joint sealant for joints exposed to vehicular traffic.
5. Unless noted otherwise on the Contract Drawings, total reduction in concrete member thickness shall be at least 1/4 the member thickness.

J. Expansion Joints:

1. Size and location of expansion joints shall be as shown on the Contract Drawings.
2. Provide 9 inch, center-bulb waterstop at expansion joints where shown on contract drawings and specified herein.
3. Do not extend reinforcement or other embedded items bonded to the concrete (except stainless steel dowels bonded on only one side of joint) continuously through any expansion joint.
4. Install stainless steel expansion joint dowels parallel to wall or slab face, perpendicular to the joint face, and in true horizontal position. Secure stainless steel expansion joint dowels tightly in forms with rigid ties. Orient dowels to permit joint movement.

3.02 - INSTALLATION OF JOINT SEALANTS

A. Immediately before installing the joint sealant, clean the joint cavity by sandblasting or power wire brushing. Install bond breaker tape per manufacturer's instructions.

B. Apply masking tape along the edges of the exposed surface of the exposed joints.

C. Application criteria for the sealant materials, such as temperature and moisture requirements and primer cure time, shall be in accordance with the recommendations of the sealant manufacturer.

D. After the joints have been prepared as described above, apply the joint sealant. Apply the primer, if required, and joint sealant only with the equipment and methods recommended by the joint sealant manufacturer.

E. Trowel the joints smooth with a tuck pointing tool wiped with a solvent recommended by the sealant manufacturer.

F. After the sealant has been applied, remove the masking tape and any sealant spillage.

G. Sealants used in water retaining structures shall achieve final cure at least seven days before the structure is filled with water.

3.03 - LEAKAGE TESTING

A. Test hydraulic structures in accordance with SECTION 03800, LEAKAGE TESTING OF CONTAINMENT STRUCTURES.

3.04 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 03300

CAST-IN-PLACE CONCRETE

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PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, equipment and incidentals required for the furnishing and installation of all materials required to provide Cast-in-Place Concrete as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

C. Provide cast-in-place concrete for architectural, civil, mechanical, and electrical work as shown on the drawings or specified under specified under those disciplines.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Product Data
    a. Manufacturer's specifications and instructions for all admixtures and curing materials. Manufacturer’s certification of compatibility of all admixtures.
2. Shop Drawings
    a. Provide certification that cement used complies with ASTM C150 and these specifications.
    b. Provide certification that aggregates comply with ASTM C33. Submit gradation analysis with concrete mix designs.

c. Provide certification of compliance with these specifications from the manufacturer of the concrete admixtures.

d. Prepare mix designs in accordance with ACI 318, except as modified herein.

1) Submit concrete mix designs, laboratory 7-day and 28-day compressive test results and laboratory shrinkage test results for review and approval by the Engineer.

2) Alternatively, submit test reports of 7- and 28-day compressive tests and shrinkage test results of the proposed mix where that same mix has been used on two previous projects in the past twelve months.

3) Do not use any concrete mixes in the work that have not been approved by the Engineer.

e. Plant Qualification Submit certification from the National Ready Mixed Concrete Association indicating compliance with the specified qualification requirements.

3. Test and Evaluation Reports

a. Provide results of drying shrinkage tests from trial concrete mixes by the Contractor's testing laboratory firm.

4. Manufacturers' Instructions

a. Provide epoxy bonding compound manufacturer's specific instructions for use. Provide manufacturer's certifications as to suitability of product to meet job requirements with regard to surface, pot life, set time, vertical or horizontal application, and forming restrictions.

5. Field Quality Control Submittals

a. Provide delivery tickets for ready-mix concrete or weigh masters certificate per ASTM C94, including weights of cement and each size aggregate and amount of water added at the plant and record of placements. Record the amount of water added on the job on the delivery ticket. Water added at the plant shall account for moisture in both coarse and fine aggregate and liquid admixtures.

b. Batch tickets shall include the following information

1) Load number, truck number and driver's name

2) Strength of concrete (compression strength)

3) Amount of concrete (cu. yds.)

4) Time truck was charged with cement

5) Revolution counter reading at first addition of water

6) Type, brand and amount of cement

7) Type, brand and amount of admixtures

8) Amount of water withheld at the plant (if any)

9) Information necessary to calculate total mixing water

10) Maximum size of aggregate

11) Weights of fine and coarse aggregates

12) Signature of ready-mix representative

13) Concrete temperature at batching plant

14) Type and amount of fly ash, other pozzolan or slag cement.

1.05 - PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance.

B. Deliver concrete to discharge locations in watertight agitator or mixer trucks without altering the specified properties of water- cementitious materials ratio, slump, air entrainment, temperature and homogeneity.

C. Reject concrete not conforming to specification, unsuitable for placement, exceeding the time or temperature limitations or not having a complete delivery batch ticket.

1.06 - DESIGN CRITERIA

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE.

B. Concrete not meeting the minimum specified 28-day design strength shall be cause for rejection and removal from the work.

C. Perform concrete work in conformance with ACI 301 unless otherwise specified.

D. Do not use calcium chloride or admixtures containing calcium chloride.

E. Do not place concrete until design mix, material tests and trial concrete batch mix compression and shrinkage test results are approved by the Engineer. Approvals shall be obtained at least 30-days prior to the need for use on the job site.

F. The Contractor shall employ an independent testing laboratory, acceptable to the Engineer, to develop concrete mix designs and testing.

G. The Contractor shall employ an independent testing laboratory, acceptable to the Engineer, to test the conformity of materials proposed for use in the concrete mixes to the project specifications and to design and test concrete mixes proposed for use. Concrete testing shall be performed by an ACI Concrete Field Technician, Grade I or equivalent. The Contractor shall allow free access to obtain test samples.

H. The Owner shall employ an independent testing laboratory, acceptable to the Engineer, to test conformity of materials placed into the work during construction. Concrete testing shall be performed by an ACI Concrete Field Technician, Grade I or equivalent. The Contractor shall allow free access to obtain test samples.

I. Methods of Sampling and Testing

1. Fresh Concrete Sampling - ASTM C 172
2. Specimen Preparation - ASTM C 31
3. Compressive Strength ASTM C 39
4. Air Content ASTM C 231
5. Slump ASTM C 143
6. Temperature ASTM C 1064
7. Unit Weight ASTM C 138
8. Obtaining Drilled Cores ASTM C 42
9. Drying Shrinkage ASTM C 157

J. Acceptance of Structure Acceptance of completed concrete work requires conformance with dimensional tolerances, appearance and strength as indicated or specified.

K. Hot weather concrete to conform to ACI 305 and as specified herein.

L. Cold weather concrete to conform to ACI 306 and as specified herein.

M. Reject concrete delivered to job site that exceeds the time limit specified.

N. Reject concrete delivered to job site that exceeds the concrete temperature limitations specified.

O. Do not place concrete in water or on frozen or uncompacted ground.

1.07 - REFERENCES

A. American Concrete Institute (ACI)

1. ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
2. ACI 301 Specifications for Structural Concrete
3. ACI 304R Guide for Measuring, Mixing, Transporting and Placing Concrete
4. ACI 304.2R Placing Concrete by Pumping Methods
5. ACI 305.1 Specification for Hot Weather Concreting
6. ACI 306.1 Standard Specification for Cold Weather Concreting
7. ACI 308.1 Specification for Curing Concrete
8. ACI 318 Building Code Requirements for Structural Concrete
9. ACI 350 Code Requirements for Environmental Engineering Concrete Structures

B. ASTM International (ASTM) Publications

1. A 123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
2. A 153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
3. C 31 Standard Practice for Making and Curing Concrete Test Specimens in the Field
4. C 33 Standard Specification for Concrete Aggregates
5. C 39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
6. C 40 Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
7. C 42 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
8. C 87 Standard Test Method for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar
9. C 88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
10. C 94 Standard Specification for Ready-Mixed Concrete
11. C 109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or (50-mm) Cube Specimens)
12. C 123 Standard Test Method for Lightweight Particles in Aggregate
13. C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
14. C 138 Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
15. C 143 Standard Test Method for Slump of Hydraulic Cement Concrete
16. C 150 Standard Specification for Portland Cement
17. C 157 Standard Test Method for Length Change of Hardened Hydraulic Cement, Mortar and Concrete
18. C 171 Standard Specification for Sheet Materials for Curing Concrete
19. C 172 Standard Practice for Sampling Freshly Mixed Concrete
20. C 192 Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
21. C 231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
22. C 260 Standard Specification for Air-Entraining Admixtures for Concrete
23. C 289 Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)

24. C 295 Standard Guide for Petrographic Examination of Aggregates for Concrete
25. C 309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
26. C 311 Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete
27. C 494 Standard Specification for Chemical Admixtures for Concrete
28. C 595 Standard Specification for Blended Hydraulic Cements
29. C 618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
30. C 881 Standard Test Method for Epoxy Resin Base Bonding Systems for Concrete
31. C 882 Standard Test Method for Bond Strength of Epoxy Resin Systems Used with Concrete by Slant Shear
32. C 989 Standard Specification for Slag Cement for Use in Concrete and Mortars
33. C 1017 Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
34. C 1064 Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete
35. C 1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
36. C 1116 Standard Specification for Fiber Reinforced Concrete
37. C 1240 Standard Specification for Silica Fume Used in Cementitious Mixtures
38. C 1602 Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
39. D 75 Standard Practice for Sampling Aggregates
40. E 154 Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
41. E 329 Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials used in Construction

C. American Association of State Highway and Transportation Officials (AASHTO)

1. M182 Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats.

D. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.08 - SHRINKAGE TESTS

A. The testing laboratory shall perform drying shrinkage tests for the trial batches as specified herein. Shrinkage limitations apply only to concrete for liquid containing structures.

B. Fabricate, cure, dry, and measure specimens in accordance with ASTM C157 modified as follows

1. Remove specimens from molds at an age of 23 hours +/- 1 hour after trial batching, place immediately in water at 70 degrees F +/- 3 degrees F for at least 30 minutes, measure within 30 minutes thereafter to determine original length, and then submerge in saturated lime water at 73 degrees F +/- 3 degrees F.
2. At age seven-days, take measurements to determine expansion, expressed as a percentage of original length. This length at age seven-days shall be the base length for drying shrinkage calculations (zero-days' drying age).
3. Immediately place specimens in a humidity-controlled room maintained at 73 degrees F +/- 3 degrees F and 50 percent +/- 4 percent relative humidity for the remainder of the test.
4. Report measurements to determine shrinkage expressed as percentage of the base length separately for 7, 14, 21, and 28-days of drying after 7-days of moist curing.

C. Compute the drying shrinkage deformation of each specimen as the difference between the base length (at zero-days' drying age) and the length after drying at each test age.

1. Compute the average drying shrinkage deformation of the specimens to the nearest 0.0001-inch at each test age.

2. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004-inch, disregard the results obtained from that specimen.

3. Report results of the shrinkage test to the nearest 0.001 percent of shrinkage.

D. Take compression test specimens in each case from the same concrete used for preparing drying shrinkage specimens. These tests shall be considered a part of the normal compression tests for the project.

E. Acceptance of Test Results The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age, shall be 0.028 percent or 0.032 percent, respectively.

1. Use only mix designs for construction that have first met the trial batch shrinkage and compression requirements.

2. If the trial batch specimens do not meet both the strength and shrinkage requirements, revise the mix designs and/or materials and retest.

1.09 - WORKABILITY

A. Concrete shall be of such consistency and composition that it can be worked readily into the forms and around the reinforcement without excessive vibrating and without permitting the materials to segregate or free water to collect on the surface.

1.10 - SITE CONDITIONS

A. Do not place concrete until conditions and facilities for making and curing control test specimens are in compliance with ASTM C 31 and as specified herein.

PART 2 - PRODUCTS

2.01 - MATERIALS

A. Cement

1. Portland cement, ASTM C150, Type II; or blended hydraulic cement, ASTM C595, Type IP (MS).

2. Type IP (MS) shall not be used for concrete to come in contact with potable water.

3. Use only one brand of cement in any individual structure. Use no cement that has become damaged, partially set, lumpy, or caked. Reject the entire contents of the sack or container that contains such cement. Use no salvaged or reclaimed cement.

4. Maximum tricalcium aluminate shall not exceed 8 percent. The maximum percent alkalis shall not exceed 0.6 percent.

B. Fly Ash

1. Provide fly ash conforming to the following requirements

a. Class F fly ash conforming to ASTM C 618 for chemical and physical properties.

b. Supplemental requirements in percent

(1) Maximum carbon content 3%

(2) Maximum sulfur trioxide (SO3) content 4%

(3) Maximum loss on ignition 3%

(4) Maximum water requirement (as a percent of control) 100%

(5) Fineness, maximum retained on No. 325 sieve 25%

C. Slag Cement

1. Slag cement, when used, shall meet the requirements of ASTM C989, Grade 100 or better.

D. Silica Fume

1. Silica fume, when used, shall meet the requirements of ASTM C1240.

a. Products

(1) BASF Corporation; MasterLife SF 100.

(2) Sika Corporation; Sikacrete 950DP

(3) Euclid Chemical Company; Eucoshot MSA

(4) Or equal.

E. Fine Aggregates

1. Clean, sharp, natural sand conforming to requirements of ASTM C33 with a fineness modulus between 2.50 and 3.0.

2. Aggregates sourced from locations known to contain Pyrrhotite or other deleterious materials shall not be acceptable.

F. Coarse Aggregate

1. Well graded crushed stone, natural rock conforming to requirements of ASTM C33.

2. Limit deleterious substances in accordance with ASTM C33, Table 3, Severe Weathering Regions, limit clay lumps not to exceed 1.0 percent by weight, and limit loss when tested for soundness using magnesium sulfate to 12 percent.

3. Test conformity of aggregate and confirm that aggregates intended for use in concrete are potentially non-reactive when tested in conformance with ASTM C 289.

4. Aggregates sourced from locations known to contain Pyrrhotite or other deleterious materials shall not be acceptable.

G. Water and Ice

1. Use water and ice free from injurious amounts of oil, acid, alkali, salt, organic matter or other deleterious substances and conforms to requirements of ASTM C1602.

2. Water shall not contain more than 500 mg/L of chlorides or more than 500 mg/L of sulfate.

3. Heat or cool water to obtain concrete temperatures specified, and in conformance with ACI 305.1 and ACI 306.1.

H. Color Additive for Exterior Electrical Duct Encasement

1. For exterior electrical duct concrete encasements, use a color additive for identification purposes.

I. Concrete Admixtures

1. Maintain compressive strength and maximum water-cementitious materials ratios specified in Table 03300-1 when using admixtures. Include all admixtures in solution form in the water-cementitious materials ratio calculations. Do not use any admixture that contains intentionally-added chlorides or other corrosive elements. Admixtures shall be used in compliance with the manufacturer's printed instructions. The manufacturer shall certify the compatibility of multiple admixtures used in the same mix. Do not use admixtures in greater dosages than recommended by manufacturer.

2. Air Entrainment

a. Air-entraining admixture shall conform to ASTM C260.

b. Products

(1) BASF Corporation – MasterAir AE 90, MasterAir VR 10, or MasterAir AE 200

(2) Sika Corporation, AER.

(3) WR Grace & Co.; Darex II-AEA

(4) Or equal.

c. Adjust the admixture content to accommodate fly ash or other pozzolan requirements, and other admixtures when used, in order to obtain the specified air content.

3. Water Reducing

a. Water-reducing admixture shall conform to ASTM C494, Type A and be compatible with the air-entraining admixture.

b. Products

(1) BASF Corporation; MasterPozzolith Series or MasterPolyHeed Series

(2) Sika Corporation, Plastocrete 161

(3) WR Grace & Co.; Daracem 65

(4) Euclid Chemical Company; Eucon NW

(5) Or equal.

4. Water Reducing and Retarding

a. Water-reducing and retarding admixture shall conform to ASTM C494, Type D and compatible with the air-entraining admixture.

b. Products

(1) BASF Corporation; MasterPozzolith Series

(2) Sika Corporation; Plastiment

(3) WR Grace & Co.; WRDA 64

(4) Or equal.

5. Accelerating

a. The use of accelerating admixtures is not permitted.

6. High-Range Water-Reducing Admixture (Superplasticizer)
    a. High-Range water-reducing admixture shall conform to ASTM C494, Type F or ASTM C1017, Type I.
    b. Products
        (1) BASF Corporation; MasterRheobuild 1000 or MasterGlenium Series
        (2) WR Grace & Co.; Daracem 100
        (3) Euclid Chemical company; Eucon SPC
        (4) Or equal.
7. Workability-Retaining Admixture
    a. Workability-enhancing admixture shall conform to ASTM C 494, Type S.
    b. Products
        (1) BASF Corporation – MasterSure Z 60
        (2) WR Grace & Co.; Adva XT2
        (3) Or equal.
8. Shrinkage Reducing Admixture
    a. Shrinkage-reducing admixture is permitted to be used in the mix to meet shrinkage limitations provided that specified strength are met and there is no reduction in sulfate resistance and no increase in permeability. Quantity of shrinkage-reducing admixture used in the mix shall be added to the quantity of water for purposes of determining the water/cementitous materials ratio.
    b. Products
        (1) BASF Corporation; MasterLIFE SRA 20
        (2) WR Grace & Co.; Eclipse 4500
        (3) Euclid Chemical company; Eucon SRA
        (4) Or equal.

K. Fiber Reinforcement
1. Fiber reinforcing shall conform to ASTM C 1116, Type III.
2. Fibers shall be 100 percent virgin polypropylene fibrillated fibers containing no reprocessed olefin materials and specifically manufactured to an optimum gradation for use as concrete secondary reinforcement
3. Dosage Rate Volume of fibers shall be a minimum of 3 pounds per cubic yard.
4. Physical Characteristics
    a. Specific gravity 0.91
    b. Tensile strength 40,000 to 110,000 psi
    c. Minimum Fiber length 1/2-inch

5. Fibrous concrete reinforcement materials provided in this section shall produce concrete conforming to the requirements for strength of concrete specified.
    a. Products
        (1) BASF Corporation “MasterFiber MAC” Series
        (2) WR Grace & Co. STRUX 90/40
        (3) Propex Operating Company,LLC Enduro 600
        (4) Or equal.

L. Epoxy Bonding Agent
1. Epoxy bonding agent shall conform to ASTM C881 Type I, II, IV or V; Grade 2 for epoxy resin adhesives, depending on the application. The class of epoxy bonding agent shall be suitable for all ambient and substrate temperatures.
2. Products
    a. Sika Corp.; Sikadur 32 Hi-Mod
    b. Euclid Chemical Company; Duralcrete
    c. BASF Corporation; MasterEmaco ADH 326
    d. Or equal

M. Vapor Retarder 10 mil polyethylene sheet conforming to ASTM E 154

N. Curing Compound
1. Liquid form, which will form impervious membrane over, exposed surface of concrete when applied to fresh concrete by means of spray gun. Compound shall not inhibit future bond of floor covering or concrete floor treatment. Use Type I-D compound with red fugitive dye, Class B, having 18 percent minimum solids conforming to ASTM C 309.
2. Products
    a. BASF Corporation; MasterKure EC 1315
    b. Euclid Chemical Company; Super Diamond Clear VOX
    c. W. R. Meadows, Inc.; VOCOMP-30
    d. Dayton Superior Corp; Safe Cure and Seal 30% J23UV
    e. Or equal.

O. Burlap Mats
1. Conform to AASHTO M182.

P. Sisal-Kraft Paper and Polyethylene Sheets for Curing
1. Conform to ASTM C171.

2.02 - MIXES

A. Conform to ASTM C94, except as modified by these specifications.

B. Air content as determined by ASTM C231

5 ± 1 1/2 percent for concrete using 1 1/2-inch maximum aggregate size.

6 ± 1 1/2 percent for concrete using 3/4-inch maximum aggregate size.

C. Provide concrete with the following compressive strengths at 28-days and proportion it for strength and quality requirements in accordance with ACI 318. The resulting mix shall not conflict with limiting values specified in Table 03300-1.

Table 03300-1

Type of Work	28-Day Minimum Compressive Strength (in psi)	Maximum Water/Cement Ratio
Concrete for liquid containing	4,500	0.42
Precast concrete	5,000	0.40
Prestressed concrete	6,000	0.40
Concrete (fiber reinforced) fill, topping and miscellaneous unreinforced concrete	4,000	0.54
Pavement	3,000	0.54
Mud mats and concrete under foundations	1,500	0.76
Concrete not otherwise specified	4,000	0.44

D. Measure slump in accordance with ASTM C143

1. Proportion and produce the concrete to have a maximum slump of 4-inches. A tolerance of up to 1-inch above the indicated maximum is allowed for individual batches provided the average for all batches or the most recent 10 batches tested, whichever is fewer, does not exceed the maximum limit. Concrete of lower than usual slump may be used provided it is properly placed and consolidated.
2. Mixes containing water reducers shall have a maximum slump of 6-inches after the addition of a mid-range water reducer and maximum slump of 8-inches after the addition of a high range water reducer.

E. Pozzolan Content

1. Fly ash shall not exceed 20 percent of the total cementitious content.
2. Slag cement will be permitted as a substitute for fly ash at no additional cost to the Owner, in the event that Class F Fly Ash is not available. The slag substitution shall be in the same proportions and percentages of the total cementitious material as shown for fly ash.
3. Use silica fume concrete where indicated on the drawings. Silica fume not to exceed 10 percent of the total weight of the silica fume plus cement.

F. Aggregate Size

1. The maximum aggregate size shall be
   a. 1 1/2-inches for walls greater than 18-inches in thickness, grade beams, footings, foundation mats, and base slabs.
   b. 3/8-inches for floor fill in clarifiers, in congested areas where approved by the engineer, for fireproofing around structural steel beams and columns and to fill cored holes.
   c. 3/4-inches for all other concrete.
2. Combined aggregate grading shall be as specified in Table 03300-2.

Table 03300-2

Maximum Aggregate Size	1 1/2-inch	1-inch	3/4-inch	3/8-inch
Aggregate Grade per ASTM C33	467	57	67	8

PART 3 - EXECUTION

3.01 - INSPECTION

A. Contractor shall examine the substrate and the conditions under which work is to be performed and notify the Engineer in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions are corrected in a manner acceptable to the engineer.

3.02 - MIXING AND TRANSPORTING CONCRETE

A. General. Conform to concreting procedures set forth in ASTM C 94, ACI 304R and as specified herein.

1. Transport concrete to discharge locations without altering the specified properties of water-cement ratio, slump, air entrainment, temperature and homogeneity.

2. Discharge concrete into forms within 1-1/2 hours after cement has entered mixing drum or before the drum has revolved 300 revolutions after the addition of water, whichever occurs first.

3. Do not add water at the jobsite unless permitted by the engineer. If it is necessary to add water to obtain the specified slump, add water per ASTM C 94, but do not exceed the amount of water that has been held back at the plant. Added water shall be incorporated by additional mixing of at least 35 revolutions. Quality control sampling shall be done after the water has been added and the batch thoroughly mixed.

4. Do not add water to concrete containing high range water reducing admixture.

5. Keep a record showing time and place of each placement of concrete, together with transit-mix delivery slips certifying the contents of the placement.

6. Discharge of concrete shall be completed within the limits set out in Table 03300-3.

Table 03300-3

MAXIMUM TIME TO CONCRETE DISCHARGE

Concrete Temperature	Limit
Over 90 Degrees F	Remove concrete from jobsite and discard concrete
86 to 90 Degrees F	45 minutes
81 to 85 Degrees F	60 minutes
70 to 80 Degrees F	75 minutes
Below 70 Degrees F	90 minutes

B. Conveying. Convey concrete from agitator or mixer truck to place of final deposit in forms by one of the following methods

1. Buckets or hoppers with discharge gates having a clear opening equal to not less than one-third the maximum interior horizontal area or five times the maximum aggregate size being used, whichever is greater, and side slopes of not less than 60 degrees to horizontal.

2. Buggies or wheelbarrows equipped with pneumatic tires.

3. Round bottom, metal or metal-lined chutes with inclined slope of between two to three feet horizontally to one foot vertically and of sufficient capacity to avoid overflow.

4. Circular drop pipes with a top diameter of at least eight times the maximum aggregate size, but not less than 6-inches, or tapered to not less than six times maximum aggregate size.

3.03 - CONCRETE ACCEPTANCE

A. The Contractor shall accept or reject each batch of concrete delivered to the point of agitator or mixer truck discharge. The signature of a Contractor's authorized representative on the delivery batch ticket shall indicate concrete acceptance.

B. The Contractor shall reject concrete delivered without a complete concrete delivery batch ticket as specified herein. The concrete supplier will furnish copies of the signed batch ticket to the Contractor and Engineer.

C. The testing agency shall perform field tests at the point of agitator or mixer truck discharge. Accept or reject concrete on the basis of conformity with slump, air content and temperature specified.

D. The testing agency shall inspect concrete transit truck's barrel revolution counter and gauge for measuring water added to the concrete. Reject concrete which exceeds the maximum barrel revolution of 300, the limits in Table 03300-3 or concrete that has water content exceeding the specified water-cement ratio.

E. The Contractor shall reject concrete not conforming to specification before discharging into the forms.

3.04 - PREPARATION AND COORDINATION

A. Contractor shall notify the Engineer or the Engineer's Representative of readiness to place concrete in any portion of the work a minimum of 48 hours prior to concrete placement. Failure to provide this notification will be cause for delay in placing until inspections can be completed and arrangements for testing established.

B. All reinforcement, installation of waterstop, positioning of embedded items, and condition of formwork shall be inspected by the Engineer or the Engineer's representative prior to concrete placement.

C. Coordinate the sequence of placement to assure that construction joints will occur only where indicated on the drawings.

D. Schedule sufficient equipment for continuous concrete placement. Provide for backup equipment and procedures to be implemented in case of an interruption in placement.

E. Compact the subbase and/or bedding. The subbase and/or bedding shall be uniformly moist at the time of concrete placement. Spraying water on the subbase and/or bedding may be necessary prior to placement of concrete. Concrete shall not be placed on standing water, mud, and foreign matter.

F. Provide mud slabs to obtain a dry and stable working platform for placement of slabs on grade and foundation mats as indicated on the drawings or as may be required.

G. Install a granular base beneath slabs on ground where shown on contract drawings, Place granular material on a compacted subgrade and compact the granular base.

H. Place vapor retarder under structural slabs and buildings and where shown on contract drawings. Install material with 6-inch lap at joints and seal joints with tape as recommended by the vapor retarder manufacturer. Tape material cut for slab penetrations to the pipe, conduit or other items passing through the slab. Use tape recommended by the vapor retarder manufacturer.

I. Install vapor retarder without punctures or tears and protect against punctures and breaks.

J. Where concrete is required to be placed and bonded to existing concrete, coat the contact surfaces with epoxy bonding agent. The method of preparation and application of the bonding agent shall conform to the manufacturer's recommendations.

3.05 - JOINTS AND EMBEDDED ITEMS

A. Provide construction and expansion joints as specified in SECTION 03250, CONCRETE JOINTS AND ACCESSORIES.

1. Clean all construction joints to remove loose concrete and laitance before placing adjoining concrete. Do not damage exposed concrete edges, key grooves, waterstops or reinforcement.

2. Intentionally roughen surfaces of set concrete to receive new concrete to 1/4-inch amplitude in a manner to expose bonded aggregate uniformly at joints.

3. Do not place concrete against construction joints for at least 72 hours after initial concrete set.

B. Embedded Items

1. Secure castings, inserts, conduits and other metalwork encased in concrete to prevent them from being displaced or deformed during concrete work. Use templates to secure items in place.

2. Clean embedded items of oil and all foreign matter.

3. Install inserts, anchors, sleeves and other items into formwork where indicated or specified under other sections of these specifications.

4. Build dovetail anchor slots into new concrete against which facing brick, concrete masonry units, tile, stone or any type ashlar is to be installed. Provide vertically at 16-in. centers where facing brick, etc., passes by concrete. Provide one continuous anchor slot where facing brick, etc., abuts the concrete work.

5. Aluminum embedded in concrete shall be coated to prevent galvanic corrosion with a zinc chromate primer and one of the following products

a. Bitumastic Super Service Black by Koppers Co., Inc.

b. Tarmastic 100 by Porter Coatings Division, Porter Paint Co.

c. 450 Heavy Tnemecol by Tnemec Company.

d. Or equal.

6. Check location and support of piping, electrical conduits and other embedded items before depositing concrete. Correct locations as required and secure in place.

7. Complete required tests on embedded piping before starting concrete placement.

C. Embedded Pipes and Conduit

1. Embedded pipes and conduit in concrete shall conform to the requirements and limitations of ACI 318, ACI 350 and these specifications and shall be as approved by the engineer.

2. Conduits, pipes, and sleeves of any material not harmful to concrete and within the limitations specified herein shall be permitted to be embedded in concrete with the approval of the Engineer.

3. Conduits and pipes of aluminum shall not be embedded in concrete.

4. Pipes passing through walls of a liquid-containing structure shall include an integral waterstop.

5. Conduits, pipes, and sleeves passing through a slab, wall, or beam shall not impair significantly the strength of the construction.

6. Conduits and pipes, with their fittings, embedded within a column shall not displace more than 4 percent of the area of cross section.

7. Except when drawings for conduits and pipes are approved by the structural engineer, conduits and pipes embedded within a slab, wall, or beam (other than those merely passing through) shall satisfy the following:
    a. Conduits and pipes shall not be larger in outside dimension than 1/3 the overall thickness of the slab, wall, or beam in which they are embedded.
    b. Conduits and pipes shall not be spaced closer than 3 times the outside diameters on center.
    c. Conduits and pipes shall be placed within the middle third of the element and between reinforcement layers. Do not install runs of piping or conduit between formwork and reinforcement.
    d. Avoid crossing pipes and conduit in concrete.
8. Pipes and fittings shall be designed to resist the effects of the material, pressure, and temperature to which they will be subjected.
9. No liquid, gas, or vapor, except water not exceeding 90 degrees F or 50 psi pressure, shall be placed in the pipes until the concrete has attained its design strength.
10. Reinforcement with an area not less than 0.002 times area of concrete section shall be provided perpendicular to piping or conduit at a maximum spacing of 12-inches.
11. Piping and conduit shall be so fabricated and installed that cutting, bending, or displacement of reinforcement from its proper location will not be required.
12. Close ends of conduits, piping and sleeves embedded in concrete with caps or plugs prior to concrete placement.

3.06 - CONCRETE PLACEMENT

A. Placement shall conform to ACI 304R as modified by these specifications.

B. Intentionally roughen surfaces of set concrete to receive new concrete to ¼" amplitude in a manner to expose bonded aggregate uniformly at joints.

C. Do not place adjacent sections of walls and slabs until seven-days after placement of the previously placed concrete.

D. Do not place concrete until all free water has been removed from the forms, clear of the work. Do not permit free or storm water to flow over surfaces of concrete so as to injure the quality or surface finish.

E. Do not place concrete during inclement weather. Protect concrete placed from inclement weather. Keep sufficient protective covering ready at all times for this purpose.

F. Deposit concrete at or near its final position to avoid segregation caused by rehandling or flowing. Do not deposit concrete in large quantities in one place to be worked along the forms with a vibrator.

G. Deposit concrete continuously and in level layers 1 to 2 feet thick. Avoid inclined layers and cold joints. Place concrete at lower portion of slope first on sloping surfaces.

H. Do not deposit partially hardened concrete in forms. Retempering of partially hardened concrete is not permitted. Remove all partially hardened concrete from site at no additional compensation.

I. Do not allow concrete to fall freely in forms to cause segregation (separation of coarse aggregate from mortar). Limit maximum free fall of concrete to 4 feet. Do not move concrete horizontally more than four feet from point of discharge. Space points of deposit not more than eight feet apart.

J. At least two hours shall elapse after depositing concrete in the columns or walls before depositing in beams, girders, or slabs supported thereon. Place beams, girders, brackets, column capitals, and haunches monolithically as part of the floor or roof system, unless otherwise shown on contract drawings.

K. Consolidate concrete using mechanical vibrators operated within the mass of concrete and/or on the forms conforming to procedures set forth in ACI 309R and as specified herein.

L. Conduct vibration to produce concrete of uniform texture and appearance, free of honeycombing, streaking, cold joints or visible lift lines.

M. Conduct vibration in a systematic manner with regularly maintained vibrators. Furnish sufficient backup units at job site. Use vibrators having minimum frequency of 8,000 vibrations per minute and of sufficient amplitude to consolidate concrete. Use not less than one vibrator with crew for each 35 to 40 cubic yards of concrete placed per hour.

N. Insert and withdraw vibrator vertically at a uniform spacing over the entire area of placement. Space distances between insertions such that spheres of influence of each insertion overlap.

O. Use additional vibration with pencil vibrators on vertical surfaces and on all exposed concrete to bring full surface of mortar against the forms so as to eliminate air voids, bug holes and other surface defects. Employ the following additional procedures for vibrating concrete as necessary to maintain proper consolidation of concrete

1. Reduce distance between internal vibration insertions and increase time for each insertion.
2. Insert vibrator as close to face of form as possible without contacting form or reinforcement.
3. Thoroughly vibrate area immediately adjacent to waterstops without damaging the waterstop.
4. Use spading as a supplement to vibration where particularly difficult conditions exist.

P. Pumping Concrete

1. Conform to the recommendations of ACI 304.2R except as modified herein.
2. Use equipment and procedures and schedule deliveries to maintain steady flow of concrete at the discharge end of pipe.
3. Maintain concrete properties of slump, air content and temperature. Make adjustments in concrete proportions as necessary to provide concrete properties in accordance with the approved concrete design mix and as specified herein.
4. Use pipe with inside diameter of at least three times the maximum coarse aggregate size, but not less than 4-inches.
5. Do not use aluminum pipes for delivery of concrete to the forms.
6. Take samples at the point of agitator or mixer truck discharge.
7. Furnish labor and assistance as required by the testing laboratory in obtaining and handling test specimens.

3.07 - CURING AND PROTECTION

A. General

1. Protect concrete from premature drying, hot or cold temperatures, and mechanical injury, beginning immediately after placement and maintain concrete with minimal moisture loss at relatively constant temperature.
2. Comply with curing procedures set forth in ACI 301, ACI 308.1 and as specified herein.
3. Perform hot weather concreting in conformance with ACI 305.1 and as specified herein when the ambient atmospheric temperature is 80 degrees F or above.
4. Perform cold weather concreting in conformance with ACI 306.1 and as specified herein when the ambient atmospheric temperature is 40 degrees F or below.
5. Concrete required to be moist cured shall remain moist for the entire duration of the cure. Repeated wetting and drying cycles of the curing process will not be allowed.

B. Curing Duration

1. Start initial curing after placing and finishing concrete as soon as free moisture has disappeared from unformed concrete surfaces. Initial curing starts as soon as concrete achieves final set. Forms left tightly in place are considered as part of the curing system, provided that wooden forms are kept continuously moist. Keep continuously moist for not less than 72 hours.

2. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 7-days and in accordance with ACI 301 procedures for a total curing period, initial plus final, of at least 10-days.

3. Avoid rapid drying at the end of the final curing period

C. Curing Requirements

1. Unformed Surfaces Cover and cure entire surface of newly placed concrete immediately after completing finishing operations and water film has evaporated from surface or as soon as marring of concrete will not occur. Protect finished slabs from direct rays of the sun to prevent checking, crazing and plastic shrinkage.

2. Formed Surfaces. Minimize moisture loss for formed surfaces exposed to heating by the sun by keeping forms wet until safely removed. Keep surface continuously wet by warm water spray or warm water saturated fabric immediately following form removal.

3. Liquid containing and below grade structures. Moist cure by the application of water to maintain the surface in a continually wet condition. Use water that is free of impurities that could etch or discolor exposed concrete surfaces.

4. Other concrete Moist cure by moisture-retaining cover curing, or by the use of curing compound.

D. Curing Methods

1. Water Curing Use water curing for unformed surfaces. Continuously water cure all exposed concrete for the entire curing period. Provide moisture curing by any of the following methods

   a. Keeping the surface of the concrete continuously wet by ponding or immersion.

   b. Continuous water-fog spray or sprinkling.

   c. Covering the concrete surface with curing mats, thoroughly saturating the mats with water, and keeping the mats continuously wet with sprinklers or porous hoses. Place curing mats so as to provide coverage of the concrete surfaces and edges, with a 4-inch lap over adjacent mats. Weight down the curing cover to maintain contact with the concrete surface, as necessary.

2. Sealing Materials

   a. Use common sealing materials such as plastic film or waterproofing (kraft) paper when permitted by the Engineer.

   b. Lap adjacent sheets a minimum of 12-inches. Seal edges with waterproof tape or adhesive. Use sheets of sufficient length to cover sides of concrete member.

   c. Place sheet materials only on moist concrete surfaces. Wet concrete surface with fine water spray if the surface appears dry before placing sheet material.

   d. The presence of moisture on concrete surfaces at all times during the prescribed curing period is proof of acceptable curing using sheet material.

3. Membrane Curing Compound

   a. Apply membrane-curing compound uniformly over concrete surface by means of roller or spray at a rate recommended by the curing compound manufacturer, but not less than 1 gallon per 150 sq. ft. of surface area. Agitate curing material in supply container immediately before transfer to distributor and thoroughly agitate it during application for uniform consistency and dispersion of pigment

   b. Do not use curing compounds on construction and expansion joints or on surfaces to receive liquid hardener, dustproofer/sealer, concrete paint, tile, concrete fills and toppings or other applications requiring positive bond.

   c. Reapply membrane-curing compound to concrete surfaces that have been subjected to wetting within 3 hours after curing compound has been applied by method for initial application.

E. Protection from environmental conditions. Maintain the concrete temperature above 50 degrees F continuously throughout the curing period. Make arrangements before concrete placing for heating, covering, insulation or housing as required to maintain the specified temperature and moisture conditions continuously for the curing period.

1. When the atmospheric temperature is 80 degrees F and above, or during other climatic conditions which will cause too rapid drying of the concrete, make arrangements before the start of concrete placing for the installation of wind breaks or shading, and for fog spraying, wet sprinkling, or moisture-retaining covering.

2. Protect the concrete continuously for the entire curing period.

3. Maintain concrete temperature as uniformly as possible and protect from rapid atmospheric temperature changes.

4. Avoid temperature changes in concrete that exceed 5 degrees F in any one hour and 50 degrees F in any 24-hour period.

F. Protection from physical injury Protect concrete from physical disturbances such as shock and vibration during curing period. Protect finished concrete surfaces from damage by construction equipment, materials, curing procedures and rain or running water. Do not load concrete in such a manner as to overstress concrete.

G. Protection from Deicing Agents Do not apply deicing chemicals to concrete.

3.08 - FIELD QUALITY CONTROL

A. Hot Weather Requirements

1. During hot weather, give proper attention to ingredients, production methods, handling, placing, protection, and curing to prevent excessive concrete temperatures or water evaporation in accordance with ACI 305.1 and the following.

2. When the weather is such that the temperature of the concrete as placed would exceed 90 degrees F, use ice or other means of cooling the concrete during mixing and transportation so that the temperature of the concrete as placed will not exceed 90 degrees F.

3. Take precautions when placing concrete during hot, dry weather to eliminate early setting of concrete. This includes protection of reinforcing from direct sunlight to prevent heating of reinforcing, placing concrete during cooler hours of the-day, and the proper and timely application of specified curing methods.

4. There will be no additional reimbursement to the Contractor for costs incurred for placing concrete in hot weather.

B. Cold Weather Requirements

1. Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather in accordance with ACI 306.1 and the following.

2. When the temperature of the surrounding atmosphere is 40 degrees F or is likely to fall below this temperature, use heated mixing water not to exceed 140 degrees F. Do not allow the heated water to come in contact with the cement before the cement is added to the batch.

3. When placed in the forms during cold weather, maintain concrete temperature at not less than 55 degrees F. All materials shall be free from ice, snow, and frozen lumps before entering the mixer.

4. Maintain the air and the forms in contact with the concrete at temperatures above 40 degrees F for the first five-days after placing, and above 35 degrees F for the remainder of the curing period. Provide thermometers to indicate the ambient temperature.

5. There will be no additional reimbursement made to the Contractor for costs incurred for placing concrete during cold weather.

C. Backfill Against Walls

1. Do not place backfill against walls until the concrete has obtained a compressive strength equal to the specified 28-day compressive strength. Where backfill is to be placed on both sides of the wall, place the backfill uniformly on both sides.

2. Do not backfill the walls of structures that will be laterally restrained or supported by suspended slabs or slabs on grade until the slab is placed and the concrete has reached the specified compressive strength.

D. Concrete Testing

1. Concrete Quality Test Specimen

a. Perform sampling and curing of test specimen in accordance with ASTM C31.

b. Testing agency personnel will record truck and load number from the delivery batch ticket, the concrete placement location of each specimen, the date, concrete strength, slump, air content and temperature.

c. For each 50 cu. yd. of each mix design of concrete but not less than once a-day nor less than once for each 5,000 sq. ft. of surface area of foundation mats, base slabs, footings, pile caps, slabs on grade, grade beams, walls, or elevated slabs, the testing agency will cast a minimum of

(1) One set of four (4) 6”x12” test specimens or

(2) One set of seven (7) 4”x8” test specimens

d. Once a cylinder size has been selected, the size and number of specimens representing a strength test for each concrete mix shall remain constant.

e. For 6”x12” test cylinders

(1) The testing agency will compression test one (1) of each set of four 6”x12” specimens at 7-days.

(2) Test two (2) of the remaining cylinders at 28-days for concrete strength acceptance.

(3) The fourth cylinder shall be held for testing at 56-days only if the 28-day cylinder strengths are deficient. The fourth cylinder of each set shall be discarded if the 28-day strengths meet or exceed the specified minimum strength.

f. For 4”x8” test cylinders

(1) The testing agency will compression test two (2) of each set of seven 4”x8” specimens at 7-days.

(2) Test three (3) of the remaining cylinders at 28-days for concrete strength acceptance.

(3) The last two cylinders shall be held for testing at 56-days only if the 28-day cylinder strengths are deficient. The 6th and 7th cylinders of each set shall be discarded if the 28-day strengths meet or exceed the specified minimum strength.

2. The laboratory firm shall immediately notify the Contractor and the Engineer if the seven-day strength is deficient.

3. The acceptance test result is the average of the strengths of the two specimens tested at 28-days.

4. The laboratory firm shall submit compression test results to both the Contractor and the Engineer. Concrete acceptance shall be based on the requirements of ACI 318 and ACI 350.

5. Field cured cylinders conforming to ASTM C31 will be required to determine field compressive strength of concrete. Laboratory cured cylinders for concrete quality testing shall not be used for determining field compressive strength.

E. Concrete Coring

a. When the concrete quality test specimen compression tests fail to be in compliance with the Contract Documents or when the Engineer detects deficiencies in the concrete, the Contractor will take concrete cores at least 4-inches in diameter from the structure in conformance with ASTM C 42 at locations determined by the Engineer.

b. Obtain at least three representative cores from each member or area of concrete that is considered potentially deficient.

c. Obtain additional cores to replace cores that show evidence of having been damaged subsequent to or during removal from the structure.

d. The testing agency shall compression test the cores taken from the structure in conformance with ASTM C 39 and submit test strength test results of cores specified above to the Contractor and to the Engineer.

e. All costs associated with coring and testing of cores will be borne by the Contractor at no additional cost to the Owner.

3.09 - REPAIRS

A. Provide in accordance with SECTION 03730, CONCRETE REPAIR.

3.10 - CONCRETE FINISHES

A. Do not use curing compound where epoxy, urethane, mortar bed, grout, additional concrete or other toppings or adhesive will be applied.

B. Do not sprinkle with dry cement or add water when finishing concrete surfaces.

C. Finish concrete surfaces in accordance with the following schedule

Table 03300-4	
Finish Designation	**Area Applied**
F-1	Beams, columns, and exterior walls not exposed to liquids or view.
F-2	Walls, beams, and columns exposed to liquids. EXCEPTION surfaces that are to be coated.
F-3	Walls, beams, and columns exposed to view and to 1 foot below liquid level or finished grade. Underside of formed floors or slabs. EXCEPTION surfaces that are to be coated.
F-4	Exterior and interior surfaces to be coated.
S-1	Slabs and floors to be covered with concrete or grout.
S-2	Slabs and floors not liquid containing.
S-3	Slab surfaces on which mechanical equipment moves. Slab surfaces to receive sealer or hardener shall be prepared in accordance with product manufacturer's requirements.
S-4	Slabs and floors exposed to view, which are liquid containing, or are to receive crystalline waterproofing.
S-5	Slabs and floors at slopes greater than 10% and stairs.
E-1	Exposed edges.
E-2	Top of walls, beams, and similar unformed surfaces.

1. Finish F-1 Repair defective concrete, fill depressions deeper than 1/2-inch, and fill tie holes.
2. Finish F-2 Repair defective concrete, remove fins, fill depressions 1/4-inch or deeper, and fill tie holes.
3. Finish F-3 In addition to Finish F-2, fill depressions and airholes with mortar. Dampen surfaces and then spread a slurry consisting of one part cement and one and one-half parts sand by damp loose volume, over the surface with clean burlap pads or sponge rubber floats. Remove any surplus by scraping and then rubbing with clean burlap.
4. Finish F-4 Repair defective concrete, remove fins, fill depressions 1/16-inch or deeper, fill tie holes, remove mortar spatter, and remove bulges higher than 1/16-inch.
5. Finish S-1 Screed to grade without special finish unless otherwise shown on contract documents. Roughen and/or apply bonding agent where shown on contract drawings.
6. Finish S-2 Smooth steel trowel finish.
7. Finish S-3 Steel trowel finish free from trowel marks and all irregularities.
8. Finish S-4 Steel trowel finish without local depressions or high points. For liquid containing slabs apply a light hair-broom finish. Do not use stiff bristle brooms or brushes. Leave hair-broom lines parallel to the direction of slab drainage.
9. Finish S-5 Steel trowel finish without local depressions or high points. Apply a stiff bristle broom finish. Leave broom lines parallel to the direction of slope drainage.
10. Finish E-1 Provide 3/4-inch chamfer on external corners of exposed concrete walls, beams columns, equipment pads and exposed edges of construction joints. Do not chamfer columns flush with concrete block walls.
11. Finish E-2 Strike smooth and float to an F-3 or F-4 finish.

D. Protect finished concrete surfaces from damage by construction equipment, materials, curing procedures and rain or running water.

3.11 - FINISHING OF FORMED SURFACES

A. Cure surfaces until finishing and repairing are completed.

B. Perform finish work in accordance with the schedule in the section herein, Table 03300-4, as soon as possible after forms are removed.

C. Conform to the requirements specified in SECTION 03100, CONCRETE FORM WORK.

3.12 - FINISHING OF UNFORMED SURFACES

A. Perform finish work in accordance with the schedule in SECTION 03350, CONTROLLED LOW STRENGTH MATERIAL Table 03350-1.

B. Provide S-3 steel-trowel finish to all top, horizontal and inclined surfaces not otherwise specified or indicated. This includes concrete fills and toppings and floors. Provide hand steel-trowel finish to all surfaces such as weirs or walls over which liquids will flow.

C. Provide S-5 broom finish to exterior walkways, exterior stairs, entrance platforms and loading docks.

3.13 - CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 03350

CONTROLLED LOW STRENGTH MATERIAL (CLSM)

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PART 1 - GENERAL

1.01 - SCOPE

A. Provide and install controlled low strength material as indicated and specified.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification section number and title and Drawing numbers and titles.

1. CLSM mix design and results of strength tests from trial mixes by the Contractor's testing laboratory firm.
2. Submit manufacturer’s Stable-Air Generator Admixture product data, installation instructions and recommendations for material use.
3. Test and Performance - Submit the following data:
    a. Any required deviations from prescribed tests and special handling instructions for test specimens.
    b. Controlled Low Strength Material shall have a maximum strength of 200 psi according to ASTM C39 at 56 days after placement.
    c. Controlled Low Strength Material shall have minimal subsidence and bleed water which is measured as a final bleeding of less than 2.0 percent (retains 98.0 percent of original height after placement, approximately 1/4” per foot of depth) as measured in Section 10 of ASTM C940.
    d. Controlled Low Strength Material shall have a unit weight of 90 - 110 lbs./ft^3 measured at the point of placement.

1.05 - PRODUCT HANDLING

A. Comply with the requirements of SECTION 01610, DELIVERY, STORAGE AND HANDLING.

B. Order CLSM from batching plant so that trucks arrive at discharge locations when material is required.

C. Deliver CLSM to discharge locations in watertight agitator or mixer trucks without altering the specified properties of water-cement ratio, slump, air entrainment, temperature and homogeneity.

D. Reject CLSM not conforming to specification, unsuitable for placement, exceeding the time or temperature limitations or not having a complete delivery batch ticket

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns.

B. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

C. Quality Assurance

1. Comply with requirements in SECTION 01400, QUALITY ASSURANCE and as specified.
2. Sustainability Standards Certifications.
3. Do not place CLSM until design mix, material tests and trial batch mix compression test results are approved by the Engineer. Approvals are required at least 30 days before placing any production CLSM.
4. Employ an independent testing laboratory, acceptable to the Engineer to test conformity of materials to specifications and to design CLSM mixes.
5. Furnish, pay for and deliver representative samples of sufficient quantity of cement, aggregates and admixtures required for trial batch mixes to the testing laboratory. Obtain materials from the batching plant that will be supplying production CLSM in conformance with ASTM D75.
6. Measure all materials for CLSM, including water, with equipment and facilities suitable for accurate measurement and capable of being adjusted in conformance with ASTM C94. Use scales certified by local Sealer of Weights and Measures within one year of use and accurate when static load tested to plus or minus 0.4 percent of total capacity of scale. Batch all materials by weight except admixtures that may be batched by volume.
7. The testing laboratory will take control test specimens; conduct slump tests and measure air content and temperature in the field.
8. Methods of Sampling and Testing:
    a. Fresh Concrete Sampling: ASTM C172.
    b. Specimen Preparation: ASTM C31.
    c. Compressive Strength: ASTM C39.
    d. Air Content: ASTM C231.
    e. Slump: ASTM C143.
    f. Temperature: ASTM C1064.
    g. Unit Weight: ASTM C138.

D. Project/Site Conditions

1. Do not place CLSM until conditions and facilities for making and curing control test specimens are in compliance with ASTM C31 and as specified herein.

1.07 - REFERENCES

A. American Concrete Institute (ACI):

1. 229R: Controlled Low-Strength Materials
2. 301: Specifications for Structural Concrete
3. 304R: Guide for Measuring, Mixing, Transporting and Placing Concrete
4. 305R: Hot Water Concreting.
5. 306R: Cold Water Concreting
6. 308: Standard Practice for Curing Concrete
7. 318: Building Code Requirements for Structural Concrete and Commentary

B. ASTM International (ASTM):

1. C31: Practice for Making and Curing Concrete Test Specimens in the Field
2. C33: Specification for Concrete Aggregates
3. C39: Test Method for Compressive Strength of Cylindrical Concrete Specimens
4. C94: Standard Specification for Ready-Mixed Concrete
5. C138: Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
6. C143: Standard Test Method for Slump of Hydraulic-Cement Concrete.
7. C150: Standard Specification for Portland Cement.
8. C172: Practice for Sampling Freshly Mixed Concrete
9. C231: Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
10. C494: Standard Specification for Chemical Admixtures for Concrete.
11. C618: Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
12. C940: Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory
13. C1064: Test Method for Temperature of Freshly Mixed Portland Cement Concrete
14. D75: Practice for Sampling Aggregates

C. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - MATERIALS

A. Furnish Portland cement conforming to ASTM C150. Use one approved brand from one mill throughout the contract term unless otherwise approved by the Engineer. Use Type II for all work, unless otherwise specified.

B. Water

1. Use water that is potable and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances, and conforms to the requirements for water in ASTM C94, and as specified herein.
2. The maximum water-soluble chloride ion in the water shall not exceed 0.060 percent by weight of cement.

C. Aggregates:

1. Use aggregates for CLSM conforming to ASTM C33 and to the following requirements.

D. Admixtures:

1. General Requirements: ASTM C494.

E. Fly Ash: Provide fly ash conforming to the following requirements:

1. Class F fly ash conforming to ASTM C618 for chemical and physical properties.
2. Supplemental requirements in percent:

a.	Maximum carbon content	3 percent
b.	Maximum sulfur trioxide (SO_3) content	4 percent
c.	Maximum loss on ignition	3 percent
d.	Maximum water requirement (as a percent of control)	100 percent
e.	Fineness, maximum retained on No. 325 sieve	25 percent

2.02 - MIXES

A. Mix design shall produce a consistency that will result in a flowable product at the time of placement that does not require manual means to move it into place.

B. Provide mix with compressive strength of maximum 200 psi when measured 56 days after placement

C. Controlled Low Strength Material shall have minimal subsidence and bleed water which is measured as a Final Bleeding of less than 2.0 percent (retains 98.0 percent of original height after placement, approximately 1/4-inch per foot of depth) as measured in Section 10 of ASTM C940 "Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory".

D. The fresh unit weight shall be 90 - 110 lbs./ft^3, except where specified, and in the absence of strength data the cementitious content shall be a maximum of 150 lbs./cy.

PART 3 - EXECUTION

3.01 - INSTALLATION

A. Batch, mix and deliver CLSM in conformance with ASTM C94. Batch all constituents at a central batching or mixing plant.

B. Seasonal Conditions:

1. Conform to ACI 305R and as specified herein for hot weather concreting. Do not add retarder admixture to any concrete.

2. Conform to ACI 306R and as specified herein for cold weather concreting. Do not add accelerator admixture to any concrete.

3.02 - TRANSPORTING AND MIXING

A. Conform to concreting procedures set forth in ACI 304R and as specified herein.

B. Transport CLSM to discharge locations without altering the specified properties of water-cement ratio, slump, air entrainment, temperature and homogeneity.

3.03 - FIELD TESTING

A. General:

1. The testing laboratory will use concrete samples taken at the point of agitator or mixer truck discharge to perform slump, air content, and temperature tests and for field control test specimens.

B. Notification of Delivery:

1. Notify the Engineer of concrete deliveries a minimum of 48 hours in advance of the scheduled placement. Include within this notification, the mix design and quantity of concrete, method and location of placement, frequency of trucks, ordered slump and time of initial delivery.

2. Furnish delivery batch ticket to the representative from the owner's testing laboratory or to the Engineer representative in the field with each batch delivered to the discharge locations in conformance with ASTM C94.

C. Test Measurements at Discharge:

1. The testing laboratory firm will take measurement of concrete slump, air content and temperature for each 50 cubic yards of each mix design but not less than once a day. The laboratory will conduct the slump, air content and temperature test measurements in conformance with ASTM C143, ASTM C231, and ASTM C1064, respectively.

2. The testing laboratory will submit test reports of field measurements specified above to the Contractor and to the Engineer.

D. Control Test Specimens:

1. The testing laboratory will cast a minimum of one set of three field control test specimens in conformance with ASTM C31 for each 150 cubic yards of each mix design of concrete but not less than once a day.

2. Laboratory personnel will record truck and load number from the delivery batch ticket, the concrete placement location of each specimen, the date, concrete strength, slump, air content, temperature and truck driver's name.

3. Furnish tightly constructed nonabsorbent test cylinder molds. Use molds of same type and manufacture for all test specimens. Leave molds on cylinders until received in testing laboratory.

4. Furnish boxes for initial curing of test cylinders in conformance with ASTM C31 from time of fabrication until they are transported to the testing laboratory.

5. The testing laboratory will compression test one of each set of three specimens at seven days. Immediately notify the Contractor and the Engineer if the seven-day strength is deficient. Test the two remaining cylinders at 65 days for concrete strength acceptance. The acceptance test result is the average of the strengths of the two specimens tested at 56 days. The laboratory firm will submit compression test results of the control test specimens to both the Contractor and the Engineer. Evaluation and acceptance of concrete shall conform to ACI 301 and ACI 318.

3.04 - CURING AND PROTECTION

A. Protect CLSM from premature drying, hot or cold temperatures, and mechanical injury, beginning immediately after placement and maintain concrete with minimal moisture loss at relatively constant temperature.

B. Comply with curing procedures set forth in ACI 301, applicable portions of ACI 308 and as specified herein.

C. Perform hot weather concreting in conformance with ACI 305R and as specified herein when the ambient atmospheric temperature is 80 degrees F or above.

D. Perform cold weather concreting in conformance with ACI 306R and as specified herein when the ambient atmospheric temperature is 40 degrees F or below.

E. Protect Controlled Low Strength Material from traffic until sufficient strength has been achieved for further construction operations

3.05 - CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT

END OF SECTION

SECTION 03420

PRECAST REINFORCED CONCRETE VAULTS

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PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide Precast Reinforced Concrete Vaults as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Manufacturer’s technical data containing information on new pipe and fittings.
2. Verifications from the pipe manufacturer of training in the proper method for handling and installing the new pipe.
    a. Completely detailed shop drawings for precast concrete vaults. Indicate all dimensions, details, reinforcing steel, inserts, connections, openings and lifting devices. Mark each component for identification. Show mark on erection plan and place legibly on unit at time of manufacture.
    b. Submit manufacturer’s specification and product data for all items specified.
    c. Drawings of modifications or changes in features or details, which are necessitated by design requirements. Make such modifications without additional compensation.
    d. Do not fabricate precast concrete vaults before shop drawings are accepted by the Engineer.
    e. Certification, signed and sealed by a Professional Structural Engineer registered in the jurisdiction where the vaults will be installed and employed by the vault manufacturer and stating:
        1) Elements and connections are designed to withstand required loads and forces
        2) Structure is not affected by buoyant forces.
        3) Codes and specifications to which structural design conforms.
        4) Do not submit calculations.

1.05 - PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance.

B. Comply with the requirements specified in SECTION 01610, DELIVERY, STORAGE AND HANDLING.

C. Comply with precast concrete manufacturer's instructions for unloading, storing and moving vault components.

D. Store vaults on clean blocking, off the ground and protected from rain and ground splatter.

E. Coordinate the delivery, storage, handling and installation of precast concrete vaults.

1.06 - DESIGN CRITERIA

A. Comply with the requirements specified in SECTION 01400, QUALITY ASSURANCE.

B. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. Vault design and construction comply with the specified design load conditions, ASTM C858 and as specified herein.

1.07 - REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):

1. HB: Standard Specifications for Highway Bridges.
2. M198: Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

B. American Concrete Institute (ACI):

1. ACI 211.1: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
2. ACI 301: Standard Specifications for Structural Concrete
3. ACI 304R: Guide for Measuring, Mixing, Transporting and Placing Concrete
4. ACI 305R: Hot Weather Concreting
5. ACI 306R: Cold Weather Concreting
6. ACI 308: Standard Practice for Curing Concrete
7. ACI 309R: Guide for Consolidation of Concrete
8. 318: Building Code Requirements for Structural Concrete and Commentary

C. ASTM International (ASTM):

1. A48: Standard Specification for Gray Iron Castings.
2. C31: Practice for Making and Curing Concrete Test Specimens in the Field
3. C33: Specification for Concrete Aggregates
4. C39: Test Method for Compressive Strength of Cylindrical Concrete Specimens
5. C143: Test method for Slump of Hydraulic Cement Concrete
6. C150: Specification for Portland Cement
7. C172: Practice for Sampling Freshly Mixed Concrete
8. C192: Practice for Making and Curing Concrete Test Specimens in the Laboratory

9. C231: Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
10. C260: Specification for Air-Entraining Admixtures for Concrete
11. C494: Specification for Chemical Admixtures for Concrete
12. C857: Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
13. C858: Specification for Underground Precast Utility Chambers
14. C1064: Test Method for Temperature of Freshly Mixed Portland Cement Concrete
15. D75: Practice for Sampling Aggregates
16. D4101: Standard Specification for Polypropylene Injection and Extrusion Materials

D. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - PRECAST REINFORCED CONCRETE VAULTS

A. Manufacturers:

1. Oldcastle Precast, Inc.
2. Shea Concrete Products Inc.
3. Or equal.

B. Materials:

1. Minimum concrete compressive strength of 5,000 psi at 28 days conforming to SECTION 03300, CAST-IN-PLACE CONCRETE.
2. Portland cement: ASTM C150, Type II.
3. Coarse Aggregate and sand conforming to SECTION 03300, CAST-IN-PLACE CONCRETE.
4. Steel reinforcement conforming to ASTM A615, Grade 60.
5. Water: Potable.
6. Provide air entraining and water reducing concrete admixtures as specified in SECTION 03300, CAST-IN-PLACE CONCRETE.
7. Butyl rubber-based sealants conforming to AASHTO M198, Type B but with no bitumen content.
8. Non-Shrink Grout:
    a. BASF Chemical Company; Masterflow 713 Plus
    b. The Euclid Chemical Co.; Euco NS Grout
    c. Sika Corporation; SikaGrout 212
    d. Or equal.

C. Design Criteria. Use design loads according to ASTM C857 or as indicated below, whichever produces the more severe conditions:

1. Design precast reinforced concrete vault to withstand earth and groundwater loads. Assume groundwater elevation to be at the top of the vault. Provide design based on an equivalent fluid pressure equal to a minimum of 95 pounds per cubic foot.
2. Design precast reinforced concrete vault to withstand internal hydrostatic and seismic loading. Assume internal fluid level to be at the top of the vault. Provide design based upon an equivalent fluid pressure of 65 pounds per cubic foot.

3. Design precast reinforced concrete vault to withstand an H20 vehicle loading with an impact factor as prescribed in ASTM C857 with a minimum surcharge of 250 psf. Account for vehicle positions both above and alongside vault including directly on each manhole cover.
4. Design precast reinforced concrete vault ceiling to withstand additional concentrated loads from lifting hooks located directly above each valve, meter or other equipment. Provide lifting hook capable of supporting the load, but not less than 2,500 pounds each hook.
5. Design and install vaults to withstand hydrostatic uplift caused by a groundwater elevation at grade level or equal to the top of the vault, whichever produces the most severe condition. Use only the weight of the vault and hold-down slab to resist hydrostatic uplift with a minimum safety factor of 1.3. Do not include side friction of soil on walls.
6. Walls and floor slab: minimum of 6 inches in thickness. Cast lower wall section and floor slab monolithically.
7. Precast reinforced concrete vault roof: minimum of 8 inches in thickness.
8. Design vault to withstand the load condition where the vault roof is removed while the structure is backfilled to grade and subject to live and dead loads.
9. Provide precast reinforced concrete vault as indicated on the drawings. Provide a watertight vault enclosure including sumps and entrance tubes as indicated**.**
10. Fabricate precast reinforced concrete vault in sections for as required for handling and installation.
11. Provide pipe sleeves with water stops, rubber pipe boots or other devices at pipe penetrations.
12. Provide reinforced concrete vertical entrance tube with inside dimensions as indicated.

2.02 - MANHOLE FRAMES AND COVERS

A. Refer to SECTION 02725, MANHOLES, CATCH BASINS, HAND HOLES AND PULL BOXES.

2.03 - BITUMINOUS WATERPROOFING MATERIAL

A. Manufacturers:

1. Tnemec Company, Inc.; Series 46-465 H.B. Tnemecol
2. PPG Industries; Amercoat 78HB.
3. Carboline; Bitumastic 300M
4. Or equal.

2.04 - ENTRANCE HATCHES

A. Manufacturers:

5. Bilco Co.
6. Halliday
7. Babcock-Davis Associates, Inc.
8. Or equal.

B. Provide aluminum hatches of the type and size indicated and as follows:

1. Fabricate hatch and frame with 1/4-inch extruded aluminum frame and 1/4- inch diamond checkered aluminum plate covers.

2. Reinforce cover, with aluminum bars and angles welded to underside of covers, to withstand AASHTO H-20 wheel loading.

3. Provide hatch with hinges, hold-open safety-lock bars and flush lift handles, factory assembled, and shipped complete for installation.

4. Provide stainless steel hardware throughout. Hinge covers to frames with heavy duty stainless steel concealed hinges and stainless steel pins. Attach hinges to covers and frames with countersunk/flathead stainless steel machine screws. Fit covers flush to frame.

5. Provide slam latch, flush mounted grip handle, and removable plug and key wrench.

6. Fabricate gutter type hatches with 1-1/2-inch drainage coupling in one corner of the channel frame.

7. Provide frost proof inner hatch.

8. Provide ladder-up safety post.

9. Provide drain PVC drain piping to location required by the Contract Drawings or as recommended by the Engineer.

2.05 - LIFTING HOOKS

A. Provide lifting hooks in the ceiling above pumps, valves and meters.

1. Lifting hooks shall have adequate capacity to lift the equipment, but not less than 2,500 pounds.

2.06 - ACCESS LADDERS

A. Provide aluminum access ladders as follows:

2. Ladders conforming to OSHA Standards 29 CFR Chapter 1926.1053.

3. Fabricate from 1-1/2-inch IPS, Schedule 80 aluminum pipe upright and 1 inch solid round aluminum rod rungs, mortised and welded to uprights. Ground welds smooth. Close, seal and ground smooth top of uprights.

4. Space aluminum rungs 12 inches on centers.

5. Securely fasten ladder to entrance tube and precast reinforced concrete vaults with aluminum brackets and 1/2-inch diameter stainless steel expansion bolts.

6. Ladders conforming to OSHA Standards 29 CFR Chapter 1926.1053.

2.07 - MANHOLE STEPS

A. Aluminum Steps

1. Stock No. 12653B made by Aluminum Company of America, Pittsburgh, PA.

2. Stock No. F-14-2-B made by New Jersey Aluminum Co., New Brunswick, NJ.

3. Or equal.

4. Stock numbers are for embedded steps, for steps to be attached after casting, shape of exposed parts to be like stock numbers, but other ends shaped to suit inserts.

B. Plastic Coated Steel Steps

1. Provide steps 13 inches minimum width projecting 5 inches minimum from the wall surface. Steps to be driven into preformed holes.

2. Provide steps with copolymer polypropylene coating conforming to ASTM D4101 and 1/2-inch diameter steel reinforcing rod conforming to ASTM A615.

C. Test steps to resist a pull out load of 1,500 pounds 750 pounds per leg without loosening or being damaged.

1. Manufacturers

a. American Step Company, Inc., Griffin, Ga.

b. Parson Environmental Products, Inc., Reading, Pa.

c. Bowco Industries, Inc., Canby, Or.

d. Or equal.

PART 3 - EXECUTION

3.01 - PROTECTION

A. Protect aluminum from contact with dissimilar metals, concrete, masonry or mortar.

B. Before coating application, clean contact surfaces, remove dirt, grease, oil, foreign substances.

3.02 - FINISHES

A. Finishes: Aluminum ladders and entrance hatches shall receive and Aluminum Association clear anodic finish, designation C22A31.

3.03 - INSTALLATION

A. Install precast reinforced concrete vault, and related appurtenances in accordance with manufacturer's instructions.

B. Place precast reinforced concrete vault onto level prepared bedding as indicated. Provide uniform bearing over entire base of vault.

C. Seal all joints inside and out with specified sealant to ensure joints are waterproof.

D. Repair or replace damaged waterproofing.

E. Backfill vault excavation uniformly and in such a manner so as not to damage the waterproofing.

3.04 - PROTECTIVE COATING

A. Apply two coats of protective coating material (minimum 10 mils dry film thickness per coat) to exterior of walls, floor and ceiling by brush or spray according to manufacturer’s printed instructions.

B. Repair or replace damaged protective coating as determined by the Engineer at no additional cost to the owner.

C. Backfill vault excavation uniformly and in such a manner so as not to damage the waterproofing.

3.05 - CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 03600

GROUT

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PART 1 - GENERAL

1.01 - SCOPE

A. Furnish all labor, materials, equipment, and incidentals required, and install grout complete as shown on the Drawings and as specified herein.

B. Summary

1. Material for grouting reinforcing bars, anchor bolts into existing or newly placed concrete.
2. Material for grouting under bearing plates for columns or beams.
3. Materials for grouting under equipment.
4. Materials for grouting under and around steel tanks.
5. Materials for miscellaneous grouting including but not limited to railing posts, equipment guides, bollards, precast concrete joints and supports etc.

C. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification section number and title and Drawing numbers and titles.

1. Manufacturer's printed data and application instructions for specified materials and locations where materials are to be used.

2. Product Data

a. Commercially manufactured non-shrink, non-metallic cementitious grout. Include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to referenced ASTM standards, and Material Safety Data Sheet.

b. Commercially manufactured non-shrink epoxy grout. Include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to referenced ASTM Standards and Material Safety Data Sheet.

c. Cement grout. Include the type and brand of the cement, the gradation of the fine aggregate, product data on any proposed admixtures, and the proposed mix of the grout.

d. Concrete grout. Include data for concrete as delineated in SECTION 03300, CAST-IN-PLACE CONCRETE. This includes the mix design, constituent quantities per cubic yard, and the water/cement ratio.

e. Bonding Agent. Include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to referenced ASTM standards, and Material Safety Data Sheet.

3. Laboratory Test Reports. Submit laboratory test data as required under SECTION 03300, CAST-IN-PLACE CONCRETE for concrete to be used as concrete grout.

4. Mill test reports for each shipment of cement, regardless of quantity, prior to incorporation into the work.

5. Manufacturer's specifications and instructions for all admixtures, curing materials, adjustable inserts and non-shrink non-metallic grout. Manufacturer’s certification of compatibility of all admixtures.

1.05 - PRODUCT HANDLING

A. Comply with the requirements of SECTION 01610, DELIVERY, STORAGE AND HANDLING.

B. Deliver materials to the jobsite in original, unopened packages, clearly labeled with the manufacturer's name, product identification, batch numbers, and printed instructions.

C. Store materials in accordance with the manufacturer's recommendations. Total storage time from date of manufacture to date of installation shall be limited to six months or the manufacturer's recommended storage time, whichever is less.

D. Reject material that becomes damp, lumpy or otherwise unacceptable and immediately remove from the site and replace with acceptable material at no cost to the Owner.

E. Deliver non-shrink cement based grouts as pre-blended, prepackaged mixes requiring only the addition of water.

F. Deliver non-shrink epoxy grouts as premeasured, prepackaged, three component systems requiring only blending as directed by the manufacturer.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns.

B. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

C. Quality Assurance

1. Comply with requirements in SECTION 01400, QUALITY ASSURANCE and as specified.

2. Qualifications

a. Grout manufacturer to have a minimum of 5 years of experience in the production and use of the type of grout proposed for the Work.

3. Field Testing

a. Field testing and inspection services required will be provided by the Owner. Provide assistance in the sampling of materials and provide any ladders, platforms, etc. for access to the Work. Comply with the applicable ASTM Standards for testing.

b. The field testing of concrete grout will be as specified for concrete in SECTION 03300, CAST-IN-PLACE CONCRETE.

c. Take compression test specimens from the first placement of each type of grout to ensure compliance with these Specifications.

1) Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing one at seven days and two at 28 days.

2) Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C579, Method B. A set of three specimens will be made for testing at seven days.

1.07 - REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO):

1. M182: Burlap Cloth made from Jute or Kenaf

B. American Petroleum Institute (API):

1. RP 686: Recommended Practice for Machinery Installation and Installation Design

C. ASTM International (ASTM):

1. C33: Standard Specification for Concrete Aggregates
2. C109: Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or (50-mm) Cube Specimens)
3. C150: Standard Specification for Portland Cement
4. C531: Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts, and Monolithic Surfacings
5. C579 Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
6. C827: Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixes
7. C939 Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
8. C1107: Standard Specification for Packaged Dry, Hydraulic, Cement Grout (Non-shrink)
9. D695: Standard Test Method for Compressive Properties of Rigid Plastics

D. U.S. Army Corps of Engineers Standard (CRD):

1. C621: Corps of Engineers Specification for Non-shrink Grout

E. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.08 - RESPONSIBILITIES

A. Assist the Owner in obtaining specimens for testing and furnish all materials necessary for fabricating the test specimens.

B. The cost of laboratory tests on grout will be paid by the Owner except where test results show the grout to be defective. In such case, the Contractor shall pay for the tests, removal and replacement of defective work, and re-testing all at no cost to the Owner.

1.09 - WARRANTY

A. Warrant the materials and products specified in this Section against defective materials and workmanship with the manufacturer's standard warranty, but for no less than one year from the date of substantial completion.

B. Warrant the work against defects for one year from the date of substantial completion.

PART 2 - PRODUCTS

2.01 - GENERAL

A. Provide materials produced by one manufacturer or supplier in order to provide standardization of appearance.

2.02 - APPLICATION

A. Unless indicated otherwise, provide grouts as listed below:

TABLE 03600-1	
Type of Grout	**Application**
Cement Grout	Surface repairs
Non-Shrink – Class I	Storage tanks and other non-motorized equipment.
	Filling block-out spaces for embedded items such as railing posts, gate guide frames, etc. (Where placement time is less than 20 min.).
	Repair of holes and defects in concrete members that are not water bearing and not in contact with soil or other fill material.
Non-Shrink – Class II	Column base plates.
	Filling block-out spaces for embedded items such as railing posts, gate guide frames, etc. (where placement time exceeds 20 min.)
	Under precast concrete elements.
Non-Shrink Epoxy	Machinery subject to severe shock loads and high vibration.
Concrete Grout	Toppings and concrete/grout fill.

2.03 - MATERIALS

A. Non-shrink Class I Grout:

1. Non-shrink Class I Grout shall have a minimum 28-day compressive strength of 5,000 psi, when mixed at a fluid consistency.
2. Non-shrink Class I grout shall meet the requirements of ASTM C1107, Grade B or C, when mixed to fluid, flowable and plastic consistencies.
3. Products:
    a. Sika Corporation; SikaGrout 212
    b. BASF Corporation; MasterFlow 713
    c. Euclid Chemical Comany; Euco NS
    d. Or equal.

B. Non-shrink Class II Grout:

1. Non-shrink grout shall be a high precision, fluid, extended working time grout. The minimum 28-day compressive strength shall be 7,500 psi, when mixed at a fluid consistency.
2. Grout shall have an extended working time of 30 minutes minimum when mixed to a fluid consistency as defined in ASTM C827 at temperature extremes of 45 to 90 degrees F in accordance with ASTM C1107.
3. Non-shrink grouts shall meet the requirements of ASTM C1107; Grade B or C when tested using the amount of water needed to achieve fluid consistency per ASTM C939.
4. The grout when tested shall not bleed or segregate at maximum allowed water.

5. Products:
    a. BASF Corporation; Masterflow 928
    b. Euclid Chemical Co.; Hi-Flow Grout
    c. Sika Corporation; SikaGrout 212
    d. Or equal.

C. Cement Grout:
1. Cement grouts shall be a mixture of one part Portland cement conforming to ASTM C150 types I, II, or III and one to two parts sand conforming to ASTM C33 with sufficient water to place the grout. The water content shall be sufficient to impart workability to the grout, but not to the degree that it will allow the grout to flow.
2. Cement grout materials shall be as indicated in SECTION 03300, CAST-IN-PLACE CONCRETE cast-in-place concrete.

D. Concrete Grout:
1. Concrete grout shall conform to the requirements of SECTION 03300, CAST-IN-PLACE CONCRETE except as specified herein. Proportion with cement, coarse and fine aggregates, water, water reducer, and air entraining agent to produce a mix having an average strength of 4,000 psi at 28 days. Coarse aggregate size shall be 3/8-inch maximum. Keep the W/C ratio as low as practical while still retaining sufficient workability.

E. Non-shrink epoxy-based grout:
1. Provide a pre-proportioned, three component, 100 percent solids system consisting of epoxy resin, hardener, and blended aggregate. It shall have a compressive strength of 14,000 psi in seven days when tested in conformity with ASTM D695 and have a maximum thermal expansion of 30×10^{-6} when tested in conformity with ASTM C531.
2. Products:
    a. BASF Corporation; MasterFlow 648
    b. Five Star Products, Inc.; HP Epoxy Grout
    c. Sika Corporation; Sikadur 42 Grout-Pak
    d. Euclid Chemical Company; High Strength Epoxy Grout
    e. Or equal.

F. Dry Pack Grout:
1. Dry pack (to be packed or tamped in place) shall be mixed to a zero slump consistency.
2. When mixing the batch, add only enough water to the dry materials to produce a rather stiff mixture. Additions of water shall be made in small increments until the desired consistency is obtained.

G. Non-epoxy Bonding Compound:
1. Provide non-epoxy bonding compound that is re-wetable for up to two weeks.
2. Products:
    a. Larsen Products Corporation; Weld-Crete
    b. Sta-Dry Manufacturing Corporation; Link
    c. Euclid Chemical Company; Euco Weld
    d. Or equal.

2.04 - CURING MATERIALS

A. Curing materials for cement grout shall be as specified in SECTION 03300, CAST-IN-PLACE CONCRETE and as recommended by the manufacturer for prepackaged grouts.

PART 3 - EXECUTION

3.01 - GENERAL

A. Grout shall not be placed until base concrete or masonry has attained its design strength.

B. Prepare surfaces for curing, and protection of cement grout in accordance with SECTION 03300, CAST-IN-PLACE CONCRETE.

C. Shade the work sites from sunlight for at least 24 hours before and 48 hours after grouting.

D. Contact the grout manufacturer's representative for assistance on hot and cold weather grouting techniques and precautions if applicable.

3.02 - PREPARATION

A. Clean concrete surfaces to receive grout free of ice, frost, dirt, grease, oil, curing compounds, laitance and paints, and free of all loose or unsound material or foreign matter that may affect the bond or performance of the grout.

B. Roughen concrete surfaces by chipping, sandblasting, or other mechanical means to ensure bond of the grout to the concrete. Remove loose or broken concrete. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance and firmly embedded into the parent concrete.

C. Remove all loose rust, oil or other deleterious substances from metal embedments prior to the installation of the grout.

D. Wash concrete surfaces clean and keep them moist for at least 24 hours prior to the placement of cementitious or cement grout. Saturate by covering the concrete with a plastic sheet or using either a soaker hose, flooding the surface or other method acceptable to the Engineer. Remove visible water from the surface upon completion of the 24-hour period prior to grouting. Use an accepted adhesive bonding agent in lieu of surface saturation when accepted by the Engineer for each specific location of grout installation.

E. Epoxy based grouts do not require the saturation of the concrete substrate. Surfaces in contact with epoxy grout shall be completely dry before grouting.

F. Construct grout forms or other leak proof containment. Forms shall be lined or coated with release agents recommended by the grout manufacturer.

G. Support equipment during alignment and installation of grout by shims, wedges, blocks, or other accepted means. Prevent the shims, wedges, and blocking devices from bonding to the grout by appropriate bond breaking coatings and remove them after grouting unless otherwise accepted by the Engineer.

3.03 - GROUTING MACHINERY FOUNDATIONS

A. After the machinery has been set in position and placed at the proper elevation by steel wedges, the space between the bottom of the machinery base and the original placement of concrete shall be filled with a pourable non-shrink grout. Grout and grouting procedure shall be in accordance with API 686.

3.04 - INSTALLATION

A. Cement Grouts and Non-shrink Cementitious Grouts:

1. Mix in accordance with manufacturer's recommendations. Do not add cement, sand, pea gravel, or admixtures without prior approval by the grout manufacturer and the Engineer.

2. Avoid mixing by hand. Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the additional water required to obtain workability. However, do not exceed the manufacturer's maximum recommended water content.

3. Place grout into the designated areas in a manner that will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement should proceed in a manner that will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary. Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (re-temper) after initial stiffening.

4. Just before the grout reaches its final set, cut back the grout to the substrate at a 45-degree angle from the lower edge of bearing plate unless otherwise accepted by the Engineer.

5. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer.

B. Non-shrink Epoxy Grouts:

1. Mix in accordance with the procedures recommended by the manufacturer. Do not vary the ratio of components or add solvent to change the consistency of the grout mix. Do not over mix. Mix full batches only to maintain proper proportions of resin, hardener, and aggregate. Partial mixes will be rejected and will require the suspect grout to be removed and be replaced.

2. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60 degrees F or above 90 degrees F.

3. Place grout into the designated areas in a manner that will avoid trapping air. Placement methods shall ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

4. The extension of grout horizontally beyond base plate shall be less than or equal to the grout thickness.

5. Epoxy grouts are self-curing and do not require the application of water. Maintain the formed grout within its recommended placement temperature range for at least 24 hours after placing, or longer if recommended by the manufacturer.

C. Concrete Grout:

1. Provide the underlying concrete surface with a broomed finish. Protect and keep the surface clean until placement of concrete grout.

2. Remove the debris and clean the surface of all dirt and other foreign materials.

3. Saturate the concrete surface for at least 24 hours prior to placement of the concrete grout. Remove excess water just prior to placement of the concrete grout. Place a cement slurry immediately ahead of the concrete grout so that the slurry is moist when the grout is placed. Work the slurry over the surface with a broom until it is coated with approximately 1/16- to 1/8-inch thick cement paste.

D. Dry Pack:

1. Dry pack consistency shall be such that the grout is plastic and moldable but will not flow.

2. The use of pneumatic pressure for dry-packed grouting requires acceptance of the Engineer.

3.05 - CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 03730

CONCRETE REPAIR

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PART 1 - GENERAL

1.01 - SCOPE

A. Provide materials labor, equipment, and services necessary to repair concrete as specified.

B. Complete concrete repair operations in accordance with these specifications and the various system manufacturers' instructions regarding surface preparation, application, inspection and requirements for safety.

C. Complete crack repair work in accordance with these specifications and crack repair material manufacturer's instructions.

D. Complete joint repair work in accordance with these specifications and the joint repair material manufacturer's instructions.

E. The areas of concrete repair shall be determined by the Contractor and the Engineer and shall include any location where acidic attack of the concrete surfaces has reached a depth of ½" or deeper and at any air voids, bug holes or poorly consolidated concrete areas where the specified filler/surfacer materials cannot be used for filling or surfacing of the concrete.

F. If repair work is required for an area indicated to receive protective lining or coating, provide such repair in accordance with the requirements of this specification and the related lining or coating specifications.

G. The repair work specified herein is intended to cover the requirements for repair of concrete only, to a maximum depth of approximately 4-inch. If after blasting and cleaning, an area is discovered that requires a repair greater than 4-inch deep, or an area is discovered that requires repair or replacement of reinforcing steel notify the Engineer so that details may be provided to the Contractor to complete the repair.

H. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. Crack Repair: The quantities in linear feet to be measured for payment shall be the actual length of cracks repaired by the methods and materials specified under.

1. Epoxy crack repair.
2. Flexible polyurethane crack repair.
3. Rigid polyurethane crack repair.

C. Spall Repair Depth 4-inch or less: The quantities in square feet to be measured for payment shall be the actual square footage of spalled concrete repaired by the method and materials specified under spall repair.

D. Spall Repair Depth Greater Than 4-inch: The quantities in cubic feet to be measured for payment shall be the actual cubic footage of spalled concrete repaired by the method and materials specified under spall repair.

E. Crystalline Waterproofing Crack and Joint Repair: The quantities in linear feet to be measured for payment shall be the actual length of joints repaired by the methods and materials specified under crystalline waterproofing crack and joint repair.

F. Pipe Penetrations: The quantities in linear feet to be measured for payment shall be the actual circumference repaired by the methods and materials specified under pipe penetrations.

G. Waterproofing Treatment: The quantities in square feet to be measured for payment shall be the actual square footage of concrete surface to which the coating shall be applied specified under waterproofing treatment.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification section number and title and Drawing numbers and titles.

1. Procedures proposed for the accomplishment of repair work. Include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations to be coordinated with other works in progress.

2. Manufacturer's recommendations and product data sheets for all repair materials including performance criteria, surface preparation, ambient condition requirements and applications, curing requirements, volatile organic compound (VOC) data, and safety requirements.

3. Material Safety Data Sheets (MSDS) for any materials brought on-site including all repair system materials, solvents and abrasive blast media.

4. Qualifications of foreman and epoxy gun operators and demonstration of meeting the minimum requirements specified.

5. Design Mixes: Provide concrete and cement mortar in conformance with SECTION 03300, CAST-IN-PLACE CONCRETE and as specified herein.

1.05 - PRODUCT HANDLING

I. Comply with the requirements of SECTION 01610, DELIVERY, STORAGE AND HANDLING.

J. Provide shelter to store materials in area or areas designated by the Owner solely for this purpose. Confine mixing, thinning, clean-up and associated operations and storage of repair mortar materials debris before authorized disposal, to these areas.

K. Mix all specified materials in the sheltered mixing operation and materials from direct sunlight and inclement weather. Protect facilities from staining and damage.

L. Do not dispose of waste materials on-site.

M. Store waste temporarily in closed, nonflammable containers until final disposal. Keep no rubbish in Contractor's area longer than 24 hours.

N. Deliver all materials to the job site in new, unopened containers. Each container shall bear the manufacturer's name and label. Labels on all material containers shall contain the following information:

1. Name of product.

2. Federal Specification Number if applicable.

3. Manufacturer's batch number.

4. Manufacturer's name.

5. Generic type of material.

6. Hazardous material identification label.

7. Shelf life date.

O. Clearly mark all containers indicating any safety hazards associated with the use of or exposure to the materials.

P. Handle and store materials to prevent damage or loss of label. Protection of materials is the Contractor's responsibility.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns.

B. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

C. Quality Assurance

1. Comply with the requirements specified in SECTION 01400, QUALITY ASSURANCE.

2. Furnish the names of all subcontractors proposed for use for this work including necessary evidence and/or experience records to ascertain their qualifications in the application of epoxy, polyurethane, polymer-modified and cement-based compounds.

3. Include in accepted applicator qualifications:

    a. A minimum of five years' experience in applying epoxy, polyurethane and polymer-modified and cement-based compounds, and crystalline waterproofing repair systems similar to those specified in this Section.

    b. A letter from the manufacturer of the specified materials, on the manufacturer's letterhead, signed by an officer of the company, stating that the subcontractor/applicator has been trained in the proper techniques for the preparation of the surface, and proper methods for mixing, placing, curing, and caring of the manufacturer's products. This letter shall further state that the subcontractor/applicator is on the manufacturer's approved list of contractors.

4. Adhere strictly to the manufacturer's printed recommendations supplied with the product regarding temperature at time of application for all work. Do not use epoxy materials when either the temperature of the concrete to be repaired or the ambient temperature is below 50 degrees F 24 hours before, during, or for a period of 48 hours after the completion of the repair. Do not use crystalline waterproofing materials when either the temperature of the concrete to be repaired or the ambient temperature is below 40 degrees F 24 hours before, during, or for a period of 48 hours after the completion of the repair. Temporary heat may be used to meet the specified requirements.

5. Use new materials and use within the shelf life limitations set forth by the manufacturer. Clearly mark the shelf life limitations of each container.

6. The Contractor is ultimately responsible for the concrete repair work. Inspections by the Engineer or others do not limit the Contractor's responsibility.

7. Make all parts of the work accessible for inspections by the Engineer. Correct any conditions not in conformance with the specifications at no additional cost to the Owner.

8. Provide a Representative on site at all times when work is ongoing to represent the Contractor and to have authority to receive and execute all instructions given by the Engineer.

9. Allow changes in the specified repair work methods only with the permission of the Engineer.

10. Provide technical field support or training services required by the accepted material manufacturers at no additional cost to the Owner.

11. Provide materials from a single manufacturer for all components of a single repair.

D. Project/Site Conditions

1. Environmental Requirements:

    a. Comply with the repair material manufacturer's recommendations as to environmental conditions under which materials can be applied and cured.

    b. Do not apply materials when dust is being generated.

2. Protection:

    a. Cover or otherwise protect finish work or other surfaces not being repaired.

3. Ventilation:

    a. Provide ventilation to meet product requirements prior to, during, and after application.

1.07 - REFERENCES

A. National Association of Corrosion Engineers (NACE):

1. 6D-173: "A Manual for Painter Safety"

2. 6F-163: "Surface Preparation of Steel or Concrete Tank Interiors"

3. TPC2: "Coatings and Linings for Immersion Service"

B. American Concrete Institute (ACI):

1. 503.4: Standard Specification for Repairing Concrete with Epoxy Mortars

C. ASTM International (ASTM):

1. C33: Standard Specifications for Concrete Aggregates
2. C150: Standard Specification for Portland Cement
3. C321: Standard Test Method for Bond Strength of Chemical-Resistant Mortars
4. C882: Test Method for Bond Strength of Epoxy Resin Systems
5. D570: Test Method for Water Absorption of Plastics
6. D638: Test Method for Tensile Properties of Plastics
7. D695: Test Method for Compressive Properties of Rigid Plastics
8. D790: Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
9. D4262: L.R. Standard Test Method for pH of Chemically Cleaned or Acid Etched Concrete Surfaces
10. E329: Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
11. E337: L.R. Standard Practice Test Method for Measuring Humidity with a Psychrometer.

D. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.08 - SERVICES OF MANUFACTURERS REPRESENTATIVES:

A. Provide the services of a qualified manufacturer's technical representative to instruct the Contractor's personnel in the mixing, proper use and application of the epoxy, polyurethane, polymer-modified, crystalline repair systems and cement-based compounds.

B. Provide written certification from the manufacturers' representative that materials have been mixed and applied properly and surfaces to receive these products have been prepared properly, all in conformance with manufacturer's requirements.

C. Provide on-site time required for the manufacturer's representative to achieve a successful installation at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 - WATER

A. Use water free from injurious amounts of ice, oil, acid, alkali, salt, organic matter, or other deleterious substances and conforms to requirements of ASTM C1602.

B. Water shall not contain more than 500 mg of chlorides or more than 500 mg of sulfates.

C. Heat or cool water to obtain concrete repair product temperatures in accordance with manufacture’s printed recommendations, and in accordance with ACI 305.1 and ACI 306.1.

2.02 - AGGREGATE

A. All aggregates shall conform to ASTM C33 and SECTION 03300, CAST-IN-PLACE CONCRETE.

2.03 - EPOXY BONDING AGENT

A. Epoxy bonding agent shall conform to ASTM C881 Type I, II, IV or V; Grade 2 for epoxy resin adhesives, depending on the application. The class of epoxy bonding agent shall be suitable for all ambient and substrate temperatures.

B. Products:

1. Sika Corporation; Sikdur 32 Hi-Mod
2. Euclid Chemical Company; Duralcrete
3. BASF Corporation; MasterEmaco ADH 326
4. Or equal.

2.04 - ANTI-CORROSION COATING

A. Anti-corrosion coating shall be a three-component, solvent free, and moisture tolerant epoxy-modified cementitious material.

B. Products:

1. Sika Corporation; Sika Armatec 110
2. Sto Corporation; CR 246
3. Euclid Chemical Company; Duralprep A.C.
4. Or equal.

2.05 - EPOXY CRACK REPAIR BINDER

A. Epoxy crack repair binder shall be a two-component, 100 percent solids, high-modulus, low viscosity epoxy adhesive suitable for crack grouting by injection or gravity feed.

B. Products:

1. Sika Corporation; Sikadur 52
2. Euclid Chemical Company; Duralcrete LV
3. BASF Corporation; MasterInject 1380
4. Or equal.

2.06 - FLEXIBLE POLYURETHANE CRACK REPAIR MATERIAL

A. Flexible polyurethane crack repair material shall be a one-component, water-activated polyurethane hydrophilic injection grout capable of 700 percent expansion. Polyurethane grout shall form a tough flexible foam seal that is impenetrable to water.

B. Products:

1. Prime Resins; Prime Flex 900 XLV
2. Sika Corporation; Sikafix HH Hydrophilic
3. Euclid Chemical Company; Dural Aqua-Fil
4. Or equal.

2.07 - RIGID POLYURETHANE CRACK REPAIR MATERIAL

A. Rigid polyurethane crack repair material shall be a one-component, water-activated polyurethane hydrophobic injection grout capable of 700 percent expansion. Polyurethane grout shall form a tough rigid foam seal that is impenetrable to water.

B. Products:

1. Euclid Chemical Company; Dural Aqua-Dam LV
2. Prime Resins; Prime Flex 920
3. Sika Corporation; Sikafix HH LV
4. Or equal.

2.08 - EPOXY REPAIR MORTAR

A. Epoxy Repair Mortar shall be two-component, 100 percent solids, and 100 percent reactive epoxy resin system.

B. Spall repair mortar for use in horizontal applications.

1. Products:
   a. BASF Corporation; MasterEmaco ADH 327
   b. Sika Corporation; Sikadur 22 Lo-Mod
   c. Euclid Chemical Company; Euco #4565 Mortar
   d. Or equal.

C. Spall repair mortar for use in vertical and overhead applications.

1. Products:
   a. Sika Corporation; Sikadur 23 Lo-Mod Gel
   b. BASF Corporation; MasterEmaco ADH 327
   c. Or equal.

2.09 - SPALL REPAIRS USING NON-SHRINK CEMENTITOUS MORTAR

A. Products:

1. BASF Corporation; MasterEmaco S 488CI
2. Sika Corporation; Sika Repair 224
3. Sauereisen, Inc.; Restokrete Underlayment No. F-120
4. Or equal.

2.10 - SPALL REPAIRS USING POLYMER MODIFIED CEMENTITOUS MORTAR

A. Repair spalls repair not requiring formwork using a two-component, polymer-modified cementitious mortar having a minimum 28-day compressive strength of 6,000 psi.

B. Spall repair mortar for use in horizontal applications.

1. Products:
   a. Sika Corporation; Sikatop 122 Plus
   b. Euclid Chemical Company; Duraltop Flowable Mortar
   c. BASF Corporation; MasterEmaco T302
   d. Or equal.

C. Spall repair mortar for use in vertical applications.

1. Products:

a. Sika Corporation; Sikatop 123 Plus

b. Euclid Chemical Company; Duraltop Gel

c. BASF Corporation; MasterEmaco N 423RS

d. Or equal.

2.11 - SPALL REPAIRS REQUIRING FORMWORK

A. Repair spalls repair requiring formwork using a two-component, polymer-modified cementitious mortar/pea gravel mixture and shall have a minimum 28-day compressive strength of 5,000 psi. Mix each unit of mortar with Saturated Surface Dry (SSD) pea gravel to form the repair material following the manufacturer's recommendations.

B. Products:

1. Sika Corporation; Sikatop 111 Plus

2. Euclid Chemical Company; Duraltop Flowable Mortar

3. BASF Corporation; MasterEmaco N 1500HCR Self Consolidated-Extended

4. Or equal.

2.12 - CRYSTALLINE WATERPROOFING CRACK AND JOINT REPAIR

A. Repair cracks and joints using a crystalline waterproofing crack and joint repair system consisting of a three stage application of filling a square or U-shaped routed out crack or joint in equal lifts followed by a surface applied slurry over a 12-inch width of the crack.

B. Products:

1. Kryton International; Krystol T1 and Krystol T2.

2. Xypex Chemical Corporation; Xypex Concentrate and Xypex Concentrate (Dry-Plug).

3. Penetron International; Penetron and Penecrete Mortar

4. Or equal.

2.13 - PIPE PENETRATIONS EXTERIOR OF CELL

A. Repair pipe penetrations using a crystalline waterproofing crack and joint repair system consisting of a three stage application of filling a square or U-shaped routed out area at the pipe/concrete interface in equal lifts.

B. Products:

1. Kryton International; Krystol T1 and Krystol Bari-Cote.

2. Xypex Chemical Corporation; Xypex Concentrate and Xypex Concentrate (Dry-Plug).

3. Penetron International; Penetron and Penecrete Mortar

4. Or equal.

2.14 - WATERPROOFING TREATMENT

A. Waterproofing treatment shall be a surface applied crystalline waterproofing system shall be a brush or spray applied two coat system.

B. Products:

1. Kryton International; Kryton T1 and Kryton T2.
2. Xypex Chemical Corporation; Xypex Concentrate.
3. Penetron International; Penetron.
4. Or equal.

2.15 - WATERPROOF MEMBRANE PATCH

A. Waterproof membrane patch shall be a hypalon sealing strip secured to the concrete substrate with an epoxy adhesive.

B. Install sealing system per manufacturer's recommendations.

C. Products:

1. Sika Corporation; Sikadur Combiflex SG System
2. Trelleborg Engineered System; Waterproofing Band
3. Or equal.

2.16 - CEMENT BASED TEXTURED COATING

A. Products:

1. Sika Corporation; Sikatop 144
2. Euclid Chemical Company; Duraltop Coating
3. BASF Corporation; MasterSeal 581
4. Or equal.

2.17 - SEALANT

A. Sealant shall be a two-component polyurethane sealant as specified in SECTION 03150, CONCRETE ACCESSORIES. Primers and bond breakers shall conform to the sealant manufacturer's recommendations.

2.18 - EXPANSION JOINT FILLER

A. Expansion joint filler shall be as specified in SECTION 03250, CONCRETE JOINTS AND ACCESSORIES.

PART 3 - EXECUTION

3.01 - GENERAL REQUIREMENTS

A. Perform exterior work during dry weather and appropriate temperature conditions in accordance with the manufacturer's recommendations. Protect unfinished work during inclement weather with tarpulins or heavy gage polyethylene sheeting.

B. Perform work in spaces within structures at temperature and conditions suitable for proper curing in accordance with the manufacturer's recommendations.

C. Coordinate concrete rehabilitation work with other work being performed.

D. Remove scaling, broken, loose and disintegrating materials by use of hand tools or power driven saws, down to solid unyielding material.

E. Clean surfaces thoroughly of efflorescence, oils, grease and other objectionable material in area to be repaired in accordance with the manufacturer's recommendations.

3.02 - EPOXY BONDING AGENT

A. Use epoxy bonding agent to adhere fresh mortar to existing concrete. Roughen existing concrete surfaces prior to application of bonding agent. Concrete surface shall be clean and sound, free of all foreign particles and laitance. Place repair material while bonding agent is still tacky or per the written instructions of the manufacturer. Reapply bonding agent if bonding agent cures prior to placement of repair material.

B. Conform to all the requirements of ACI 503.4, and as specified herein.

3.03 - ANTI-CORROSION COATING

A. Sandblast, clean and coat reinforcing steel that is cut or exposed during alteration and/or repair operations with an anti-corrosive coating.

B. Cover all exposed parts of the steel with the coating and apply according to manufacturer's recommendations.

3.04 - EPOXY CRACK REPAIR

A. Cracks on horizontal surfaces: When permitted by the Engineer repair existing cracks by gravity feeding an epoxy crack repair binder into the prepared crack.

1. Rout concrete surface at the crack to form a minimum 1/4-inch wide by 1/4-inch deep V-notch and clean to remove all loose and foreign particles. Fill crack with clean, dry sand and pour epoxy crack repair binder into V-notch, completely filling crack.

2. As binder penetrates into crack, apply additional binder to the V-notch.

B. Cracks on vertical or horizontal surfaces: Repair cracks by pressure injecting an epoxy crack repair binder into the prepared crack. Seal cracked surfaces and install injection ports per manufacturer's recommendations.

1. Do not damage reinforcement steel when drilling holes for injection ports. If rebar is encountered during drilling, abandon the hole and relocate. Patch the abandoned hole immediately with epoxy mortar flush with the surface of the existing concrete.

2. Inject crack with epoxy crack repair binder once the surface sealing material has cured as directed by the manufacturer.

3. Remove injection ports upon satisfactory completion of crack injection and patch with epoxy mortar.

3.05 - RIGID AND FLEXIBLE POLYURETHANE CRACK REPAIR

A. Repair leaking cracks by pressure injecting with a waterproof hydrophilic or hydrophobic injection grout as directed by the Structural Engineer of Record. Seal crack surfaces and install injection ports per manufacturer's recommendations.

B. Do not damage rebar when drilling holes for injection ports. If rebar is encountered during drilling, abandon the hole and patch immediately with epoxy mortar flush with the surface of the existing concrete.

C. Inject crack with hydrophilic or hydrophobic injection grout as directed once the surface sealing material has cured, as directed by the manufacturer.

3.06 - SPALL REPAIR

A. Saw cut the perimeter of the repair area to a minimum depth of 1/4-inch below the surface of the concrete. Chip all loose concrete in the repair area to remove loose and degraded concrete to a minimum of 1/4-inch or until a sound substrate is reached. Clean the area to be repaired and restore to the original dimensions with spall repair patching material according to the manufacturer's recommendations.

B. Make final finished surface of patches flat, level and even with the existing concrete surface. Do not feather repair mortar to meet existing concrete surface.

C. Finish final patches on horizontal surfaces consistent with the finish on the existing structure.

3.07 - JOINT REPAIR

A. Remove sealant, bond breaker and joint filler.

B. Remove unsound concrete on the joint faces.

C. Remove laitance and provide a clean dry surface.

D. Prepare an epoxy mortar by combining epoxy crack repair binder with aggregate following the manufacturer's instructions.

E. Restore surface to original dimensions by trowelling epoxy mortar onto the existing substrate in a manner to ensure bonding following the manufacturer's instructions.

F. Cure repair in accordance with the manufacturer's instructions.

G. Install new joint filler, bond breaker and sealant.

3.08 - WATERPROOF MEMBRANE PATCH

A. Clean and install waterproof membrane textured patches on existing concrete areas requiring a textured patch according to manufacturer's recommendations.

3.09 - CEMENT BASED TEXTURED COATING

A. Clean existing concrete areas requiring a textured coating and apply the cement based textured coating according to manufacturer's recommendations.

B. Complete other concrete rehabilitation prior to applying coating.

3.10 - CRYSTALLINE WATERPROOFING CRACK AND JOINT REPAIR

A. Identify all cracks and joints to be repaired prior to commencing repair operations.

B. Using a concrete saw or angle grinder, create a 1/4 inch deep groove 1/2 inch to either side of the crack or joint to create a vertical seam for chipping operations. Using a 1 inch square chisel, chip a 1 inch wide chase along all cracks and joints to a minimum depth of 1.5 inches. The chase must be square or U-shaped.

C. Clean the chase of dust and loose concrete.

D. Pre-wet the surface to a saturated-surface-dry (SSD) condition. Do not leave any standing, pooled, or puddled water.

E. Fill one-third of the depth of the chase with the first lift of repair material. Cure the material per manufacturer’s printed instructions.

F. Fill the next one-third of the chase with the second lift of repair material. Cure the material per manufacturer’s printed instructions.

G. Fill the remaining one-third of the chase with the third and final lift of repair material. Cure the material per manufacturer’s printed instructions.

H. If the surface of the concrete is not receiving a complete Waterproofing Treatment, apply a slurry coat of waterproofing treatment to 6-inch to either side of the crack or joint.

3.11 - PIPE PENETRATIONS

A. Identify all pipe penetrations to be repair prior to commencing pipe penetration repairs.

B. Pipe penetration repairs shall not be performed against flowing or seeping water.

C. Prepare a recessed chase using a 1 inch square chisel to chip a 1 inch wide chase to a minimum depth of 1.5 inches. The chase must be square or U-shaped.

D. Prepare the pipe surface so that the repair products will adhere to the pipe in accordance with manufacturer printed instructions. Remove all grease, oil, corrosion, and scale. Abrade the pipe surface within the chase by coarse sanding to achieve a coarse surface profile.

E. Clean the chase of dust and loose concrete.

F. Fill one-third of the depth of the chase with the first lift of repair material. Cure the material per manufacturer's printed instructions.

G. Fill the next one-third of the chase with the second lift of repair material. Cure the material per manufacturer's printed instructions.

H. Fill the remaining one-third of the chase with the third and final lift of repair material. Cure the material per manufacturer's printed instructions.

3.12 - WATERPROOFING TREATMENT

A. Repair surface defects in accordance with Section 3.06, Spall Repair.

B. Clean existing concrete areas by high pressure water blasting (3,000 psi minimum) to remove loose concrete and surface contaminants. Wash and rinse with a detergent or concrete degreaser if required to remove contaminants prior to water blasting. Sand blasting, scarifying, shot blasting, other mechanical methods, or acid-etching are not permitted.

C. Apply first coat of waterproofing treatment to a surface saturated dry surface. Apply at the recommend rate in accordance with manufacture's printed instructions for the surface orientation. Cure the material in accordance with the manufacturer's printed instructions.

D. Apply second coat of waterproofing treatment to a surface saturated dry surface following the recommended cure time for the first coat. Apply at the recommend rate in accordance with manufacture's printed instructions for the surface orientation. Cure the material in accordance with the manufacturer's printed instructions.

E. Wait a minimum of 14 days following completion of final curing prior to cleaning and filling tanks that are to contain potable water.

3.13 - CURING

A. Cure repair materials in accordance with manufacturer's printed instructions.

3.14 - CLEANING

A. Mechanically remove excess material from walls, floors, etc. after material has cured.

B. Clean excess materials caused by work under this Section from existing surfaces by the use of power sanders. Vacuum surfaces to receive final cleaning and finishing specified under other sections of the specifications. Sand cracks (except those repaired by crystalline waterproofing crack and joint repair methods) flush to adjacent surfaces.

C. Remove misplaced sealants using methods and materials recommended by the manufacturers. Leave finished work and work area in a neat and clean condition.

D. Rinse tanks containing drinking water with potable water following completion of repairs.

3.15 - LEAKAGE TESTING

A. Provide leakage testing in accordance with SECTION 03800, LEAKAGE TESTING OF CONTAINMENT STRUCTURES.

B. Leak test all cells in the single test. Do not test cells individually.

3.16 - CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 05500

MISCELLANEOUS METAL

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PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide metal fabrications not specifically included in other Sections and required for completion of work as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings: Submit the following in accordance with SECTION 01300, SUBMITTALS:

1. Manufacturer's literature describing standard items.

2. Shop drawings showing materials, sizes, finishes, locations, attached hardware and fittings, and details for manufactured items and fabricated metalwork, including field erection details showing cuts, copes, miter connections, holes, thread fasteners and welds. Indicate welds, both shop and field, by symbols conforming to AWS standards. Indicate coatings or other protection against corrosion.

3. Setting diagrams, erection plans, templates and directions for installation of backing plates, anchors, and other similar items.

4. Manufacturer’s specifications, load tables, anchor details, installation details for grating.

5. Material, product data and specifications with standards designated.

1.05 - PRODUCT HANDLING

A. Provide in accordance with SECTION 01610, DELIVERY, STORAGE AND HANDLING and as specified.

B. Identify and match-mark, materials, items and fabrications, for installation and field assembly.

C. Deliver items to jobsite as complete units, wherever practicable, ready for installation or erection, with anchors, hangers, fasteners and miscellaneous metal items required for installation.

D. Carefully handle and store materials, protected from weather, rusting and other damage.

E. Store structural shapes, pipes, tubes and sheets off the ground on suitable supports, with webs of flanged shapes vertical.

1.06 - DESIGN CRITERIA – Not Used

1.07 - QUALITY ASSURANCE

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE and as specified.

B. Obtain field measurements prior to preparation of shop drawings and fabrication.

C. Welding Qualification and Certification:

1. Furnish written welding procedure for all welds in conformance with AWS Structural Welding Code.

2. Each welder, tacker and welding operator shall be certified by test within the past six months to perform type of work required in conformance with AWS Structural Welding Code. Testing shall be conducted and witnessed by an independent testing laboratory.

3. Maintain duplicate qualification and certification records at the job site readily available for examination.

1.08 - REFERENCES

A. Aluminum Association (AA):

1. AA M12C22A41.

a. M12: Mechanical Finish, Non-Specular.

b. C22: Chemical Finish, Medium Matte.

c. A41: Clear Anodic Coating, Class I.

2. AAM12C22A42:

a. M12: Mechanical Finish, Non-Specular.

b. C22: Chemical Finish, Medium Matte.

c. A42: Dark Bronze Anodic Coating, Class 1.

B. American Institute of Steel Construction (AISC):

1. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

C. American Welding Society (AWS):

1. D1.1: Structural Welding Code Steel.

D. Aluminum Association Standard Anodic Finish (AASAF).

E. American Society for Testing and Materials (ASTM) Publications:

1. A36: Specification for Structural Steel.
2. A53: Specification for Pipe, Steel Black and Hot-dipped, Zinc-Coated Welded and Seamless.
3. A123: Specification for Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.
4. A153: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
5. A167: Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
6. A269: Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
7. A276: Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
8. A312: Specification for Seamless and Welded Austenitic Stainless Steel Pipe.
9. A325: Specification for High Strength bolts for Structural Steel Joints.
10. A366: Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
11. A569: Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.
12. A780: Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
13. B26: Specification for Aluminum-Alloy Sand Castings.
14. B209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
15. B211: Specification for Aluminum-Alloy Bars, Rods, and Wire.
16. B221: Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
17. B241: Specification for Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
18. B247: Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings and Rolled Ring Forgings.
19. B249: Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, and Shapes.
20. B308: Specification for Aluminum-Alloy 6061-T6 Standard Structural Shapes, Rolled or Extruded.
21. B429: Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

F. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - MATERIALS

A. Steel:

1. Conform to latest issue for the following:
    a. Steel Shapes and Plates: ASTM A36
    b. Steel Pipe: ASTM A53.
    c. Nuts, Bolts, Rivets, Washers, and Anchorage Devices: ASTM A325 and AISC Specification.
    d. Steel Sheets: Cold-rolled or hot-rolled carbon steel, ASTM A366, or ASTM A569.

B. Stainless Steel

1. Type 316Lunless otherwise indicated or specified.
2. General: Type (or Grade) 304L for welding, otherwise Type (or Grade) 304.
3. Shapes and Bars: ASTM A276
4. Plate, Sheet, and Strip: ASTM A167
5. Tubing: ASTM A269
6. Pipe: ASTM A312, Schedule 40S

C. Aluminum:

1. Plates, rolled or extruded shapes, sheets or castings conforming (unless otherwise permitted or indicated) to the following Aluminum Association alloy and temper designations:
    a. Rolled structural sheets and plates: ASTM B209-6061-T6
    b. Rolled Structural Shapes: ASTM B308-6061
    c. Extruded structural shapes, bars and tubes: ASTM B221 Alloy 6061-T6
    d. Extruded structural tube or pipe: ASTM B429 Alloy 6061 T-6
    e. Gratings (bearing bars): ASTM B211-6061-T6
        (crimp bars): ASTM B211-6061-T5
    f. Castings: ASTM B26-214
    g. Sheets: ASTM B209-Alclad 3003-H14 and 3003
    h. Bolts and nuts: Type 316Lstainless steel
    i. Pipe railings: ASTM B241-6061-T6
    j. Handrail posts: ASTM B241-6061-T6
    k. Die and hand forgings: ASTM B247 Alloy 6061-T6
    l. Welding filter rods: ASTM B241-6061-T6

D. Bolts, washers and nuts: Type 316Lstainless steel

E. Welding:

1. Provide filler materials appropriate and compatible for the alloys and tempers in accordance with the AWS Structural Welding Code.
2. Provide Class 5356 electrodes.

2.02 - FABRICATION

A. General:

1. Fabricate true to shape, size and tolerances as indicated and specified with straight lines, square corners or smooth bends; free from twists, kinks, warps, dents, and other imperfections. Straighten work bent by shearing or punching.

2. Dress exposed edges and ends of metal smooth, with no sharp edges and with corners slightly rounded. Construct connections and joints exposed to weather to exclude water.

3. Provide sufficient quantity and size of anchors for the proper fastening of work.

4. Fabricate details and connection assemblies in accordance with drawings and with projecting corners clipped and filler pieces welded flush.

5. Weld shop connections, bolt or weld field connections, unless otherwise noted or specified.

6. Provide clips, lugs, brackets, straps, plates, bolts, nuts, washers, and similar items, as required for fabrication and erection.

7. Use connections of type and design required by forces to be resisted, and to provide secure fastening.

8. Welding

   a. Grind exposed edges of welds to a 1/8-inch minimum radius. Grind burrs, jagged edges and surface defects smooth.

   b. Prepare welds and adjacent areas such that there is (1) no undercutting or reverse ridges on weld bead, (2) no weld spatter on or adjacent to weld or any other area to be painted, and (3) no sharp peaks or ridges along weld bead. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

9. Bolting

   a. Provide Type 316L stainless steel stud bolts and nuts with heavy aluminum washer for fastening of aluminum material.

   b. Draw up bolts or nuts tight and deform threads where possible. Use bolts of lengths required so that bolts do not project more than 1/4-inch beyond face of nut. Do not use washers unless specified. Provide hexagonal head bolts with hexagonal nuts.

   c. Provide holes required for the connection of adjacent or adjoining work wherever noted on drawings. Locate holes for bolting equipment to supports to a tolerance of + 1/16-inch of exact dimensions indicated.

   d. Provide plastic protection caps.

B. Fit work together in fabrication shop and deliver complete, or in parts, ready to be set in place.

C. Fabricated Products:

1. Pipe Sleeves in Concrete Construction: Weld standard weight, black steel pipe, with anchors to exterior to accommodate passage of conduits, pipes ducts and similar items.

2.03 - ALUMINUM PLATE COVERS AND FRAMES – NOT USED

2.04 - LOOSE LINTELS AND CMU PARTITION SUPPORTS – NOT USED

2.05 - ENGINE EXHAUST SLEEVE – NOT USED

2.06 - GRAB BARS – NOT USED

2.07 - ALUMINUM PIPE RAILS – NOT USED

2.08 - UNPUNCHED ALUMINUM PLANK – NOT USED

2.09 - ALUMINUM LADDERS

A. Fabricate from 1-1/2-inch IPS, Schedule 80 aluminum pipe side rails and 1-inch solid round aluminum rod rungs, mortised and welded to uprights. Ladders for roof access, provide with uprights flared at top and turned back to form guard rails.

1. Provide rungs knurled or dimpled to minimize slipping.

B. Provide aluminum safety cages around ladders where the vertical distance between floors or landings is 20 feet or more. Fabricate cages from structural aluminum components as detailed.

C. Conform to OSHA Regulation 1910.27 for safety cages.

D. Ladder safety post extensions shall be provided on all fixed ladders 20 feet or less in height located below hatches and roof scuttles and as indicated. The aluminum telescoping tubular safety post extension shall lock in its vertical position and extend a minimum of 36 inches above the opening and shall be secured to the ladder rungs with stainless steel fasteners and brackets. The ladder post extension shall be Ladder UP Safety Post, Model LU-4 by Bilco Co.; Series L1E Safety Extension by Halliday Products; Pull-up Bar by Access Manufacturing or equal.

2.10 - ALUMINUM FINISHES

A. After fabrication, provide interior and exterior aluminum pipe railing assemblies, kick plates, posts, and ladders with Aluminum Association Standard clear anodized finish, Designation C22A41.

2.11 - ALUMINUM PROTECTION

A. Protect aluminum against electrolysis from all sources as specified in SECTION 01063, MISCELLANEOUS REQUIREMENTS. Under no circumstances shall aluminum contact a dissimilar metal.

1. Members Encased in Concrete: Zinc chromate primer.

2. Members in Contact with Concrete Masonry or Mortar: Coal tar epoxy.

B. Manufacturers:

1. 46H-413 Hi-Build Tneme Tar by Tnemec Co., Inc.

2. Bitumastic 300M by Carboline Co.

3. Or acceptable equivalent product.

2.12 - RUNGS

A. Fabricate rungs from 1-inch diameter, Type 316Lstainless steel rod and shaped to meet the requirements of OSHA 1910.27, Fig. D-1. Provide a clear width of 16 inches, drop front design approximately 3 inches deep and turned upward at least 2 inches at the embedded ends, and embed to a depth of 6 inches into the wall. Space rungs a maximum 12 inches apart vertically and projecting 7 inches from face of wall to centerline of rungs. Provide stainless steel grab bars built into wall above the hinged floor plate covers.

1. Provide rung knurled or dimpled to minimize slipping.

2.13 - FALL PREVENTION SYSTEM FOR LADDERS

A. Provide ladders with a rigid, fall prevention system complete, of Type 316Lstainless steel construction. Provide Saf-T-Climb system manufactured by Siebe Norton, Inc., Cerritos, CA, or an acceptable equivalent product.

1. System Components: Rigid notched carrier rail (1-5/16-inch stainless steel tubing) with guide channel, alignment guide and connecting strap; saf-t-lok sleeve and safety locking mechanism; mounting brackets; safety belt with two side "D" rings for attaching, body strap (nylon w/elk leather wrap), and buckle of stainless steel.

B. Conform to OSHA Regulation 1910.27 for fall prevention system.

2.14 – STEEL BOLLARDS AND GUARD POSTS

A. Pipe for the bollards and guard posts shall be 6-inch O.D. standard strength galvanized steel conforming to ASTM A120 or A53, except for bollards are located around electrical transformers which shall be 4-inch O.D.s standard strength galvanized steel conforming to ASTM A120 or A53. Lengths shall be such as to allow guard posts to extend 4-feet above and below grade.

B. Concrete for bollard encasement and for filling the inside of the pipe shall conform to DIVISION 3, CONCRETE.

C. Bollards shall be covered with a dome top low-density polyethylene thermoplastic tube having ultra-violet resistance and anti-static properties with a nominal thickness of 0.250 inches. Color shall be OSHA yellow and surface of sleeve shall be smooth with round top. No ribbed or multiple piece systems accepted.

2.15 - HATCHES

A. Hatches shall be of the styles, types and sizes shown on the Contract Drawings. All hatches shall be of the same manufacturer. Manufacturer shall guarantee proper operation and against defects in material or workmanship for a period of five (5) years. All hatches shall be of aluminum as manufactured by the Bilco Company, Halliday Products Inc., or Babcock Davis.

B. Type J and JD hatches shall be single leaf and double leaf, respectively, watertight, self-draining type. Door leaf shall be of 1/4-inch thick aluminum diamond pattern plates reinforced with aluminum stiffeners as required and capable of withstanding a live load of 300 pounds per square foot. Channel frame shall be 1/4-inch thick aluminum with anchor flange around the perimeter. Each door leaf shall be equipped with a minimum of two (2) hinges, with stainless steel pins, compression spring operators enclosed in telescopic tubes to afford easy operation, and an automatic hold-open arm with release handle. Snap locks with removable handle and safety chains shall be provided. A 1-1/2-inch drainage coupling shall be located in the front right corner of the channel frame. Hardware shall be stainless steel with factory mill finish and bituminous coating applied to exterior of frame.

C. Type K and KD hatches shall be single leaf and double leaf, respectively. Door leaf shall be 1/4-inch thick aluminum diamond pattern plate reinforced with aluminum stiffeners as required and capable of withstanding a live load of 150 pounds per square foot. Channel frame shall be of 1/4-inch thick extruded aluminum with built-in neoprene cushion and with strap anchors bolted on the exterior. Door leaf shall be equipped with a minimum of two (2) hinges bolted to underside and pivoted on torsion bars that counterbalance the door for easy operation. The door shall open 90 degrees and lock automatically in that position. A vinyl grip handle shall be provided to release the cover for closing. Doors shall be equipped with a snap lock and removable handle. Hardware shall be stainless steel with factory mill finish and bituminous coating applied to exterior of frame.

D. Type J and JD hatches that are not shown connected to a drainage system shall be provided with extensions to the drainage coupling to allow drainage to the area below.

E. Hatches shall be installed in accordance with the recommendations of the manufacturer and as approved by the Engineer.

F. Hatches shall be provided with integral protective safety grating panels which operate independently from the hatch cover. Panel shall be constructed with aluminum “I” bar construction, all T-316L stainless steel hardware, tamper proof stainless steel hinge bolts, lockable with owner-supplied padlock, hinged with positive latch to maintain upright position, load rated consistent with access cover, view area for observation and limited maintenance, safety orange powder-coated finish, nut rail and stainless steel spring nuts with 300 psf loaded doors.

2.16 - MISCELLANEOUS ITEMS

A. Provide items of miscellaneous metalwork not particularly specified, of the shape, size, material and detail indicated and suitable for the purpose intended.

PART 3 - EXECUTION

3.01 - GENERAL

A. Accurately set and properly secure in place as indicated and specified. Where bolted connections are used, draw closely together and draw nuts tightly. Use bolts of lengths so that they do not project more than 1/4-inch [6 mm] beyond face of nut. Do not use washers unless specified. Provide hexagonal head bolts with hexagonal nuts.

B. Locate anchors and anchor bolts and build into connecting work. Insert expansion bolts into drilled holes.

C. After erection, clean aluminum with mild soap and water, followed by clear water rinse, after erection.

D. Miscellaneous metal items specified shall be installed as indicated, specified and in accordance with accepted shop drawings.

3.02 - ALUMINUM PROTECTIVE COATING

A. Protect aluminum from contact with dissimilar metals, concrete, masonry, motar or grout.

B. Coat surfaces of aluminum with heavy coat of bitumastic paint.

C. Before coating application, clean contact surfaces, remove dirt, grease, oil, foreign substances, followed by immersing in, or wipe thoroughly with, an acceptable solvent. Rinse with clean hot wate and dry thoroughly.

3.03 - ALUMINUM PIPE RAILINGS – Not Used

3.04 - ALUMINUM HANDRAILS – Not Used

3.05 - LADDERS

A. Anchor uprights to wall with angles or bent plates, weld to uprights and bolt expansion to wall. Ground smooth all welds.

B. Secure interior ladders to floor slabs with floor flanges.

C. Install safety cages or fall prevention system as indicated and in accordance with accepted shop drawings.

3.06 - ALUMINUM GRATINGS AND FRAMES – Not Used

3.07 - ALUMINUM PLATE COVERS – Not Used

3.08 - LIFTING HOOKS

A. Fasten lifting hook to 1/2-inch by 4-inch by 11-inch steel anchor plate and assembly placed in formwork before concrete is placed.

B. Place lifting hooks in punched holes in bottom flange of steel beams and secure in place by nuts.

3.09 - ENGINE EXHAUST SLEEVE – Not Used

3.10 – RUNGS AND GRAB BARS

A. Space rungs and grab bars at 12-in. on center or as indicted.

B. Apply protective coat of bituminous material to embedded parts of rungs and grab bars.

3.11 - STRUCTURAL DOOR FRAMES – Not Used

3.12 - ANGLE PROTECTION – Not Used

3.13 - FALL PREVENTION SYSTEM

A. Install in accordance with manufacturer's printed instructions and as specified.

3.14 - ALUMINUM PLANK – Not Used

3.15 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 09940

SHOP PAINTING

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PART 1 - GENERAL

1.01 - SCOPE

A. Provide labor, materials, equipment and incidentals required for the surface preparation and application of shop primers and finish coats, as specified herein.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

Manufacturer's specifications and data on the proposed primers and detailed surface preparation, application procedures and dry mil thicknesses, including list of items and surfaces to receive shop painting.

1.05 - PRODUCT HANDLING

A. Provide in accordance with SECTION 01610, DELIVERY, STORAGE AND HANDLING and as specified herein.

B. Deliver materials to application area in original, unbroken containers, plainly marked with name and analysis of product, manufacturer's name, and shelf lift date. Do not store or use contaminated, outdated, prematurely opened, or diluted materials.

C. Store coated items to prevent damage or dirtying of coatings. Avoid need for special cleaning and store coated items out of contact with ground or pavement. Place suitable blocking under coated items during storage.

D. Do not expose surfaces to weather for more than six months before being top-coated, or less time if recommended by coating manufacturer.

E. Protect surfaces not to receive paint coatings during surface preparation, cleaning, and painting.

F. Protect coatings from damage during shipment and handling by padding, blocking, use canvas or nylon slings, and use care when handling.

G. At time of delivery of shop painted items to job site, ensure coatings are undamaged and in good condition.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. Job Conditions

1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.
2. Do not apply coatings when dust is being generated.

PART 2 - PRODUCTS

2.01 - MATERIALS

A. Coatings are divided into the following service types, as determined by conditions:

1. Non-Potable Water

a. All ferrous metals not subject to potable water provide one coat with a dry film thickness of 2.5 to 3.0 mils with one of the following:

(1) #1 Purple Prime made by Tnemec Co.

(2) Carbozinc 859 by Carboline Co.

(3) Multiprime EFD Epoxy Fast Day Inhibitive Primer 94-109 made by PPG Protective & Marine Coatings (4.0 – 6.0 DFT).

2. Potable Water

a. Ferrous metals submerged or which are subject to splash action in contact with potable water, provide one coat with a dry mil thickness of 3.0 to 3.5 mils of a certified NSF Standard 61 product by one of the following:

(1) 91 H20 Urethane Zinc Rich Primer made by Tnemec Co.

(2) Carboguard 561 made by Carboline Co.

(3) Aquapon High Build Potable Water Epoxy 95-132 Series made by PPG Protective & Marine Coatings (4.0 – 6.0 DFT).

B. Shop prime with primers guaranteed by the manufacturer to be compatible with their corresponding primers and finish coats specified in SECTION 09941, FIELD PAINTING for use in the field and which are recommended for use together.

PART 3 - EXECUTION

3.01 - APPLICATION

A. Surface Preparation and Priming

1. Sandblast clean in accordance with SSPC-SP-6, Commercial Grade, immediately prior to priming non-submerged components scheduled for priming, as defined above.

2. Sandblast clean in accordance with SSPC-SP-10, Near White, immediately prior to priming submerged components scheduled for priming, as defined above.

3. Before priming, provide surfaces dry and free of dust, oil, grease and other foreign material.

4. Shop prime in accordance with approved manufacturer's printed recommendations.

B. Non-primed Surfaces: Apply approved coating in accordance with manufacturer's printed recommendation.

3.02 - TOUCH-UP

A. Repair or replace damaged or defective coated areas. Resultant shop painting: Paint items as specified.

B. Remove damaged or defective coatings by specified blast cleaning to meet surface cleaning requirements, just before recoating. When small areas of coating need touch up, surface preparation may be done with suitable power needle gun to match specified blast cleaning.

3.03 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 09941

FIELD PAINTING

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PART 1 – GENERAL

1.01 - SCOPE

A. Provide and apply paints and coatings specified and indicated. Prepare, clean, and finish all existing and new surfaces to be field painted as specified and indicated.

1. The terms “paint” and “coating” used herein include emulsions, enamels, paints, stains, varnishes, sealers, and other coatings, organic or inorganic, whether used as intermediate, or finish coats.

B. Complete painting and test patches for existing surfaces in accordance with specifications, paint manufacturer's current surface preparation and application instructions and safety requirements. In the event of conflict, the more stringent specifications will apply.

C. Furnish and apply pipe, valve, and equipment identification legends as specified.

D. Items Not to Be Field Painted:

1. SECTION 15056, PIPE SUPPORTS

a. All pipe supports will be delivered with finish paint and will not require field painting.

2. SECTION 15600, HEATING, VENTILATION AND AIR CONDITIONING EQUIPMENT

a. All equipment except piping valves, meters and fittings will be delivered with finish paint and will not require field painting. Painting Subcontractor shall paint piping, valves, meters and fittings as specified herein as indicated on the contract drawings.

b. HVAC ductwork shall not be field painted.

3. Stainless steel and CPVC piping, fittings and supports will not be field painted, except that identification of piping with stencil text shall be provided by the work of this section.

E. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. List of coating products (Paint Schedule) with brand, type and manufacturer including dry film thickness and volatile organic compound (V.O.C.) regulations conforming to these specifications. Refer to Paragraph 2.04.

2. Manufacturer's current printed recommendations and data sheets for each product including performance criteria, surface preparation, application instructions.

3. Product data and pertinent information including results of test patch data indicating compatibility of field applied coatings with shop applied primers including a schedule listing each primer with field applied coatings to be applied over the primer.
4. Color chip samples of manufacturer's full range of colors for initial selection by Engineer.
5. Color chip samples matching colors indicated in Piping Identification Schedule, included in this specification. Submit list of piping to be included under each color.
6. Submit manufacturer's published data showing service record specified herein.
7. Submit letter(s) signed by paint manufacturer certifying that submitted products are suitable for application on the surfaces to be coated and for the service conditions.
8. Product data for mil thickness testing equipment including operating instructions.
9. Field Submittals
    a. Submit letter(s), signed by Contractor, stating that existing and new surfaces to be coated are ready for preparation as specified herein.
    b. Submit letter(s) signed by Painting Subcontractor, certifying that existing and new surfaces to be coated have been prepared in accordance with paint manufacturer's printed instructions and are ready for field paint application.
    c. Approved mil thickness test results, including location, and surface or item for identification.
    d. Provide samples of existing paint coatings to paint manufacturer for identification of existing coatings. Submit to Engineer final recommendations of the paint manufacturer for the proper type of coatings that can be applied to existing surfaces. If the specified paint coating for existing surfaces is not acceptable to paint manufacturer, then the painting subcontractor and paint manufacturer shall submit the recommended coating at no additional cost.

1.05 - PRODUCT HANDLING

A. Provide in accordance with SECTION 01610, DELIVERY, STORAGE AND HANDLING and as specified herein.

B. Deliver materials to painter's area in original, unbroken, containers with name and analysis of product, manufacturer's name, and shelf life date. Do not use or retain contaminated, outdated, prematurely opened, or diluted materials.

C. Store coated items and protect coating from damage and foreign matter, by not allowing contact with soil or pavement, exposure to wind-blown particles, or other harmful contacts which necessitate special cleaning. Use blocking during storage.

D. Protect coated items, whether prime or finish, from damage due to shipping and handling.

E. Paint Storage and Mixing Areas and Waste Disposal
    1. Store paints and painter's materials in area or areas designated by the Engineer solely for this purpose. Confine mixing, thinning, clean-up and associated operations, and storage of painting debris, to these areas before authorized disposal.
    2. Do not use plumbing fixtures, piping or mechanical equipment for mixing or disposal of paint materials.
        a. Transport water to paint area by temporary hose or piping.
        b. Store waste temporarily in closed, nonflammable containers until final legal disposal. Keep no rubbish in painter's area longer than 24 hours. Legally dispose any hazardous materials and place all non-hazardous waste in the central trash trailer area.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. Job Conditions

1. Environmental Requirements:

a. Comply with manufacturer's printed recommendations as to environmental conditions under which coatings and coating systems can be applied.

b. Do not apply coatings when dust is being generated.

2. Protection

a. Cover or otherwise protect finish work of other trades and surfaces not being painted concurrently or not to be painted.

b. Do not paint over nameplates, tagging or other identification devices.

C. Quality Assurance

1. Provide in accordance with SECTION 01400, QUALITY ASSURANCE and as specified herein.

2. Use products of one manufacturer in any one paint coating system with compatible coating materials. Provide same coating product for touch-up as for original coating.

3. Do not use or retain contaminated, outdated, or diluted materials for painting. Do not use materials from previously opened containers.

4. Provide paint products having a minimum of five (5) years of service, with no peeling, flaking, chipping, blistering, or fading, under similar service conditions.

1.07 - REFERENCES

A. Society for Protective Coatings (SSPC) Specifications:

1. SSPC-PA 1: Shop, Field, and Maintenance Painting of Steel.

2. SSPC-PA-2: Measurement of Dry Coating Thickness with Magnetic Gages.

3. SSPC-SP 1: Solvent Cleaning.

4. SSPC-SP 3: Power Tool Cleaning.

5. SSPC-SP 6: Commercial Blast Cleaning.

6. SSPC-SP10: Near-White Blast Cleaning.

B. American National Standards Institute (ANSI)

1. A13.1: Scheme for the Identification of Piping Systems, Designation.

C. National Sanitation Foundation (NSF)

D. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 – PRODUCTS

2.01 - MANUFACTURERS

A. Tnemec Co., Inc.

B. Carboline.

C. PPG Protective & Marine Coatings, Inc.

2.02 - MATERIALS – GENERAL

A. Products: Recommended by their manufacturer for intended service.

B. Material Compatibility

1. Provide block fillers, undercoats and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2. Provide field applied coatings that are compatible with shop applied primers.

2.03 - COLORS AND FINISHES

A. Interior finish colors: As indicated in Finish Schedule and Pipe Identification Schedule.

B. To provide contrast between successive coats, lightly tint each coat to distinguish it from preceding coats.

C. Unless otherwise indicated for finish paint, use gloss or semi-gloss on metal, and satin finish on masonry and concrete.

2.04 - COATING TYPES

A. Coatings are described in the COATING IDENTIFICATION SCHEDULE by abbreviations, generic type, minimum solids by volume and minimum dry film thickness. Provide coatings that comply with the volatile organic compounds (VOC) regulations applicable to the project site and in no case to exceed 3.5 lbs/gal.

COATING IDENTIFICATION SCHEDULE

				Manufacturer		
Abbreviation	**Generic Type**	**Solids by Volume (%) See Note 1**	**DFT Per Coat See Note 2**	**Tnemec Co., Inc.**	**Carboline**	**PPG Protective & Marine Coatings, Inc.**
AGE	Alkyd- Enamel	49	2.0-3.0	23 Enduratone	Carbocrylic3359 or 3359 DTM	PPG Industrial Alkyd Enamel 7-824 Series
AGU	Alkyd	56	2.0-3.0	Series 36	Undercoater	Undercoater
AL	Emulsified Acrylic	43	2.0-3.0	Series 6	Carbocrylic 3350	PPG Pitt-Tech EDF Exterior WB Acrylic Dry Fog 90-812 Series
APE	High Build Acrylic Polyurethane Enamel	60/745	3.0-5.0	Series 73 1074	Carbothane 134HG	PPG Amercoat 450H
BF	Cementitious Acrylic Filler	68	100 sq. ft. per gal.	Series 130	Sanitile 100	BF Cementitious PPG Amercoat 965
HSE	High Solids Catalyzed Epoxy	70	6.0-8.0	Series N39	Carboguard 893SG or 691 NSF	PPG Amerlock2/400 or Amerlock 2 NSF
LTE	Polyamide Epoxy	58	4.0-6.0	Series 161 or N69F	Carboguard 893SG or 691 NSF	PPG Amerlock2/400 or Amerlock 2 NSF

COATING IDENTIFICATION SCHEDULE

				Manufacturer		
Abbreviation	**Generic Type**	**Solids by Volume (%) See Note 1**	**DFT Per Coat See Note 2**	**Tnemec Co., Inc.**	**Carboline**	**PPG Protective & Marine Coatings, Inc.**
MAEP	Modified Aliphatic Amine Epxoy Mortar	100	125	Perma-Shield H_2S	---	---
PE See Note 3	Polyamide Epoxy	60	5.0-7.0	Series 61 or N69F	Carboguard 893SG or 691 NSF	PPG Amerlock2/400 or Amerlock 2 NSF
PRW	Pressure washing and cleanup with materials recommended by Paint Manufacturer.					
PVA	Poly Vinyl-Acrylic-	28	1.0-1.5	Series 51-792	Carbocrylic120	PPG Speedhide6-2 Primer
TY	Polyamide Epoxy	56	2.0-3.0	Series 66	---	---
ZR	Zinc Rich Primer	63 See Note 4	3.0-4.0	Series 91-H_2S or Series 90-97 or Series H90-97	Carbozine 859 or Carbozinc 11	PPG Amercoat 68HS or Dimetcote 9

Notes:

1. Solids by volume based on Tnemec Co., Inc.
2. Dry film thickness and performance criteria based on Tnemec Co., Inc. Provide dry film thicknesses for equivalent products as recommended by manufacturer.
3. If application of PE type coating occurs during low temperatures, provide and apply LTE type coating in lieu of PE and substitute throughout in Paint Schedule at end of Section, unless otherwise recommended by coating manufacturer.
4. 80% minimum zinc by weight. If intended for bolted connections, provide minimum Coefficient of Friction as recommended by bolt manufacturers.

B. Description of coating types includes minimum acceptable percent, by volume, of component solids. Brand identification is to establish standard of quality. Products meeting general physical characteristics and performance criteria, are acceptable.

C. Provide coatings submerged in potable water with National Sanitation Foundation approval.

2.05 - PIPE, VALVE/EQUIPMENT IDENTIFICATION AND COLOR CODING

A. Provide identification of existing and new pipes, valves, pumps, tanks and similar vessels by color as specified in the Pipe Identification Schedule and with name of contents, directional flow arrows and other required legend.

B. For existing and new pipe systems, use stenciled letters and arrows or self-adhesive labels or tapes located at intervals no greater than 20 ft. apart on straight runs except that stainless steel piping at intervals shall be no greater than 15 ft. apart on straight runs. Mark each valve, branch, wye change in direction and each side of floor and wall penetrations.

C. Labels or tapes shall be moisture and U.V. resistant.

D. Provide legend of size, character and location conforming to ANSI A13.1 for stenciled letters or labels.

E. Refer to notes at end of Pipe Identification Schedule for further clarifications.

PART 3 - EXECUTION

3.01 - INSPECTION

A. Examine existing and new surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work.

B. Do not proceed with surface preparation or coating application until after submitting to the Engineer a letter signed by Contractor, stating that existing and new surfaces to be painted are in acceptable condition for preparation and painting according to the Painting Subcontractor and in accordance with paint manufacturer’s printed instructions.

C. Do not proceed with coating application until after submitting to the Engineer a letter signed by paint manufacturer certifying that submitted products are suitable for application in accordance with paint manufacturer’s printed instructions.

3.02 - PREPARATION

A. Basic Steps:

1. Prepare and paint existing and new surfaces in heated enclosure unless the ambient weather conditions ensure still, dry air above 50 degree F temperature, and humidity above manufacturer's printed recommended level. Do not apply paints to surfaces in direct sunlight. Conform to manufacturer's printed instructions for safety requirements.

2. Coordinate cleaning and painting operations to eliminate contamination of one by the other.

3. Maintain coating materials at manufacturer's recommended mixing and application temperatures for not less than 24 hours before use. Have clean containers, spray equipment, applicators and accessory items ready for use before decanting or mixing paint materials.

4. Coordinate materials to be applied with previous coatings on affected surfaces. Obtain, in all cases, manufacturer's written directions, and follow them strictly, except where otherwise specified.

5. Coordinate preparation and material compatibility requirements with the work specified in SECTION 15400, PLUMBING SYSTEMS and SECTION 15600, HEATING, VENTILATING AND AIR CONDITIONING.

B. Before any paint application, clean existing and new surfaces to be coated of dust, dirt, grease, white rust, paint unsuitable for top coating, efflorescence, oil, moisture, foreign matter or similar conditions detrimental to coating bond and durability.

1. Following cleaning, apply preparatory treatment in strict accordance with manufacturer's written instructions.

2. Fill imperfections and holes in surfaces to be painted with material recommended by paint manufacturer.

C. Metals to Receive Paint Finishes:

1. Prepare ferrous metals, including field welds and unprimed shop welds, without shop prime coats as follows:

a. Near White blast cleaned (SSPC-SP-10), for submerged components.

b. Commercial blast cleaned (SSPC-SP-6), for non-submerged components.

c. Use needle gun for field welds and shop welds which occur in narrow, unprimed areas in an otherwise shop primed surface, followed by SSPC-SP1-solvent wipe.

2. Clean previously shop primed ferrous metals in accordance with manufacturers printed recommendations prior to field painting.

3. Non-ferrous and galvanized metal surfaces scheduled for paint finish:

   a. Clean in accordance with manufacturers recommendations prior to field painting (SSPC-SP-1 including power washing).

   b. Brush blast all exterior and interior exposures above constant 35% relative humidity or treat with Oakite LTS or equal etching solution. Brush blasted galvanized metal surfaces to receive a uniform profile of 0.75-1.25 mils.

   c. For interior galvanized and non-ferrous metals not exposed to wet environments apply in accordance with manufacturers written instructions.

D. Concrete to Receive Paint Finishes:

1. Clean thoroughly of form oil, release agents, dirt, dust, grease, paint, loose material and foreign matter. Remove laitance, roughen smooth surfaces by brush sand blasting, remove fins and projections, fill voids and honeycombs with material recommended by paint manufacturer.

2. Prime after concrete has dried in strict accordance with manufacturer's printed instructions.

3. Concrete in Immersion: Brush blast all new and existing surfaces to receive coating to achieve profile of 2.0-4.0 mils. Previously coated surfaces shall be inspected and evaluated prior to commencing work.

E. Concrete unit masonry for paint finishes: Clean thoroughly by brushing, scraping and sanding or grinding slick areas. Remove loose or projecting mortar, solvent wash oil, grease, paint spots before applying block filler.

F. Provide higher degree of cleaning for acceptable equivalent paint products when paint manufacturer recommends in his printed surface preparation recommendations.

G. Delay painting of areas which will be damaged by heat from welding, until welding is complete. Reclean and recoat substrate as specified for original coats, when coated areas have been damaged by welding or have not been painted to allow welding.

H. PVC Pipe: Sand all surfaces with 60-80 grit paper to provide profile to adhere coatings.

3.03 - TOUCH-UP

A. Before applying field coat, touch-up abraided areas of shop coats with paint of the same type. Apply an entire coat to abraided area. Touch-up coats are in addition to, and not a substitute for first field coat. Clean deteriorated surfaces as specified herein and in accordance with manufacturer’s recommendations before applying touch-up coat.

B. Equipment, motors, pumps, instrumentation panels, electrical switchgear, and similar items with shop coats, paint filler, enamel or other treatment customary with manufacturer; after installation, touch-up scratches and blemishes before applying field coats.

3.04 - APPLICATION

A. Refer to Paint Schedule at end of this specification for coating requirements. Provide additional prime, undercoat, and finish coats as specified, indicated, and recommended by coating manufacturer's printed instructions.

B. Conditions

1. Do not apply paints or other finish to wet or damp surfaces, except in accordance with instructions of manufacturer. Do not apply exterior paint during cold, rainy, or frosty weather, or when temperature is likely to drop to freezing. Do not apply paints to surfaces in direct sunlight.

2. Paint surfaces which have been cleaned, pretreated, or otherwise prepared for painting with first field coat as soon as practicable after such preparation has been completed, but in any event prior to deterioration of prepared surface.

3. Coat blast cleaned metal surfaces in accordance with SSPC guidelines, before any rusting or other deterioration or contamination of the surface occurs. Do not coat blast cleaned surfaces later than 8 hours after cleaning.

C. Methods

4. Spraying with apparatus may be substituted for brush application of paints in locations approved for spraying.

5. Prepare surfaces, mix and apply paint materials in strict accordance with manufacturer's printed instructions and recommendations. Control temperature of materials upon mixing and application, surface temperature and condition, thinning and modifying.

6. Protect surfaces to be coated, before, during and after application.

D. Workmanship

7. Apply coating materials to meet manufacturer's spreading rate and dry film thickness recommendations. Dry film thicknesses specified are constant for brush, spray, roller or other form of application.

a. Control thinning in accordance with V.O.C. regulations for spray use and to manufacturer's printed instructions, and produce specified dry film thickness on level surfaces, interior and exterior angles.

8. Apply paints and coatings using painters continuously employed in the painting profession for no less than five (5) years, brushed or rolled out carefully to a smooth, even coating without runs or sags. Curing time in accordance with manufacturers printed instructions.

9. Finish surfaces: Uniform in finish and color, and free from flash spots and brush marks.

3.05 - PROTECTION AND CLEAN-UP

A. Protect existing and new surfaces to be painted or coated under this Section as follows:

1. Arrange for preparation and coating activities to be performed in areas and during times when no continuous traffic and no dust generating activity will be present.

2. During time between preparation and coating, protect work from dust and dirt with dropcloth. Do not allow contact with surfaces in this time period.

3. During painting activity, clearly mark the area being used by painters to prevent interference with painting being applied as specified.

4. After painting, clearly barricade painted surfaces with cones, plastic barrier tape, or other visible barrier. Locate "WET PAINT" signs near painted surfaces. Do not remove barriers and signs until paint surface dries throughout entire film thickness.

B. Cover existing water surfaces to protect them from dust and debris.

C. Remove or completely mask existing and new accessory items, finish hardware, lighting fixtures, escutcheon plates, trim and similar finish items not to be painted before painting adjacent surfaces. Carefully replace and reposition upon completion of adjacent painting and cleaning work.

D. Upon completion of the work, clean up paint spots, oil, and stains from floors, glass, hardware, and similar finished items and remove tape.

3.06 - SCHEDULE OF PAINTING

A. Coordinate and schedule the various cleaning, touch-up and finishing operations. Transmit and coordinate the transmission of materials data, color selections and coating system methods between the coating applicators. Do not exceed exposure and recoat time limits.

PIPE IDENTIFICATION COLOR SCHEDULE
VALVES, BLOWERS, PIPE, PUMPS, TANKS

Pipe System	Legend Symbol	Paint Color		
		Component	Letters and Arrows	Stencil Text
Drain	D or W	Black	White	Drain
Potable Water Supply	W1	Light Blue	White	Potable Water – Cold
Raw Wastewater	RWW	Gray	Black	Raw Wastewater
Sump Pump Discharge	PD	Black	White	Sump Pump Discharge
Vent	VT	Black	White	Vent

Notes:

1. Chemical piping shall be labeled with actual chemical name.
2. The color stenciled text and directional arrow designation required for chemical piping located inside containment trays shall be applied to the containment trays and not the chemical piping.
3. Provide and place a 2-inch color band (4-in. bands for the color yellow) extending around the complete perimeter of the tray on each side of the stencil text and directional arrow designation.
4. Legend symbols listed above in Pipe Identification schedule shall also be added in parenthesis to the end of all stencil text designations indicated.
5. Provide banding 4 ft. 0 in. on center for sludge lines not otherwise specified above.
6. Provide in dark brown and stenciled.

PAINT SCHEDULE

Item No.	Surface or Item	Field Coats		
		1st	2nd	Final
1	Ferrous parts of operating devices and supports, guard posts and bollards	PE	PE	APE
2	Items with factory finish	Touch-up with materials supplied by manufacturer		
3	Shop painted ferrous metals, galvanized metals and equipment submerged, non-submerged and subject to splashing	PE	HSE	HSE
4	Exterior shop painted ferrous metals, galvanized metals and equipment submerged, non-submerged and subject to splashing	PE	HSE	APE

PIPE IDENTIFICATION COLOR SCHEDULE
VALVES, BLOWERS, PIPE, PUMPS, TANKS

			Paint Color		
Pipe System	**Legend Symbol**	**Component**	**Letters and Arrows**	**Stencil Text**	
5	Concrete Wetwells (interior walls, floor and ceiling)		Concrete Surfacer: Tnemec Series 218 Mortar-Clad at 1/16-inch thickness HSE Finish: Series 434 PermaShield polyamine epoxy mortar at 125.0 mils dft		
6	PVC piping		PE	---	PE

Notes:

1. If prime coat has been exposed for more than 6 months, Painting Subcontractor will provide test patches to insure adhesion of field-applied coatings. Test patches in accordance with paint manufacturer's instructions.
2. Provide patching compound for existing and new concrete surfaces before beginning field painting, in accordance with Paint Manufacturer's recommendations. Patch existing concrete masonry unit walls immediately after demolition has been completed and areas have been cleaned.
3. Repaint all existing piping which is modified (existing piping which is partially demolished or to which new piping and equipment will be connected) for the services listed in the Pipe Identification Schedule. Piping, valves, supports, and accessories are to be repainted. Floors, walls, and ceiling surfaces are also to be repainted.
4. Conform to paint manufacturer's written instructions with regard to surface preparation and compatibility of new paint coatings over existing paint coatings. Painting Subcontractor shall take samples of existing paint coatings and coordinate with paint manufacturer and identify the generic type existing. Final recommendations of the paint manufacturer shall be given to the Painting Subcontractor in writing for the proper generic type coating that can be applied to the existing surfaces. If the specified paint coating for existing surfaces is not acceptable by paint manufacturer, then the Painting Subcontractor shall submit the recommended coating and at no additional cost. Paint coating submitted shall have the performance criteria for the intended purpose of that existing item/surface with regard to corrosion-resistance, self-priming, and ease of application.

3.07 - FINAL TOUCH-UP

A. Prior to final completion and acceptance, examine painted and finished surfaces and retouch or refinish areas to leave touched-up areas with same appearance as and even with the surrounding finish specified.

B. After doors have been fitted and hung, refinish edges, tops and bottoms.

3.08 -TESTING

A. Conduct field testing in the presence of the Engineer for specified mil thickness in accordance with SSPC-PA-2.

B. Test results shall meet requirements of SSPC-PA-2. Failure of test results shall require that surfaces be repainted until approved results of testing have been obtained for the specified mil thickness.

3.09 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 11306

SUBMERSIBLE SOLIDS HANDLING PUMPS AND APPURTENANCES

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PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide Submersible Solids Handling Pumps and Appurtenances as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections with DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specficiation.

C. Provide and test submersible solids handling pumps, motors, discharge base elbow, variable frequency motor controllers and appurtenances as indicated and in compliance with Contract Documents.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limted to the following:

1. Data regarding pump and motor characteristics and performance:

a. Prior to fabrication and testing, provide manufacturer's guaranteed performance curves based on actual shop tests of mechanically duplicate pumps, showing they meet indicated and specified requirements for head, capacity, horsepower, efficiency and $NPSH_3$.

(1) For units of same size and type, provide curves for a single unit only.

b. Provide catalog performance curves at maximum pump speed indicated and specified for each service showing maximum and minimum impeller diameters available, acceptable operating range (AOR) and preferred operating range (POR).

c. Results of shop performance tests as specified.

d. Submit curves for manufacturer's guaranteed performance, and shop performance tests on 8-1/2-inch by 11-inch (A4) sheets, one curve per sheet.

2. Characteristic curves for variable speed pumps for maximum pump speed and for speeds required to obtain minimum pump flow and head conditions specified and indicated. Identify curves by speed and provide all curves on one sheet. Provide $NPSH_3$ curve for each speed.

3. Shop drawing data for accessory items.

4. Certified setting plans, with tolerances, for anchor bolts.

5. Manufacturer's literature as needed to supplement certified data.

6. Operating and maintenance instructions and parts lists.

7. Listing of reference installations as specified with contact names and telephone numbers.

8. Certified results of hydrostatic testing.

9. Certified results of dynamic balancing.

10. List of recommended spare parts other than those specified.

11. Shop and field inspection reports.

12. Bearing Life: Certified by the pump manufacturer. Include design data.

13. Pump shop test results.

14. Motor shop test results.

15. Qualifications of field service engineer.

16. Recommendations for short and long-term storage.

17. Shop and field testing procedures, pump and piping set up, equipment to be used and ANSI/HI testing tolerances to be followed.

18. Special tools.

19. Number of service person-days provided and per diem field service rate.

20. Recommended location of discharge pressure gauges.

21. Manufacturer's product data, specifications and color charts for shop painting.

22. Provide a listing of the materials recommended for each service specified and indicated. Provide documentation showing compatibility with process fluid and service specified and indicated.

23. The latest ISO 9001 series certification.

24. Provide a scaled drawing for each pump service showing the pumps, motors, hoists and bridge cranes including equipment weights, lifting attachments, slings and clearances for equipment removal and maintenance.

25. Material Certification

a. Provide certification from the equipment manufacturer that the materials of construction specified are recommended and suitable for the service conditions specified and indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the Owner.

b. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated.

C. A copy of the contract mechanical process, electrical and instrumentation drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with "No changes required" or provide a statement that no changes are required.

1. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.

D. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.

1. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.

2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

1.05 - PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer's written recommendations,

B. The materials and equipment shall be stored on a flat, clean, dry surface to tprevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

C. Comply with the requirements specified in Section 01610 DELIVERY, STORAGE AND HANDLING.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with manufacturer's written recommendations and the Contract Documents.

B. The specifications call attention to certain features but do no purport to cover all details entering into the construction of the equipment.

C. The design conditions and other pertinent requirements for the equipment specified in this section are indacted on the Contract Drawings.

1.07 - QUALITY ASSURANCE

A. Comply with the requirements specified in Section 01400 QUALITY ASSURANCE.

B. Pumps shall be the product of one manufacturer.

C. Pumps shall be manufacturer's standard cataloged product and modified to provide compliance with the drawings, specifications and the service conditions specified and indicated.

D. Welding: In accordance with latest applicable American Welding Society Code or equivalent.

E. Shop tests as specified.

F. The Contractor shall obtain the pumps, motors and appurtenances from the pump manufacturer, as a complete and integrated package to insure proper coordination and compatibility and operation of the system.

1. Variable frequency motor controllers can be supplied by the Contractor or the pump manufacturer at the Contractor's option. The pumping system must be a complete and integrated package to insure proper coordination and compatibility and operation of the system.

a. The Contractor shall coordinate the variable frequency motor controllers with the pump and motor manufacturer and submit as part of the shop drawings a written statement signed by the Contractor, pump manufacturer, motor manufacturer and variable frequency motor controller manufacturer that the variable frequency motor controller manufacturer has received the required information from the pump and motor manufacturers and that all parties have reviewed the system and coordinated the equipment selection. Also include all motor data and information that has been used for the coordination.

b. Provide variable frequency motor controllers in accordance with Section 16260, VARIABLE FREQUENCY DRIVES.

2. Guide cables or rails and hatches can be supplied by the Contractor or the pump manufacturer at the Contractor's option. The pumping system must be a complete and integrated package to insure proper coordination and compatibility and operation of the system.

a. The Contractor shall coordinate the hatch size with the pump manufacturer and submit as part of the shop drawings a written statement signed by the Contractor and pump manufacturer that the Contractor has received the required information from the pump manufacturer and that all parties have reviewed the hatch size and coordinated the hatch size, bridge crane and equipment removal.

b. The Contractor shall coordinate the cable or rail size with the pump manufacturer and submit as part of the shop drawings a written statement signed by the contractor and pump manufacturer that the Contractor has received the required information from the pump manufacturer and that all parties have reviewed the cable or rail size and coordinated the size and equipment removal.

G. Services of Manufacturer's Representative as stated in Section 01400, QUALITY ASSURANCE and as specified herein.

H. Provide services of factory-trained Service Technician, specifically trained on type of equipment specified:

1. Service Technician must be present on site for all items listed below. Person-day requirements listed are exclusive of travel time, and do not relieve Contractor of the obligation to place equipment in operation as specified.

2. Installation: Inspect grouting, location of anchor bolts; setting, leveling, alignment, field erection; coordination of piping and electrical:

a. 1 person-days.

3. Functional Testing: Calibrate, check alignment and perform a functional test with water. Tests to include all items specified.

a. 1 person-days.

4. Performance Testing: Field performance test equipment specified.
    a. 2 person-days.
5. Vendor Training: Provide classroom and field operation and maintenance instruction including all materials, slides, videos, handouts and preparation to lead and teach classroom sessions.
    a. 1 person-days.
6. Credit to the Owner, all unused service person-days specified above, at the manufacturer's published field service rate.
7. Any additional time required of the factory trained service technician to assist in placing the equipment in operation, or testing or to correct deficiencies in installation, equipment or material shall be provided at no additional cost to the Owner.

I. Manufacturer of pumps shall have a minimum of five (5) operating installations with pumps of the size specified and in the same service as specified operating for not less than five (5) years.

J. If equipment proposed is heavier or taller, different rotation, or discharge arrangement than specified and indicated; provide all structural, architectural, mechanical, electrical and plumbing revisions at no additional cost to the Owner.

1. If equipment is heavier than specified, the Contractor shall provide all hoisting equipment sized to maintain the minimum safety factor between the specified maximum equipment weight and the lifting capacity of the hoisting equipment indicated and specified.

1.08 - REFERENCES

A. American Bearing Manufacturers Association (ABMA)

1. 9: Load Ratings and Fatigue Life for Ball Bearings.
2. 11: Load Ratings and Fatigue Life for Roller Bearings.

B. ASTM International (ASTM)

1. A36/A36M: Standard Specification for Carbon Structural Steel.
2. A48/A48M: Standard Specification for Gray Iron Castings.
3. A576: Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
4. A743/A743M: Standard Specification for Castings, Iron-Chromium, Iron-Chromium Nickel, Corrosion Resistant, for General Application.
5. D2240: Standard Test Method for Rubber Property – Durometer Hardness.

C. American National Standards Institute (ANSI)

1. B16.1: Standard for Cast Iron Pipe Flanges and Flanged Fittings, 125 lb.

D. Hydraulic Institute (HI)

1. Current Standards.
2. 11.6: Submersible Pump Tests

E. National Electrical Manufacturers Association (NEMA)

1. MG1: Motors and Generators.

F. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - SYSTEM DESCRIPTION

A. Pump capacities and operating data are indicated in the Process Pump Schedule.

B. Raw Wastewater Pumps: Pump unscreened raw wastewater from wet wells.

C. Coordinate pump dimensions and weights with Portable Davit Crane (DAV.HST-1) as specified in SECTION 14300, HOISTING EQUIPMENT as indicated.

D. Pumps normally operate with a flooded suction except that pumps will be subject to a suction lift if indicated in the Process Pump Schedule.

2.02 - MANUFACTURERS

A. Submersible Solids Handling Pumps

1. WEMCO
2. KSB
3. Goulds

2.03 - SEISMIC DESIGN REQUIREMENTS

A. Conform to the requirements indicated on the structural drawings and as specified in Section 01900, SEISMIC DESIGN REQURIEMENTS.

B. The Contractor shall conform to the seismic design requirements for this project and for the work of this specification section.

C. Provide all equipment bases, anchorage, supports and foundations designed in accordance with the seismic requirements indicated and specified.

D. Additionally, provide with the Certificate of Unit Responsibility, certification for all equipment signed by a registered structural engineer stating that computations were performed and that all components have been sized for the seismic forces specified and indicated.

2.04 - PUMP CONSTRUCTION

A. Pumps: Recessed impeller, vortex type, single-stage, centrifugal pumps. Driven as indicated in the Process Pump Schedule.

B. Design and proportion all parts of pump specially adapted for the service specified and indicated.

C. Pump Mounting: Provide type as indicated and specified.

1. Mount each pump on a discharge elbow with discharging vertically.

D. Pump Casing, Fronthead, Backhead and Lower Housing:

1. Materials
    a. Cast iron ASTM A48 Class 35.
    b. ASTM A532 Class IIIA or HC600
        (1) Minimum 600 to 650 BHN
2. Provide lifting devices on pump/motor assembly for handling.
    a. Type 316 stainless steel.
3. Provide ribs or reinforcing if required to withstand the specified hydrostatic test pressure, to prevent deflection caused by hydraulic thrust and to support the motor.
4. Face and drill flanges of discharge connections in accordance with 125-lb ANSI/ASME B16.1 Class 125 Standard.

5. Where a rail pipe is required face and drill suction in accordance with 125-lb ANSI/ASME B16.1 Class 125 Standard.

6. Provide components with machined registered concentric shoulder fits for precision alignment. Equipment without registered fits is not acceptable.

7. Pumps with splitter vanes in casing are not acceptable unless specifically indicated in the Process Pump Schedule.

E. Impeller

1. Type: Recessed radial curved vane or cupped type solids handling single suction.

a. Straight vane impellers are not acceptable

2. Pump capable of passing a sphere size as indicated in the Process Pump Schedule.

3. Material

a. Ni-Hard, ASTM A532 Class I, HC 600, or ASTM A532 Class IIIA minimum 650 BHN, or wear resistant hardened duplex stainless steel CD4MCu for pumps specified with Ni-Hard or High Chrome Iron Casing.

b. Impellers shall be of wear resistant materials as specified above.

c. Taper fit or key-seat and hold impeller to shaft by a streamlined bolt or locknut capable of holding in event of motor reversal under full torque. Impeller fasteners: Type 416 stainless steel.

d. Statically and dynamically balance each impeller.

2.05 - MOTORS

A. Provide in accordance with Section 01170, ELECTRIC MOTORS and as specified and indicated.

B. Horsepower rating of motors: Not less than maximum brake horsepower requirements of pumps under any condition of operation specified and indicated without operating in the motor service factor.

C. Motor speed: As stated in the Process Pump Schedule.

D. Enclosure: Explosion proof, Class I, Division 1, Group D; UL Listed or FM Approved.

E. In addition to the requirements for bearings specified under Electric Motors in Section 16220, MOTORS, provide pump motors with ball or roller bearings. Provide vertical motors with at least one bearing designed for thrust with bearings. Provide bearing with a minimum B-10 life of 100,000 hours.

F. Operate without overheating at the speeds specified and indicated.

G. Service Factor: 1.15, with 1.0 inverter duty rating for pumps equipped with variable frequency motor controllers.

H. Minimum Efficiency

1. 100 percent Load

2. 75 percent Load

3. 50 percent Load

I. Rating: 460V, 3-phase, 60 Hertz.

J. Insulation: Class H with Class B temperature rise, 40 degrees C ambient.

K. Site Altitude: Less than 3,300 feet above sea level.

L. Motors

1. Provide complete sealed electric submersible squirrel cage induction motors in accordance with the above and as specified herein.
2. Provide all components housed in an air or oil filled cast-iron watertight electric submersible squirrel cage induction motor in accordance with the above and as specified herein.
3. Insulate stator-winding and lead with moisture resistant Class F or Class H insulation for continuous duty in 40 degrees C rise liquids.
4. Provide motor capable of ten (10) starts per hour at maximum speed.
5. Motor shaft: Type 416 or Type 420 stainless steel or ASTM A576 Cr 1040 with Type 420 stainless steel sleeve.
    a. One piece internal pump/motor shaft.
    b. Provide shaft of sufficient diameter that the ratio of the shaft overhand, distance from lowest bearing to the impeller hub, to the shaft diameter through the seal area not to exceed 2.5.
6. Dynamically balance rotor to within NEMA vibration limits.
7. All hardware: Type 316 stainless steel.
8. Provide all cables of multi-conductor SOW-A, G-GC or W of sufficient length to extend from pump motor to a junction box. Cable size shall be in accordance with NEC specifications.
9. Cable Entry
    a. Provide all power and control lead wires double sealed entering the motor in a method that prevents cable wicking.
    b. Provide the sealing system consisting of a rubber grommet to seal the cable exterior followed by interior epoxy seal.
    c. Provide each cable wire with a section of insulation removed to establish a window area of bare wire and each wire surrounded by epoxy potting material.
    d. Provide a cable strain relief mechanism as an integral part of this sealing system.
    e. Provide the cable sealing system capable of withstanding an external pressure test of 1,200 psi as well as a cable assembly pull test as required by UL or FM.
    f. Provide the cable entry rated by UL or FM for submerged operating depths to 85 feet.
    g. Singular grommet or other similar sealing systems are not acceptable.
10. Seals
    a. Provide two separate tandem-mounted mechanical seals with the upper and lower seals mounted to rotate in the same direction.
    b. Upper Seals
        (1) Provide seal completely immersed in an oil or glycol bath sealing the oil chamber and motor housing.
        (2) Materials: Silicon carbide rotating and stationary faces.

c. Lower Seals

(1) Provide lower seal with mating faces immersed in the oil or glycol bath sealing the pump volute and oil chamber.

(2) Materials: Silicon carbide rotating and stationary faces.

(3) Provide a cover extending completely over the lower seal spring.

d. Springs: Type 316 stainless steel.

e. Elastomers: Viton.

11. Moisture and Temperature Probes

a. Provide two moisture detection probes to detect moisture in the seal and stator cavity measuring conductivity.

b. Provide moisture detection panel and one piece cable from pump to panel, see electrical drawings for panel location. Contractor to provide conduit and cable from pump to control panel.

c. Provide sufficient length of cable to extend from the pump assembly to a junction box above top of wet well as stated in Part 6.

d. Provide O-ring sealed plugged fill and drain inspection ports.

e. Provide winding over temperature protection.

f. Moisture detection to alarm, over temperature to shut down pumps, indicate condition and alarm.

g. Provide NEMA 4X Type 316L stainless steel panel with moisture detection system.

12. Bearings

a. Provide a minimum of two bearings permanently lubricated but capable of being regreased.

b. Minimum B-10 bearing life of 100,000 hours.

13. Provide all mating surfaces machined and fitted with O-rings. All fittings shall be metal to metal contact between each machine surface.

14. Provide a Type 316 stainless steel or cast iron lifting attachment capable of lifting the entire pump and motor assembly.

15. Motors shall conform to UL or FM quality assurance specifications and be manufactured by an ISO-9001 company.

2.06 - DISCHARGE BASE

A. Provide an ASTM A48 Class 35 cast iron discharge base assembly including a 90 degree elbow and base to support the entire weight of the pump and motor and to secure the lower end of the guide rails.

B. Provide base machined to receive sliding bracket of pump discharge.

C. Provide seat constructed of bronze or non-metallic O-ring that is self-cleaning, non-clogging and non-sparking UL LISTED or FM APPROVED explosion proof.

D. Bolt to floor with Type 316 stainless steel anchors.

2.07 - GUIDE ASSEMBLY

A. Provide Schedule 40 Type 316L stainless steel guide rails or Type 316 cables for each pump discharge assembly.

1. Guide Rail: Pump manufacturer's standard size but not less than 2-inch diameter.

B. Provide Type 316L stainless steel intermediate supports for guide rails with a maximum spacing of 10 feet between supports.

C. Provide Type 316L stainless steel top guide rail retainer brackets to support the guide rails or cables. Bracket to be attached to top slab of wet well.

D. Provide Type 316 stainless steel chain of sufficient length, to reach from pump to top of wet well plus 10 feet and of strength for lifting pump and motor. Provide chain designed for attachment to lifting bail provided on motor and to the guide rail retainer bracket.

2.08 - HARDWARE

A. Type 316 stainless steel.

2.09 - GAUGES

A. Provide gauges assemblies for discharge of each pump in accordance with Section 15370, PROCESS PIPING AND APPURTENANCES and as indicated.

B. Discharge Gauges: Compound type with operating range with top limit above pump shutoff head at maximum pump speed.

1. Scale: inches Hg to psi.

2.10 - SHOP PAINTING

A. Primer and Finish Paint: Shop apply to all exterior ferrous surfaces, high solids epoxy in accordance with Section 09940, SHOP PAINTING.

B. Ferrous surfaces which are not to be painted shall be given a shop applied coat of grease or rust resistant coating.

C. Provide additional shop paint coating for touch-up to all surfaces after installation and testing is completed and equipment accepted.

2.11 - SHOP TESTING

A. Provide motor shop testing in accordance with Section 01171, MOTORS and as specified.

1. Conduct motor efficiency and power factor tests at full load 100 and 50, 75 percent load.

2. Provide the following motor tests in accordance with ANSI/HI 11.6

a. Test motor integrity in a submerged condition.

b. Dry run no load test.

c. Motor electrical integrity test.

d. Moisture and temperature sensors integrity test.

B. Pump Tests

1. Test pump casings under a hydrostatic head of at least 75 psi or 150 percent of rated shutoff head, whichever is greater. Test casing with pump assembled.

2. Provide certified performance tests as specified herein for all pumps.

3. Certified performance testing.
    a. Testing of submersible pumps dry is not acceptable.
    b. Run pump at full speed rating point for 60 minutes prior to start of any testing.
    c. Full speed tests
        (1) Test pumps at the conditions specified and indicated and take not less than seven operating points between shut-off and run out. Test points must be at the conditions specified and indicated.
        (2) Take readings to determine flow, differential pressure, rpm, horsepower, and wire to water efficiency.
        (3) Operate each pump for not less than one hour and take readings to determine that the pump will operate as specified and indicated without cavitation at the specified minimum head condition with not more than the specified NPSH available.
    d. Variable speed tests
        (1) Conduct tests as specified above for full speed at reduced speeds except that tests for cavitation at run out are not required.
        (2) Run one speed test at speed required to discharge the minimum rating point specified and indicated with one point of test at the minimum rating point.
        (3) Run a second test at a speed approximately midway between full and minimum speed.
        (4) Run addition tests for each reduced speed operating condition specified and indicated.
    e. Conduct additional tests as follows:
        (1) Run each pump at the minimum speed rating point for 4 hours and continuously record motor temperature. Pumps must be run submerged at LWL submergence as indicated.
    f. Factory tests on pumps
        (1) Use factory calibrated test drives.
    g. Provide a minimum of 30 days written notice to the Engineerprior to shop testing.
4. Run all tests in accordance with the latest standards of the Hydraulic Institute and as specified.
5. Testing Acceptance Grade and Tolerances
    a. ANSI/HI 14.6 Acceptance Grade: 1U.
    b. Efficiency Tolerance: -0 percent.
    c. If pumps do not meet the tolerances specified, trim the impeller and retest until the specified results are obtained.
6. Tests of variable frequency motor controllers specified in Section 16260, VARIABLE FREQUENCY DRIVES..
7. In the event that specified tests indicate that pump, motor, or variable frequency drive will not meet specifications, Engineer has the right to require additional complete witnessed tests for all pumps, motors, and variable frequency drives at no additional cost to the Owner.
8. Repeat tests until specified results are obtained.
9. Correct or replace promptly all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.

PART 3 - EXECUTION

3.01 - VERIFICATION OF CONDITIONS

A. Before the start of the work of this Section, verify that the project is ready for this work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this work and coordinate the work with them.

3.02 - INSTALLATION

A. Install items in accordance with shop drawings, and manufacturer's printed instructions.

B. Install pumping units and align.

1. Set base on metal shims placed directly under the part of the base carrying the greatest weight and spaced close enough to provide uniform support.

C. After alignment is correct, grout using high grade non-shrink grout.

1. Do not imbed leveling nuts in grout.

3.03 - PAINTING

A. After installation and accepted testing by the Engineer, apply touch-up paint to all scratched, abraided and damaged shop painted surfaces. Coating type and color shall match shop painting.

3.04 - CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment.

B. Spillage of lubricants used in servicing the system shall be cleaned from all equipment and concrete surfaces.

3.05 - MANUFACTURER’S FIELD SERVICES

A. Manufacturer’s Field Services shall be provided as specified herein.

3.06 - MANUFACTURER’S TRAINING

A. Manufacturer’s training shall be provided as pecified herein.

3.07 - LUBRICATION REQUIREMENTS

A. All lubricating oils required for the first year of operation shall be provided.

3.08 - SPARE PARTS

A. Comply with the requirements specified in Section 01600, CONTROL OF MATERIALS.

B. Provide spare parts that are identical to and interchangeable with similar parts installed.

1. For each pump

a. One complete set of gaskets and O-rings.

2. For each set of pumps of the same size and performance.

a. One set of all special tools required.

3.09 - FIELD TESTING

A. Test piping connections to prove the pump nozzle are installed with the pipe in a free supported state and without need to apply vertical or horizontal pressure to align piping with pump nozzles. This must be performed and the piping acceptable prior to any field performance testing.

B. Field testing will not be conducted without an accepted procedure, calibration certificates for all testing equipment, gauges and flow meters and a completed and signed pretesting check list. See DIVISION 1, GENERAL REQUIREMENTS for checklist.

C. After installation of pumping equipment, and after inspection, operation, testing and adjustment have been completed by the manufacturer's field service technician, conduct running test for each pump in presence of the Engineerto determine its ability to operate within the vibration and temperature limits specified, and to deliver its rated capacity under specified conditions.

1. During tests, observe and record head, capacity, and motor inputs.

    a. Test Duration: Determined by the Engineer, but not less than three hours of continuous operation at each condition specified and indicated.

2. Immediately correct or replace all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.

3. Repeat tests until specified results are obtained.

4. Contractor to provide all water labor, piping, testing equipment, equipment, flow meters and test gauges for conducting tests.

    a. Contractor shall provide calibrated test gauges for all permanently installed gauges and portable calibrated flow meters for all pumping systems even in those cases where permanent flow meters are installed.

    b. All calibrations must be within 30 days of the field testing.

    c. The testing will not be started and will not be accepted until the calibrated testing equipment stated above is operational and all certifications have been submitted.

D. Make all adjustments necessary to place equipment in specified working order at time of above tests.

E. Test pump on product only. If product is not available, test with water. Water for testing furnished by Contractor.

F. Remove all replace equipment at no additional cost to the Owner with equipment that will meet all requirements specified and indicated if unable to demonstrate to the satisfaction of the Engineer that equipment will perform the service specified, indicated and as submitted and accepted.

3.10 - CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 11398

DIESEL ENGINE-GENERATOR SET AND APPURTENANCES

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PART 1 – GENERAL

1.01 - SCOPE

A. Furnish, place in operation, and test standby diesel engine driven generator set, EPA Compliant, complete with enclosure, instrumentation and controls, and required supporting systems as specified herein.

B. The unit shall be provided in an outdoor, weather-proof, non-walk-in, sound attenuated enclosure with an integral sub-base fuel storage tank with a capacity for 24 hours of standby operation running at full load.

C. The unit shall have a minimum power rating as indicated on Contract drawings, standby at 80 percent lagging power factor with three-phase, 60-Hertz, 480 volt, four-wire, alternating current generator.

D. The unit shall be arranged for automatic starting and stopping-, and load transfer upon failure of the normal source of power through the pump station electrical enclosure automatic transfer switch specified in SECTION 16900, ELECTRICAL CONTROLS AND MISCELLANEOUS ELECTRICAL EQUIPMENT.

E. The engine generator set shall exhibit less than 20 percent voltage dip and less than 5 percent frequency dip during starting of the loads identified in Attachment A, Attachment B and Attachment C to this Section.

F. The engine-generator package shall be complete in all respects and shall include all equipment and controls necessary for a fully operational standby power supply system.

G. The generator unit shall comply with the Commonwealth of Massachusetts, local and federal codes and regulations for standby diesel generators.

H. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance.
2. Outline equipment drawings and elevation drawings with shipping splits with estimated weights defined.
3. Bill of Materials including manufacturer name, model number, and quantities.
4. Equipment catalog cuts clearly annotated to show which products and options are being supplied.
5. Wiring diagrams showing internal and external wiring. Wiring diagrams shall clearly indicate all required field wiring and terminations.
6. Enclosure layout drawings showing locations of internal and external mounted devices including light fixtures, receptacles, panelboards, heaters, batteries and battery chargers and fire alarm system components.
7. Submit catalog cut sheets for devices including light fixtures, receptacles, panelboards, batteries, battery chargers, and fire alarm system components.
8. Engine-generator skid base drawings.
9. Performance specifications of all items of equipment.
10. Engine generator loading calculation, per the requirements of Attachment A, Attachment B and Attachment C to this section.
11. Provide certificate of conformance to UL Standard 2200, Stationary Engine Generator Assemblies.
12. Attenuation curve for the silencing equipment as offered to accomplish the required silencing for this installation.
13. EPA Tier compliance certificate.
14. Data to be provided by engine generator system supplier:
    a. Submit generator loading calculations and data for engine, generator, and accessories: (for rated kW capacity).
        (1) Engine Data
            (a) Manufacturer
            (b) Model
            (c) Number and arrangement of cylinders
            (d) RPM
            (e) Bore X stroke
            (f) Maximum power at rated RPM
            (g) BMEP at rated kW (including any parasitic loads and generator efficiency)
            (h) Piston speed, feet per minute
            (i) Make and model of governor
            (j) Make and model of overspeed shutdown device

(2) Generator Data

(a) Manufacturer

(b) Model

(c) Rated kVA

(d) Rated kW

(e) Voltage

(f) Temperature rise above 40 degrees C ambient. Stator by thermometer and field by resistance in degrees C.

(g) Class of insulation

(h) Generator efficiency including excitation losses at 80 percent PF

1) Full load

2) Three quarters load

3) Half load

(i) Generator sub-transient reactance in ohms

(3) Guaranteed maximum fuel consumption rate at generator terminals @ 138,000 BTU/gallon of ultra-low sulfur diesel fuel:

(a) Full load, gal/hr

(b) Three-quarters load, gal/hr

(c) Half load, gal/hr

(4) Generator unit and accessories

(a) Weight of unit

(5) Exhaust gas emissions data, maximum values at full load, 3/4 load, 1/2 load, and 1/4 load:

Temperature in degrees F

(6) Flow in ACFM (mass and volume)

(7) Combustion air volume in CFM

(8) Cold cranking amperes rating of engine starting batteries (CCA).

1. Provide manufacturer's printed installation instructions including anchoring details to meet earthquake requirements as specified and indicated.
2. Information on the proposed jacket water treatment and procedures for flushing of the cooling systems.
3. Engine-generator skid base drawings, indicating size and location of anchor bolts, and conduit locations.
4. Operations and Maintenance Manuals.
5. As-built drawings and material summary shall be shipped with the equipment.
6. Control panel layout drawings, dimensions, and component bill of materials. Outline drawings showing conduit entry areas and anchoring information. Description of control including operation of interface equipment.
7. Electrical, instrumentation, control and wiring diagrams in sufficient detail to allow installation of instrumentation and controls and electrical components.
8. Time versus current characteristic curves for generator main circuit breaker.

1.05 - PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

B. The design conditions and other pertinent requirements for the equipment are listed on the Contract Drawings.

1.07 - QUALITY ASSURANCE

A. The engine-generator set shall be factory designed, certified prototype tested, and as specified. The manufacturer shall be regularly engaged in the production of this type of equipment and shall maintain a permanent service organization and supply of spare parts, of the types utilized for the equipment specified herein.

1.08 - REFERENCES

A. American Gear Manufacturers Association (AGMA)

B. American Institute of Steel Construction (AISC)

C. American Iron and Steel Institute (AISI)

D. American Society of Mechanical Engineers (ASME)

E. American National Standards Institute (ANSI)

F. American Society for Testing Materials (ASTM)

G. American Welding Society (AWS)

H. American Bearing Manufacturers Association (ABMA)

I. Institute of Electrical and Electronic Engineers (IEEE)

J. National Electrical Code (NEC)

K. National Electrical Manufacturers Association (NEMA)

L. Occupational Safety and Health Administration (OSHA)

M. Steel Structures Painting Council (SSPC)

N. Underwriters Laboratories, Inc. (UL)

O. National Fire Protection Association (NFPA)

P. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.09 - SEISMIC REQUIREMENTS:

A. Generator unit shall conform to the seismic requirements as indicated and as specified in SECTION 01900, SEISMIC AND WIND REQUIREMENTS.

1.10 - UNIT PERFORMANCE

A. The units shall be utilized to provide standby power service in the event the normal source is not available.

B. The voltage regulation shall be within plus or minus one percent from zero load to full-rated load. Upon application or removal of full-rated load in one step, the transient voltage dip and recovery to steady state operation shall be within five seconds.

C. Stable or steady state operation is defined as operation with the frequency variation not exceeding plus or minus 0.25 percent (0.15 Hertz) and voltage variation plus or minus one percent of their mean value for constant load from zero load to full rated load. A rheostat shall provide plus or minus five percent voltage adjustment from rated voltage.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

A. The Owner has standardized on standby diesel engine driven generator sets as manufactured by Kohler.

B. This is a proprietary specification. No other manufacturers are acceptable.

2.02 - GENERAL

A. Engine-generator set shall be a factory-assembled unit that is a standard production unit with existing torsional analysis data. Mixing and matching engine and generator by a third-party supplier is not acceptable.

B. The engine and generator shall be directly connected with a flexible coupling, shall be free from injurious torsional or other vibration and shall be mounted on a heavy steel sub-base.

C. The engine and generator shall be directly connected and shall operate at the same rotative speed. The use of gearing or other speed adjustment between the engine and the generator, such that the engine and generator operate at different rotative speeds will not be allowed.

D. The engine-generator set shall allow easy access to the various parts for maintenance purposes.

E. The engine-generator set shall be pre-piped and pre-wired.

F. The complete engine-generator unit shall be free from harmful torsional or other vibration throughout the entire operating range of speed and load. The engine manufacturer shall provide an analysis of the complete engine-generator unit, which shall show where any critical speed will be encountered, together with the order, the frequency and magnitude of any critical speed.

2.03 - ENGINE

A. The diesel engine shall be of V-type construction, four-stroke cycle, turbo-charged, full compression ignition, diesel, with mechanical fuel injection. The unit shall operate at a speed of not more than 1800 rpm.

B. The rating of the engine shall not exceed the manufacturer's published standby rating. The gross engine horsepower required to produce the standby rating shall not exceed the manufacturer's published continuous duty rating by more than 150 percent. Continuous duty rating shall be as defined in BS649 or DIN6270 but in no case shall it exceed the manufacturer's published continuous duty rating. The gross engine horsepower required for the generator set standby rating described above shall include all parasitic demands such as generator inefficiencies, fuel pumps, water pumps, and all accessories necessary to the unit's proper operation while operating at rated loads.

C. The engine shall be capable of satisfactory operation on ultra-low sulfur diesel fuel.

2.04 - ENGINE GENERATOR ENCLOSURE

A. Provide complete factory pre-wired, weatherproof, sound attenuated, non walk-in enclosure.

B. Building capable of withstanding wind equal to 125 mph.

C. Roof load equal to 50 psf.

D. The sound attenuation shall be provided with noise reduction level of 65 dBA at 23ft from the enclosure.

E. The inlet and exhaust air handling system shall provide the necessary level of sound attenuation.

F. Provide enclosure with high efficiency, LED type, industrial, enclosed with acrylic lens, fiberglass housing and UL listed light fixtures. Provide light switches at each door.

G. The enclosure shall be provided with electrical space heater(s), designed to hold a minimum space temperature of 50 degrees F, with outside temperature of -1 degree F. Building shall be pre-painted aluminum stressed-skin construction, door and door frame, lifting rings, mounting frame, insulation, electrical package, louvers, muffler mounting bracket, and other appurtenances to provide complete unit.

H. Electrical Package

1. All equipment and devices shall be U.L. listed.

2. Provide enclosure electrical package complete and factory pre-wired. The enclosure package shall include lighting, receptacles, heating and ventilation equipment.

3. Provide ground studs for earth grounding.

I. Louvers and Dampers

1. Provide acoustical louvers and dampers for engine generator inlet, exhaust and ventilation air.

2. Fixed louvers, all aluminum construction, riveted into aluminized steel frame to form rigid, water resistant assembly.

3. Dampers shall be powered closed, spring open, fail safe type.

4. Properly size louvers and dampers to allow sufficient engine combustion air, radiator cooling air, and ventilation air with maximum 0.5 in. water restriction.

J. Enclosure shall be pre-painted steel construction, with removable panels to allow for maintenance with muffler mounting bracket, and other appurtenances to provide a complete unit.

1. Muffler and Mounting Bracket

a. Critical grade silencer with bracket.

b. Provide exhaust pipe with birdscreen and rain cap.

c. All interior engine exhaust piping to be insulated.

2. Fuel Piping

a. Provided integral with base fuel tank.

2.05 - EQUIPMENT

A. Governor

1. Provide isochronous solid state governor, capable of maintaining isochronous regulation from no load to full rated load within 0.25 percent of rated frequency.

2. The governor controller shall be mounted within the generator control panel. The governor shall have the capability for manual adjustment of speed setting and speed droop. Speed droop shall be adjustable from 0 to 5 percent from no load to full load. The controller shall eliminate all electromagnetic interference.

3. Provide a separate overspeed shutdown device which shall, in case of predetermined overspeed of the operation of various protective devices as later specified, instantly stop the engine without the fuel injection system losing its prime.

2.06 - GENERATOR AND EXCITATION SYSTEM

A. The generator shall be drip-proof, guarded, and be able to connect to the specified engine output and shall be 3-phase, 60-Hertz, 4-wire, 480-volt operation, "WYE" connected. The generator shall be mechanically and torsionally matched to the engine driver and shall be provided to withstand inherent pulsating torques of the engine. Full load efficiency of the combined generator, exciter and regulator shall be not less than 95 percent.

B. The generator shall conform to the applicable parts of the following standards, unless otherwise specified:

1. NEMA MG1, Motors and Generators
2. IEEE 43, Recommended Practice for Insulation Testing of Large AC Rotating Machinery
3. CSA C22.2-100 Designation ABL3
4. Testing shall be in accordance with IEEE-115 and NEMA MG-1 standards

C. The generator windings, insulation and excitation system shall be braced to withstand any possible short-circuit stresses.

D. The temperature rise of the generator windings, when operated at rated prime power load and under continuous duty conditions with cooling air inlet temperature of 40 degrees C, shall not exceed 130 degrees C when measured by the resistance method.

E. The stator frame shall be fabricated bar and plate steel construction.

1. All insulation materials used in the stator shall have a temperature rating of Class H per IEEE Standard 1. The coils shall be of a formed coil construction using a magnet wire meeting NEMA MW36-C specifications.
2. The complete stator shall be wound with a 2/3 stator winding pitch and processed in a vacuum pressure impregnation chamber. Encapsulation of the stator shall be accomplished with a two-part epoxy system.

F. The rotor shall be of the fully laminated, salient pole type. Cooling fans shall be an integral part of the rotor assembly. The rotor shall be dynamically balanced for all speeds up to 125 percent of rated speed per NEMA specification.

1. Insulation materials used on the rotor shall have a temperature rating of Class H. The poles shall be of a layer wound construction using a magnet wire meeting NEMA MW35-C or MW36-C specifications.
2. The complete winding and rotor pole assembly shall be in a vacuum pressure impregnation chamber. Encapsulation of the assembly shall be accomplished with a thixotropic, single component epoxy resin.

G. The exciter shall be a high frequency, direct connected, rotating brushless type, three phase, full wave rectified, and shall be matched with the generator rotor and control system. Both the armature and field windings shall be a vacuum pressure impregnated with epoxy resin.

H. The pilot exciter shall be permanent magnet generator type. The stator winding shall be vacuum pressure impregnated with epoxy resin. The permanent magnet generator shall have the ability to provide a nominal 300 percent of the 130 degrees C rise rated three-phase short circuit for ten seconds at the alternator terminals.

I. The digital voltage regulator shall be hermetically sealed, silicon controlled rectifier type and shall employ a zener reference and three phase sensing. The voltage regulator shall provide automatic protection of the entire unit on 3 phase short-circuits. The voltage regulator shall include automatic over-excitation and under-frequency protection. Input isolation transformers and filters shall be provided. Exciter shall be fast response type with a rotating rectifier and surge suppresser, 3-phase, full-wave bridge.

J. The voltage regulator and associated equipment shall be mounted in the generator terminal box. Manual voltage adjustment potentiometer shall be mounted in the Generator Control Panel.

K. Generator stator leads shall be connected to tinned copper bus bars in an oversize terminal box. The box shall allow bottom entry of cables and conduits shown on the contract drawings.

2.07 - SYSTEMS

A. Fuel Storage System:

1. Provide base fuel storage tank, integral to the mounting of the engine generator unit.
2. The fuel tank shall be UL listed as “primary containment aboveground tank for flammable and combustible liquids”.
3. Provide necessary supply and return lines; drainage and supply valve control.

4. Tapped openings in tank shall be bushed to desired size with double-tapped cast-iron tank bushing.

5. Tank vent shall be standard weight, black steel pipe with screwed malleable-iron fittings.

6. Provide double-walled tank, with level indication and auxiliary pre-wired leak detection alarm contacts.

B. Engine Fuel System:

1. Diesel fuel system shall consist of an engine-driven fuel supply pump, fuel filters, and a base tank and lift pump set.

C. Electric (Battery) Starting System:

1. Starting shall be accomplished by a 24-volt, engine mounted, solenoid shift electric starter, capable of withstanding four consecutive continuous cranking periods of 15 seconds duration each separated by 15 seconds rest periods before shutting down completely and sounding the overcrank alarm.

2. The starting batteries shall be low maintenance, premium industrial grade, high-output, long-life, lead acid type especially designed for diesel engine cranking service, and of a capacity as recommended by the battery manufacturer for cranking the engine being furnished. The engine starting batteries shall be sized to also supply power to the generator control panel.

3. Furnish an engine starting battery charger for charging the starting batteries for the engine. The battery charger shall be U.L. listed, fully automatic, filtered, equalize and float-type, appropriate for wall or rack mounting. Supply voltage shall be 120 volts, AC, single phase, 60 Hz obtained from the generator electrical package. The DC output shall be not less than 20 amperes, regulated to within one percent with plus or minus ten percent fluctuations of the input voltage, and shall be current limited at 120 percent of rated output. Accessories shall include DC ammeter and voltmeter (panel type; 2 percent accuracy), adjustable float and equalize controls toggle switch, AC and DC circuit breakers, AC power failure alarm relay, low DC voltage alarm relay and DC ground fault relay. Fault relays shall operate individual alarm indicators on the face of the charger panel and shall also operate a common alarm relay for remote transmission of alarm. Charger shall have a continuous power rating sufficient to power all generator control devices in both the standby mode and the running mode.

D. Lubrication System:

1. The engine shall be provided with a full pressure lubricating oil system arranged to lubricate and cool the pistons and distribute oil to all moving parts of the engine including the turbocharger bearings. The system shall include a full flow oil filter of the replaceable element type, an appropriately sized shell and tube type oil cooler, and an automatic temperature regulator.

2. Furnish a low oil level float switch to alarm to the generator control panel.

E. Engine Cooling System Radiator:

1. General: Provide a unit mounted radiator complete with integral jacket water circulating pump, thermostatic central of cooling system, fan and drive motor sized to maintain full load operation continuously as specified herein for engine-generator set.

2. Provide radiator to operate engine at full rated generator load at 104 F ambient temperature.

3. Provide jacket water treatment for the prevention of both scale formation and corrosion in the engine water jackets and cooling system components which are in contact with the engine jacket water. This treatment shall be added to the cooling system prior to running the field acceptance test

F. Miscellaneous Equipment and Requirements

1. Heaters

a. Automatic thermostatically controlled heater(s), shall be provided to maintain not less than 90º F temperature for the engine jacket water system.

b. Heater(s) shall be rated 208/120VAC.

c. Heater shall be automatically deactivated when the engine-generator unit is in operation.

2. Emergency Stop Pushbuttons

   a. Furnish an emergency stop pushbutton on the engine control panel.

   b. The emergency stop buttons shall be maintained type, red colored, push to stop, mushroom type with a hinged plastic Lexan cover, labeled as "Emergency Stop," "Push."

   c. The pushbutton shall be wired to the engine-generator instrument/control panel and shall immediately stop the engine.

3. Control Power Fuses

   a. Fuses shall be mounted in locations where they are accessible. Pullout type fuses shall be provided.

4. Main Circuit Breaker

   a. Provide generator with a molded case circuit breaker to protect generator against overload and short circuit conditions. Circuit breaker shall be rated for 65 kA short circuit symmetrical and shall conform to the provisions of NEMA Standard AB1 and UL Standard 489.

   b. Provide circuit breaker with adjustable trip unit, rating plug, long-time, short-time and instantaneous protective relaying and ground fault protection.

5. Terminal Blocks

   a. Terminal blocks shall be one-piece, 20 AMP rated, with barriers appropriate for ring tongue terminals and provided with binding head screws. The terminal block rating shall be 600 V.

6. Solid State Circuitry

   a. Heavy-duty solid state controls, relays, timers or monitors shall meet the following specifications:

Accuracy:	+ 2% of set point
Temp Range:	- 40 C to +65 C (-40 F to 150 F)
Protection:	Transient overvoltage with-stand of 1500 volts peak, 1 m sec. time constant
Ratings:	Current ratings to exceed application of devices. Devices shall be UL listed.

2.08 - SYSTEM OPERATING SEQUENCE

A. The engine generator unit shall be operated in the following manner:

   1. The engine generator unit shall be arranged for automatic or manual starting and stopping.

   2. The engine generator shall be brought up to rated voltage and frequency and closed onto facility main Switchboard through open transition automatic throw-over system.

B. Normal – system utility powered:

   1. During normal system operation, the normal (utility) shall power the electrical distribution system with loads as indicated.

C. Loss of utility power - standby operation:

1. Upon loss of utility power, automatic transfer switch shall sense loss of power and after an adjustable time delay the automatic transfer system shall initiate generator start.
2. When the generator is up to speed and capable of accepting load, pump station loads will transfer to generator power.
3. Upon return of utility power, the automatic transfer switch shall initiate transfer back to the utility after an adjustable time delay.
4. After an adjustable cool-down period, the engine-generator shall shutdown.

2.09 - ENGINE CONTROL PANEL

A. The engine starting control logic shall be microprocessor based and shall automatically start, protect and monitor the engine-generator set. Electro-Mechanical controls are unacceptable.

B. The following gauges shall be mounted within an engine mounted control panel. Gauges shall be digital:

1. Jacket water temperature cooler temperature into heat exchanger
2. Lube oil temperature
3. Lube oil pressure
4. Lube oil filter differential pressure.

C. An engine coolant level switch shall be furnished. Level switch shall shut down generator on low level.

D. The engine starting control logic shall be capable of controlling the following engine devices.

1. Starting motor magnetic switch.
2. Electrically operated fuel control.
3. Normally open protective switches that close for abnormal conditions of pressure, temperature, speed and liquid level.

E. The panel shall have the following controls:

1. Emergency stop
2. Lamp test
3. Cycle crank
4. Voltage control
5. Cool-down timer
6. Phase selector switch
7. Programmable relays 4 (std)
8. Stop/Auto/Test.

F. The panel shall be provided with the following indicating lights:

1. Low oil pressure
2. High coolant temperature
3. Over speed
4. Over crank
5. Emergency stop
6. Fault shutdown

7. 3 spare lights, programmable input.
8. Not in Auto

G. Protection shall include:

1. Over and under voltage
2. Over and under frequency
3. Low coolant level
4. Oil temperature.

G. Provide contacts to alarm the following functions:

1. Low oil pressure
2. Sub-base oil tank rupture
3. Low fuel
4. Fuel tank leak
5. Battery malfunction
6. Low battery voltage
7. Common fault alarm
8. Not in automatic
9. In exerciser mode
10. E-stop activated
11. Generator run status
12. Low coolant level

H. Provide analog (4-20mA) output from fuel tank control panel for fuel level.

I. Engine Start/Stop Operation: The automatic engine control logic shall initiate operation of the engine upon receipt of a signal from a contact at the facility main Switchboard automatic transfer system. The contact(s) shall close for engine run and open for engine stop.

J. If the engine fails to start after 4 adjustable cranking attempts (factory set at 10 seconds on, 10 seconds off, adjustable from 5 to 30 seconds) or if any protective device should operate while the engine is running, the engine shall be disconnected from service and immediately stopped. The engine control logic shall lock the failed set out of service and requires a manual reset. The engine control logic shall include a provision for conversion to single cycle cranking, adjustable from 35 to 210 seconds.

K. Three-position engine control switch:

1. **Stop/Reset:** In this position, the engine shall not be capable of starting and/or running. If the engine was shutdown due to the operation of a protective device, the shutdown malfunction shall be reset when the switch is moved to this position. If the engine is running when the switch is moved to this position, it shall be immediately shutdown.
2. **Automatic:** In this position, the engine control shall be in readiness for fully automatic operation upon receipt of a start signal.
3. **Test:** When placed in this position, the engine shall start and run as if a start signal were received except it shall not be connected to the bus unless a start signal is received. When returned to the automatic position, the engine will shut down.

2.09 - SHOP PAINTING

A. The engine-generator set shall be shop primed and finished coated in accordance with the manufacturer's standard practice prior to shipment. A supply of touch-up paint shall be supplied by the manufacturer.

2.10 - SHOP TESTING

A. The complete engine-generator set shall be shop tested to simulate a complete and integrated system prior to shipment.

B. The procedure for the shop test of the diesel engine shall cover the engine manufacturer’s standard practice.

2.11 - SPARE PARTS

A. Provide a recommended list of spare parts.

PART 3 – EXECUTION

3.01 - INSTALLATION AND START UP

A. The generator unit shall be mounted on a concrete pad.

3.02 - FIELD TEST

A. Upon completion of the installation and as soon as conditions permit, the diesel engine driven generator, including the engine, generator, electrical circuit controls, transfer controls other devices shall be tested to assure that the system functions as specified.

3.03 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF TEXT

See Attachments

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ATTACHMENT A
Pump Station No. 1

Loads to be powered up by the engine-generator for engine generator load calculation.
The Generator shall be capable of picking up the loads in order shown.

Equipment List

Equipment	Total Quantity	Quantity Operating	HP/AMPS/kVA/kW
Step 1			
Mini Power Center MPC.01-1	1	1	7.5kVA
Odor Control Fan PS1.OC-1*	1	1	1HP
Step 2			
PS1.P-1**	1	1	40HP
Step 3			
PS1.P-2**	1	1	40HP
Step 4			
PS1.P-3**	1	1	40HP

* Motor is powered by full voltage motor starter.

** Motor is powered with 6-pulse variable frequency drive with 5% input line reactor.

ATTACHMENT B
Pump Station No. 2

Loads to be powered up by the engine-generator for engine generator load calculation.
The Generator shall be capable of picking up the loads in order shown.

Equipment List

Equipment	Total Quantity	Quantity Operating	HP/AMPS/kVA/kW
Pump Station No. 2			
Step 1			
Mini Power Center MPC.02-1	1	1	7.5kVA
Odor Control Fan PS2.OC-1*	1	1	1HP
Step 2			
PS2.P-1**	1	1	40HP
Step 3			
PS2.P-2**	1	1	40HP

* Motor is powered by full voltage motor starter.

** Motor is powered with 6-pulse variable frequency drive with 5% input line reactor.

ATTACHMENT C
Pump Station No. 3

Loads to be powered up by the engine-generator for engine generator load calculation.
The Generator shall be capable of picking up the loads in order shown.

Equipment List

Equipment	Total Quantity	Quantity Operating	HP/AMPS/kVA/kW
Step 1			
Mini Power Center MPC.03-1	1	1	7.5kVA
Odor Control Fan PS3.OC-1*	1	1	1HP
Step 2			
PS3.P-1**	1	1	30HP
Step 3			
PS3.P-2**	1	1	30HP

* Motor is powered by full voltage motor starter.

** Motor is powered with 6-pulse variable frequency drive with 5% input line reactor.

SECTION 13300

INSTRUMENTATION AND CONTROL SYSTEM – GENERAL

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PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide a complete, functional control system as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

C. Provide and test the instrumentation and controls systems as specified and indicated on the Contract Drawings.

D. Provide all equipment, installation, services, and appurtenances required to achieve a complete, integrated, and fully operational system.

E. Retain the services of a System Supplier (SS). The SS shall provide all instrumentation and hardware provided under DIVISION 13, and shall coordinate with the System Integrator hired under Contract No. 2019-01 DOWNTOWN AREA WWTF AND EFFLUENT DISPOSAL as required.

F. Not Used

G. Test all components individually as well as in a system as specified.

H. Provide and calibrate instruments as specified in SECTION 13330, PROCESS INSTRUMENTS.

I. The Contractor shall be responsible with the assistance of the SS for the coordination of other equipment furnished in this contract with overall control system requirements.

J. Preconstruction Meeting: The Contractor shall arrange a Preconstruction Meeting. The meeting shall be held prior to the submission of shop drawings. The meeting shall be held at the job site. The meeting shall be attended by the Contractor, the Owner, a technical representative of the SS and the Engineer. The purpose of the meeting shall be to review the scope of work, submittal procedures, project documentation, proposed instruments and control systems, contacts and communications and other issues that the Contractor, Owner or the SS may wish to discuss.

K. All equipment shall comply with the electrical area classification indicated in the electrical drawings.

L. Design the system and equipment used therein, to resume normal operation without manual intervention, following resumption of power after a power failure.

M. Provide UL approved materials and equipment.

N. Ambient Conditions for control panels

1. Minimum Temperature: 50 °F
2. Maximum Temperature: 90 °F
3. Relative Humidity: 95% Non-condensing

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Field Instrumentation

C. Provide submittals for all instrumentation and control systems equipment as indicated under the referenced specification sections.

1. Operation and Maintenance Manuals.

2. Submit "record copy" of all drawings previously submitted for review within 30 days after completion of system installation as part of operating and maintenance instructions. Show all changes and modifications made during installation. Define special maintenance requirements particular to system along with special calibration and test procedures.

3. Submit brief description of calibration procedures listing actual calibration and test equipment. Include typical calibration sheet and description of loop check procedures, provide typical loop check sheet.

4. Provide manufacturer's certified statement of installation approval.

D. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance.

1. Failure to include a copy of the marked-up specification sections will result in rejection of the entire submittal with no further review and consideration.

1.05 - PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project

site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESSGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

B. The design conditions and other pertinent requirements for the equipment are listed on the Contract Drawings.

C. Quality Assurance

1. Work of SS service personnel shall be coordinated by the Contractor.

2. Coordinate with instrumentation, mechanical and electrical systems suppliers to identify any signal isolation, signal boosting devices or auxiliary relays that may be required to complete the system.

3. Provide auxiliary devices for proper operation, such as transducers, relays, current/current isolators, and signal boosters for interfacing with equipment provided under this and other sections of this specification.

4. Provide a qualified manufacturer representative to oversee the installation, the placing and location of system components, the location of sleeves, methods of installing conduits and special cables, mounting, piping, and wiring of one of each type of device, and methods of protecting all equipment prior to being placed into service, their connections to the process equipment panels, cabinets and devices, subject to the Owner’s approval. Provide on-site services for a minimum period of three 8-hour days, excluding travel time. Certify that all field wiring for power and signal circuits are correctly installed and terminated in accordance with best industry practice and provide for all system grounding to insure a satisfactory functioning installation. Schedule and coordinate work under this section with that of the electrical work specified under applicable Sections of DIVISION 16, ELECTRICAL.

5. Upon completion of installation, provide service personnel, for field check-out of the System.

6. Instrument Calibration: Calibrate electronic and pneumatic test equipment within 6 months prior to use. Accuracies of test equipment shall be traceable to Bureau of Standards.

7. Provide calibration tag to all calibrated instruments. The calibration tag shall have the name and phone number of the SS who performed the calibrations with the date of calibration and the date of the next calibration. The tag shall be signed by the individual that performed the calibration. Linkage or range adjustments sealed by colored lacquer immediately following calibration. Provide calibration records to the Engineer prior to substantial completion.

8. System energizing not allowed prior to receipt of certified statement from Contractor and supplier approving system and authorizing energizing of system.

9. Protect materials and equipment against damage in storage and during construction.

10. Replace damaged materials or equipment as determined by the Engineer at no additional cost to the Owner.

1.07 - REFERENCES

A. Federal Specifications: WW-T-799F; Tube, Copper, Seamless, Water, (For Use with Solder-Flared-Or Compression Type Fittings).

B. National Fire Protection Association: NFPA 70.

C. The International Society of Automation (ISA) PR7.1, Pneumatic Control Circuit Pressure Test, Tentative Recommendation Practice.

D. American Petroleum Institute (API) RP-550 Manual of Installation of Refinery Instruments and Control Systems.

E. The International Society of Automation (ISA) S5.2, S5.3 and S5.4, Instrument Loop Diagrams, standard.

F. National Electrical Manufacturers Association (NEMA) Publication, General Standards for Industrial and Control Systems, ICS1 and Industrial Controls and Systems ICS2.

G. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.08 - WARRANTY

A. Guarantees and warranties shall be furnished in accordance with DOCUMENT 00700, GENERAL CONDITIONS.

B. Equipment Manufacturer - Not Used

C. Contractor

1. The Contractor shall provide a warranty that the installation of materials and hardware are in compliance with applicable provisions of the National Electric Code, UL, NEMA, the rules and regulations of the Federal Communications Commission, and state and/or local codes or ordinances that may apply. The Warranty, obtained by the Contractor, shall be secured by a Performance Bond issued jointly to the Contractor and the Owner. The Contractor agrees to furnish a Warranty in the sum of the full amount of the equipment price and duly executed by the said Contactor as Principal and by a surety company qualified to do business under the laws of the Commonwealth of Massachusetts and satisfactory to the Owner, as Surety, for the faithful performance of the work proposed. The premiums for such Bonds shall be paid by the Equipment Manufacturer. Bonds must be issued by surety companies listed on the latest IRS Circular 570.
2. The Warranty shall be for a period of one (1) year from Substantial Completion of the construction contract.
3. The Contractor shall be responsible for execution of warranties during the warranty period should the need arise.

D. It is the Contractor's and Equipment Manufacturer's responsibility to resolve any and all warranty claims.

E. The Warranties shall be provided as part of the shop drawing submittal. Submittals which do not include the required Warranty Bonds will be summarily rejected and returned to the Contractor without further review and consideration.

SECTION 13300 ATTACHMENT A

INSTRUMENT PRODUCT SHEETS

PART 2 - PRODUCTS

2.01 - GENERAL

A. Equipment, cabinets and other devices furnished hereunder shall be rated for continuous use in the intended application.

B. The system shall consist of current production products.

C. Equipment shall be UL listed (or approved equivalent listing where UL listing is not available).

D. Refer to equipment specification sections as referenced.2.02 - SPARE PARTS

A. Spare Parts:

1. Provide spare parts specified in the products specifications.

PART 3 - EXECUTION

3.01 - VERIFICATION OF CONDITIONS

A. Before the start of the Work of this Section, verify that the project is ready for this Work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this Work and coordinate the Work with them.

3.02 - INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. Minimum requirements of all wiring of the equipment shall be as specified under DIVISION 16, ELECTRICAL.

C. Provide proper installation of the equipment in accordance with manufacturer’s written instructions and/or as approved by the Engineer. Coordinate the proper installation of equipment with the Work of all other trades.

3.03 - PAINTING

A. Shop painting and the surface preparation is a part of the Work specified in this section and shall be as specified in SECTION 09940, FIELD PAINTING.

3.04 - CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment.

B. Spillage of lubricants used in servicing the system shall be cleaned from all equipment and concrete surfaces.

3.05 - MANUFACTURER'S FIELD SERVICES

A. Provide field services for the instrumentations and control systems as specified under the respective section.

3.06 - MANUFACTURER'S TRAINING

A. Provide training for the instrumentations and control systems as specified under the respective section.

3.07 - LUBRICATION REQUIREMENTS

A. All lubricating oils required for the first year of operation shall be provided.

3.08 - SPARE PARTS

A. Provide spare parts for the instrumentations and control systems as specified under the respective section.

3.09 - SHOP TESTING

A. Provide shop testing for the instrumentations and control systems as specified under the respective section.

3.10 - FIELD TESTING

A. Provide field testing for the instrumentations and control systems as specified under the respective section.

3.11 - GENERAL INSTALLATION

A. Install instrumentations and control systems as specified under equipment sections and in accordance with manufacturer's instructions.

3.12 - TRAINING

A. Upon completion of the start-up, provide competent training personnel for a period of not less than three, 8-hour working days, excluding travel time, for training of personnel in the use, operation and maintenance of the instrumentation and control system. Training to utilize the submitted operation and maintenance manuals and record copy drawings as reference materials. Training to be for 6 personnel in each class. Each class to be of a 4-hour duration.

3.13 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 13330

PROCESS INSTRUMENTS

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PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide a complete, functional control system as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

C. The System Supplier (SS) shall furnish process instruments as specified and in accordance with the Contract Documents.

D. Instrument Product Sheets are as specified herein, Attachment A.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Field Instrumentation

C. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance.

1. Failure to include a copy of the marked-up specification sections will result in rejection of the entire submittal with no further review and consideration.

D. Submit Product Data Sheets, in accordance with ISA-S20 with the information noted below and other data pertinent to the equipment and the application.

1. Initial submission for review to accompany Shop Drawings:

a. The product manufacturer and the supplier or representative.

b. The complete model or catalogue number(s) including any special options.

c. The available adjustment range(s) and the operating range(s).

2. Second Submission during pre-commissioning, testing and calibration period:

a. Serial numbers, part numbers, dates of installation and calibration.

b. Calibration and programming procedure.

c. Calibration and programming documentation.

d. Provide linkage or range adjustments sealed by colored lacquer following calibration.

e. This submission is for signature by the Contractor and the Engineer following acceptance of the operation of each instrument.

3. Final Submission of signed-off Product Data Sheets included with Operating and Maintenance Instruction Manuals:

a. All of the above information.

b. Phone number and email address of contact person for product support/service.

E. Submit Shop Drawings for all instruments. Manufacturers' catalog cuts and product specifications shall be accepted only if the following information is clearly indicated and highlighted for the equipment proposed:

1. Submit information on each instrument to demonstrate compliance with the data sheet.

2. Tag names, quantities, options provided, full description and performance data.

3. Installation details depicting mounting assemblies, physical dimensions.

4. Termination details, clearly indicating the type and lengths of external wiring required and electrical connections.

5. Power supply rating, input and output signal ranges, maximum measured process range and calibrated scale, physical, electrical and environmental requirements.

6. Specific catalog model numbers for each piece of equipment and its accessory options, clearly referenced by the respective instrument or equipment tag name. Improperly tagged items shall be rejected.

7. Sales bulletins and other general publications are not acceptable as submittals except where necessary to provide supplemental technical data.

F. Submit a separate document with manufacturers' recommended list of spare parts, including individual pricing with the shop drawings.

G. Drawing submissions shall clearly show the enclosures proposed for each instrument.

H. Submit completed Calibration forms and Instrument Installation Checklist forms.

I. Submit schedule of proposed instrument nametag inscriptions.

1.05 - PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details regarding the construction of the equipment.

B. Where possible, all equipment shall be provided by the same manufacturer.

C. The design conditions and other pertinent requirements for the equipment are listed on the Contract Drawings and on the data sheets.

D. Quality Assurance

1. All instruments shall be UL listed or equivalent listing system when UL listing is not available.

1.07 - REFERENCES

A. American Petroleum Institute (API):

1. RP 551: Process Measurement Instrumentation

B. International Society of Automation (ISA):

1. S-20: Specification Forms for Process Measurement and Control Instruments, Primary Elements, and Control Valves.

C. National Electrical Manufacturers Association (NEMA):

1. 250: Enclosures for Electrical Equipment (1000 Volts Maximum).

D. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.08 - WARRANTY

A. Guarantees and warranties shall be furnished in accordance with DOCUMENT 00700, GENERAL CONDITIONS.

B. In addition, the equipment shall be warranted to be free from defects in workmanship, design and materials for a period of 5 years from shipment. If any part of the equipment should prove to be defective during the warranty period, the manufacturer at no expense to the Owner shall replace the part.

C. All installed equipment shall conform to the contract specifications and to manufacturer’s published specifications. The warranty shall begin at the substantial completion date and remain in effect for a period of one (1) year from that date. The Contractor shall repair, adjust, service and/or replace any defective equipment, materials, or other parts of the system at the Contractor's sole cost. The Owner will incur no costs for service or replacement of parts during the warranty period. All third party warranties shall be passed through from the Contractor to the Owner.

D. The Contractor shall warrant that the installation of materials and hardware are in compliance with applicable provisions of the National Electric Code, UL, NEMA, the rules and regulations of the Federal Communications Commission, and state and/or local codes or ordinances that may apply.

E. The Contractor shall warrant that the system will function in accordance with the manufacturer's published technical description guides and as specified herein.

PART 2 - PRODUCTS

2.01 - GENERAL REQUIREMENTS

A. Provide instruments with enclosure rating indicated on electrical drawings or in instrument Product Sheet - whichever is more stringent.

B. Instruments shall have an integral indicator to display the current process measurement, calibrated in engineering units. Blind instruments shall be provided with a separate digital indicator mounted adjacent to the instrument as specified.

C. Provide electronic instruments with linear 4-20 mA DC isolated output signals capable of driving a maximum load of 750 ohms.

D. Electronic instruments shall have integral configuration capability. Instruments without integral configuration capability shall be provided with a wireless remote handheld terminal. One handheld terminal shall be provided for each type of device in the Contract Documents.

E. Provide standard instrument process connections of 1/2-inch (12.7 mm) NPT female, other than pressure gauges which shall be 1/2-inch (12.7 mm) NPT male.

F. Instruments shall be of current manufacturer design. Obsolete equipment or equipment that has been identified for withdrawal from the market by the manufacturer before date of shop drawing submittal shall not be accepted.

G. Field measure lengths for transducer cables and similar items prior to ordering and supply adequate cable length for application.

2.02 - MATERIALS

A. Provide manufacturer's written certificate that the materials of construction are suitable for the service and process fluids.

2.03 - EQUIPMENT

A. Provide instruments in accordance with the Product Sheets, Schedules, and Special Construction notes in the attachments to this Section.

2.04 - ACCESSORIES

A. Provide the necessary mounting brackets and mechanical shields to secure and protect transducers and other instrumentation devices.

B. Provide all electrical connections, transducer junction boxes, power supplies, and accessory items or options required to satisfy each application.

C. Provide cable between transducers and transmitter units with adequate length based on the location of the devices as shown on the Contract Drawings. Cables shall be continuous run with no splices.

D. Mounting brackets shall be AISI 316 Stainless-steel, and design to securely fasten the devices.

E. Provide shields for outdoor mounted electronic instrument with integral displays, to provide protection against rain, ice and snow and shade from the sun.

F. Provide all special instrumentation communication cables, transducer cables, power cables, process sensing/sampling lines and capillary tubing in field measured lengths without joints or couplings in accordance with the Manufacturer's written instructions.

G. Provide identification nametags for instruments, engraved stainless-steel, 3-inch x 1.5-inch x 1/16-inch. Affix to component with minimum 18 AWG minimum stainless-steel wire or stainless-steel screws. Provide inscription in block letters with following lines, text height as indicated:

1. Line 1: Device Tag and Name, ¼-inch.
2. Line 4: Power Source, 1/6-inch.

PART 3 - EXECUTION

3.01 - VERIFICATION OF CONDITIONS

A. Before the start of the Work of this Section, verify that the project is ready for this Work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this Work and coordinate the Work with them.

3.02 - INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. Minimum requirements of all wiring of the equipment shall be as specified under DIVISION 16 - ELECTRICAL.

C. Provide proper installation of the equipment in accordance with manufacturer’s written instructions and/or as approved by the Engineer. Coordinate the proper installation of equipment with the Work of all other trades.

3.03 - PAINTING

A. Shop painting and the surface preparation is a part of the Work specified in this section and shall be as specified in SECTION 09940, SHOP PAINTING.

3.04 - CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment.

B. Spillage of lubricants used in servicing the system shall be cleaned from all equipment and concrete surfaces.

3.05 - MANUFACTURER'S FIELD SERVICES

A. Manufacturer's Field Services shall be provided for installation and startup for the equipment - 1 calendar day (via 1 separate trip to project site).

3.06 - MANUFACTURER'S TRAINING

A. Manufacturer's training shall be provided for training of Owner's personnel for the equipment at the project site - 1 calendar day (via 1 separate trip to project site).

3.07 - LUBRICATION REQUIREMENTS

A. All lubricating oils required for the first year of operation shall be provided.

3.08 - SPARE PARTS

A. Provide spare parts as indicated on the instruments’ data sheets.

3.09 - SHOP TESTING – Not Used

3.10 - INSTALLATION

A. Provide, install, test, calibrate and commission instruments and all peripheral devices necessary in accordance with the Contracts Documents.

B. Install instruments as follows:

1. Install instruments in accordance with the manufacturer's written instructions.
2. Instruments shall be pedestal or wall mounted. Mounting brackets shall not be fastened to process piping or equipment.
3. Mounting brackets, Screws, bolts, nuts and other fasteners shall be 316 Stainless-steel.
4. Do not mount instruments on vibrating structures (e.g. handrails), or on piping or near equipment that induces vibration.

C. Locate instruments as follows:

1. Locate instruments and their associated sensors, local isolation valves, isolation switches and other related accessories so that they are readily accessible for operation, maintenance or removal.
2. Orient instrument displays to be easily viewed from a standing position.
3. Position instruments so that they do not block or obstruct walkways or access points and provide space around installation for removal of covers, etc.
4. Unless otherwise indicated in the Contract Documents, mount instruments 55-inches above finished floors, grade or platforms. Allow for cabinet plinth/floor-pad heights when locating panel instruments.
5. Do not mount instruments below or directly adjacent to lines conveying corrosive chemicals or near sources of leakage or spillage.
6. Where manual operation of valves or equipment is required, based on an instrument reading, the indicator shall be located adjacent to the valve or equipment local control panel.
7. Confirm instrument mounting locations with the Engineer to ensure accurate process measurements.
8. Any instrument that is not easily accessible for operation or maintenance, or any indicator that is not easily and readily visible shall be relocated as directed by the Engineer at no charge to the Contract.

D. Provide process isolation devices such as valves on instrument lines for maintenance and instrument removal, without disruption to the process.

E. When installing conduit entry points in instruments, protect internally mounted equipment from vibration, shock and metal filings. All enclosure penetrations shall maintain the equipment or panel NEMA and UL rating.

F. Process sample and sensing lines:

1. Instrument sample and sensing lines shall be 1/2-inch (12.7 mm) 316 Stainless-steel, cut and bent by methods and tools recommended by the tubing supplier, with compression type fittings.
2. Install process sensing lines to avoid accumulation of vapor or gas (on liquid service) and accumulation of liquid or condensate (on vapor or gas service), as appropriate. Instruments on liquid service shall be mounted below sensing lines, with process tapping points taken from the side of the process line. Instruments on gas service shall be mounted above the sensing lines, with process tapping points taken from the top of the process line.
3. Protect sample and sensing lines throughout their length and secure to eliminate sagging, by using painted/galvanized angle iron and clips.
4. Avoid sharp bends in lines and coil any excess close to the sensor end. Protect the coiled capillary by clipping instrument stanchion.
5. Locate all drain plugs below the lowest tube fitting, union or valve. Slope horizontal tubing toward drain plug by minimum 1 percent. Provide drain plugs on all tubed instrument systems.

G. Provide cable and sample or sensing line lengths so instrument/transducer could be removed from the process without disconnecting process piping.

H. Provide transducers with stilling wells and mounting hardware.

3.11 - PRE-COMMISSIONING

A. Provide, install, test, calibrate and commission instruments and all peripheral devices necessary in accordance with the Contracts Documents.

B. Install instruments as follows:

1. Install instruments in accordance with the manufacturer's written instructions.

2. Instruments shall be pedestal or wall mounted. Mounting brackets shall not be fastened to process piping or equipment.

3. Mounting brackets, Screws, bolts, nuts and other fasteners shall be 316 Stainless-steel.

4. Do not mount instruments on vibrating structures (e.g. handrails), or on piping or near equipment that induces vibration.

C. Locate instruments as follows:

1. Locate instruments and their associated sensors, local isolation valves, isolation switches and other related accessories so that they are readily accessible for operation, maintenance or removal.

2. Orient instrument displays to be easily viewed from a standing position.

3. Position instruments so that they do not block or obstruct walkways or access points and provide space around installation for removal of covers, etc.

4. Unless otherwise indicated in the Contract Documents, mount instruments 55-inches above finished floors, grade or platforms. Allow for cabinet plinth/floor-pad heights when locating panel instruments.

5. Do not mount instruments below or directly adjacent to lines conveying corrosive chemicals or near sources of leakage or spillage.

6. Where manual operation of valves or equipment is required, based on an instrument reading, the indicator shall be located adjacent to the valve or equipment local control panel.

7. Confirm instrument mounting locations with the Engineer to ensure accurate process measurements.

8. Any instrument that is not easily accessible for operation or maintenance, or any indicator that is not easily and readily visible shall be relocated as directed by the Engineer at no charge to the Contract.

D. Provide process isolation devices such as valves on instrument lines for maintenance and instrument removal, without disruption to the process.

E. When installing conduit entry points in instruments, protect internally mounted equipment from vibration, shock and metal filings. All enclosure penetrations shall maintain the equipment or panel NEMA and UL rating.

F. Process sample and sensing lines:

1. Instrument sample and sensing lines shall be 1/2-inch (12.7 mm) 316 Stainless-steel, cut and bent by methods and tools recommended by the tubing supplier, with compression type fittings.

2. Install process sensing lines to avoid accumulation of vapor or gas (on liquid service) and accumulation of liquid or condensate (on vapor or gas service), as appropriate. Instruments on liquid service shall be mounted below sensing lines, with process tapping points taken from the side of the process line. Instruments on gas service shall be mounted above the sensing lines, with process tapping points taken from the top of the process line.

3. Protect sample and sensing lines throughout their length and secure to eliminate sagging, by using painted/galvanized angle iron and clips.

4. Avoid sharp bends in lines and coil any excess close to the sensor end. Protect the coiled capillary by clipping instrument stanchion.

5. Locate all drain plugs below the lowest tube fitting, union or valve. Slope horizontal tubing toward drain plug by minimum 1 percent. Provide drain plugs on all tubed instrument systems.

G. Provide cable and sample or sensing line lengths so instrument/transducer could be removed from the process without disconnecting process piping.

H. Provide transducers with stilling wells and mounting hardware.

3.12 - COMMISSIONING

A. Demonstrate instrument calibration and loop checks. Each loop check shall be witnessed by, and successfully demonstrated to the Engineer for sign-off.

3.13 - MANUFACTURER SERVICES AND CERTIFICATION OF INSTALLATION

A. Provide the services of a trained, qualified manufacturer's representative to test, program and start the instruments to ensure correctness of installation, calibration, testing, start-up, commissioning and training.

B. Manufacturer field services shall be split into three stages: inspection during installation, start up and commissioning, plant operation personnel training.

C. The qualified representative shall:

1. Provide on-site supervision of installation, commissioning and testing for the initial and critical stages of the work as agreed to with the manufacturer/supplier and as required by the Engineer. The Engineer may order additional supervision at no additional cost to the Contract if, in their opinion, procedures are compromised.

2. Provide operation and maintenance instruction to the plant operation personnel.

D. Provide all materials, labor and equipment to make any adjustments to the installation as required by the manufacturer or the Engineer.

E. On completion of installation and testing, provide written certification from the manufacturer confirming that the equipment is installed correctly, is in full operating condition, and is operating in accordance with its design rating. Submit the original certificate to the Engineer.

3.14 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF TEXT

See Attachment A

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ATTACHMENT A

INSTRUMENTS PRODUCT SHEETS

DATA SHEET 416.1	MAGNETIC FLOW METER SPECIFICATION
DATA SHEET 853.1	LEVEL SWITCH (FLOAT TYPE) SPECIFICATION
DATA SHEET 873.1	SUBMERSIBLE WATER LEVEL SENSOR/TRANSMITTER SPECIFICATION
DATA SHEET 1452.1	PRESSURE SWITCH SPECIFICATION
DATA SHEET 1454.1	PRESSURE GAUGE SPECIFICATION
DATA SHEET 1457.1	PRESSURE ISOLATOR RING SPECIFICATION

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MAGNETIC FLOW METER SPECIFICATION

DATA SHEET NO. 416.1

GENERAL		
1.	Tag No.:	SEE TABLE
2.	Service	SEE TABLE
3.	P & I D No.:	SEE TABLE
4.	Location:	SEE MECHANICAL DRAWINGS
CONNECTIONS		
5.	Line Size:	SEE TABLE
6.	Line Material:	DUCTILE IRON
7.	Conn. Type:	FLANGED
8.	Conn. Materials:	CARBON STEEL
PROCESS CONDITIONS		
9.	Fluid:	WATER WITH ~40% PROPYLENE GLYCOL
10.	Maximum Flow:	SEE TABLE
11.	Max. Flow Velocity:	SEE TABLE
12.	Minimum Flow:	SEE TABLE
13.	Min. Flow Velocity:	SEE TABLE
14.	Operating Temp.:	40 TO 250 °F.
15.	Operating Pressure:	57 PSI
METER		
16.	Meter Size:	SEE TABLE
17.	Tube Material:	304 STAINLESS
18.	Housing:	WELDED STEEL
19.	Liner Material:	INJECTION MOLDED HARD RUBBER OR EQUIVALENT
20.	Electrode Type:	FLUSH MOUNT
21.	Electrode Material:	316 STAINLESS OR EQUIVALENT
22.	Terminal Box:	DIE CAST ALUMINUM
23.	Enclosure Class:	NEMA 4X
24.	Power Supply:	120 VAC, 60 HZ
25.	Grounding Type:	STRAP AND RING
TRANSMITTER		
26.	Type:	INTELLIGENT, MICROPROCESSOR BASED
27.	Mounting:	WALL MOUNTED
28.	Transmitter Range:	SEE TABLE BASED ON INSTRUMENT SPAN
29.	Enclosure Class:	NEMA 4X
30.	Power Supply:	120 VAC, 60 HZ
31.	Analog Output:	4 - 20 mADC
32.	Elect. Class:	SEE ELECTRICAL DESIGN FOR AREA CLASSIFICATION
33.	System Accuracy:	+/- 0.5% OF FLOW RATE AT VELOCITIES ABOVE 1 FOOT PER SECOND
34.	Sys. Repeatability:	+/- 0.1% OF FULL SCALE
35.	Empty Pipe Detect.:	REQUIRED
36.	Local Display:	MULTI-LINE LC FOR MEASURED VARIABLE, DIAGNOSTICS PLUS BAR

GRAPH AND KEY PAD

37.	Local Totalizer:	REQUIRED, 6 DIGIT, NON RESET
38.	Cable Length:	APPROX. 50 FEET PROVIDED BY METER MANUFACTURER

MISCELLANEOUS

39.	Manufacturer(s):	FOXBORO, E+H, KROHNE OR SIEMENS
40.	Model No.:	2000 SERIES, PROMAG W, ENVIROMAG OR MAG 5100

NOTES.

a. Provide grounding ring from meter manufacturer. Fabricated grounding rings from a third party shall not be accepted.
b. Provide meter manufacturers cable between the meter and the transmitter.
c. Wet calibrate all meters (at 3 points over the specified flow range) by gravimetric or volumetric methods that are traceable to NIST (National Institute Standard Testing).
d. Provide certificate of wet calibration to the engineer/owner prior to meter installation.
e. Provide, by the meter manufacturer, insitu calibration of all meters prior to system acceptance. Submit written calibration report from the manufacturer to the engineer.
f. PROVIDE 316 STAINLESS STEEL MOUNTING HARDWARE including all nuts and bolts connecting the meter to the process pipe.
g. Contractor to provide all power and signal cable in rigid conduit or liquid-tight conduit. See electrical specification for product specifications.
h. Contractor to provide grounding from ground rings to meter and meter to ground, using green size 10 AWG (6mm) ground wire. The Contractor shall install ground as directed by the meter manufacturer or to nearest water pipe. Contractor is responsible for all connections.
i. Remote communication must not interfere with the analog output signal. Use frequency shift keying (FSK) technique for communication.

TAG NO	SERVICE	LINE SIZE (in)	FLUID	MAX FLOW (gpm)	MAX VEL (fps)	Min FLOW (gpm)	Min VEL (fps)	METER SIZE (in)	P&I D
FE/FIT 0105	PS 1 EFFLUENT	4	RWW	1,400				4	01 DI-601
FE/FIT 0204	PS 2 EFFLUENT	4	RWW	700				4	02 DI-601
FE/FIT 0304	PS 3 EFFLUENT	4	RWW	400				4	03 DI-601

LEVEL SWITCH (FLOAT TYPE) SPECIFICATION

DATA SHEET NO. 853. 1

GENERAL		
1.	Tag Number:	SEE TABLE BELOW
2.	Service:	SEE TABLE BELOW
3.	P & I D No.:	SEE TABLE BELOW
4.	Location:	SEE ELECTRICAL DRAWINGS
FLOAT		
5.	Dimensions:	APPROX. 6 INCH DIAMETER
6.	Material:	POLYPROPYLENE
SWITCH		
7.	Type:	MICRO SWITCH STEEL BALL ACTIVATED
8.	Contact:	SPDT
9.	Rating:	5 AMPS AT 120 VAC
10.	Enclosure:	ENCAPSULATED
11.	Open/Close:	CLOSE ON INCREASING, OPEN ON DECREASING
12.	Mounting:	ADJUSTABLE CLAMP ON 1 INCH STAINLESS PIPE
13.	Elec. Class'tion:	SEE ELECTRICAL DRAWINGS
PROCESS CONDITIONS		
14.	Operating Temp.:	40 TO 75 DEG. F.
15.	Operating Pressure:	ATMOSPHERIC
MISCELLANEOUS		
16.	Interconn. Cable:	REQUIRED APPROX. 50 FEET
17.	Manufacturer(s):	COX OR KARI NO OR EQUAL
18.	Model No.(s):	OPTI-FLOAT OR KA SERIES NO OR EQUAL

NOTES

a. Provide 1-inch diameter SCH 40 316L SS pipe to mount the float switch(s).
b. Provide COX or KARI level switches as specified. Other manufacturers shall not be accepted based on performance.
c. Provide detailed instructions for proper installation of switches, enclosures and mounting hardware.
d. Provide 316 SS brackets and hardware to attach pipe to side of well or tank.
e. Provide a minimum of 3 brackets spaced a maximum of 10'-0" OC.
f. Provide all 316 SS mounting hardware to mount float switch(s) to 1-inch pipe. Mounting hardware shall allow for float level adjustment with hand tools.
g. Provide single sealed well/tank penetration for float switch(s) cables.
h. Provide 316 SS NEMA 4X or cast aluminum termination enclosure (based on area electrical classification). The enclosure shall provide termination for the float(s) and include isolation relays and intrinsic safety barriers.
i. Provide termination enclosure mounted on 316 SS UNISTRUT® supports for wall or floor mounting.

TAG NO.	SERVICE	P&ID
LSHH 0104	PUMP STATION 1 HIGH-HIGH LEVEL	01 DI-601
LSLL 0104	PUMP STATION 1 LOW-LOW LEVEL	01 DI-601
LSHH 0203	PUMP STATION 2 HIGH-HIGH LEVEL	02 DI-601
LSLL 0203	PUMP STATION 2 LOW-LOW LEVEL	02 DI-601
LSHH 0303	PUMP STATION 3 HIGH-HIGH LEVEL	03 DI-601
LSLL 0303	PUMP STATION 3 LOW-LOW LEVEL	03 DI-601

SUBMERSIBLE WATER-LEVEL SENSOR/TRANSMITTER SPECIFICATION

DATA SHEET NO. 873.1 0

GENERAL

1.	Tag Number:	SEE TABLE
2.	Service:	SEE TABLE
3.	P & I D No.:	SEE TABLE
4.	Location:	SEE TABLE

SENSOR AND TRANSMITTER

5.	Type:	HYDROSTATIC HEAD-PRESSURE TRANSDUCER
6.	Wetted Parts:	316 STAINLESS STEEL, VITON OR TITANIUM BASED ON CORROSIVE FLUID
7.	Diaphram:	316 STAINLESS STEEL OR HASTELLOY OR PLATINUM BASED ON CORROSIVE FLUID
8.	Analog Coms:	4 - 20 mADC / 10-30 VDC
9.	Digital Coms:	NONE REQUIRED.
10.	Cable:	PROVIDED BY SENSOR MANUFACTURE
11.	Cable Connection:	WATERTIGHT
12.	Cable Type:	POLYURETHANE
13.	Cable Length:	AS REQUIRED FOR INSTALLATION
14.	Pressure Range:	BASED ON TANK OR VESSEL DIMENSIONS W/ 200% OVER RANGE PROTECTION
15.	Oper. Temperature:	-20 TO 190 DEG. F.
16.	Zero Point Shift:	90% OF MEASURING RANGE

INDICATING DISPLAY

17.	Type:	INDICATING
18.	Display:	LCD
19.	Supply Voltage:	120 VAC
20	Housing:	CAST ALUMINUM
21.	Calibration:	FIELD
22.	Enclosure:	IP66 NEMA 4X MINIMUM AND AS REQUIRED FOR ELECTRICAL AREA CLASSIFICATION.
23.	Elec. Class:	SEE ELECTRICAL

MISCELLANEOUS

24.	Manufacturer(s):	ENDRESS HAUSER (E+H) AMERICAN SENSOR TECHNOLOGIES (AST) OR APPROVED EQUAL

NOTES.

a. Provide lighting and surge protection
b. Provide manufacturers mounting hardware for transmitter and level transducer mounting. Submit mounting details with shop drawings.

TAG	SERVICE	P&ID
LE/LT 0104	PUMP STATION 1 LEVEL	01 DI-601
LE/LT 0203	PUMP STATION 2 LEVEL	02 DI-601
LE/LT 0303	PUMP STATION 3 LEVEL	03 DI-601

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PRESSURE GAUGE SPECIFICATION

DATA SHEET NO. 1454.1

GENERAL		
1.	Tag Number:	SEE TABLE
2.	Service:	SEE TABLE
3.	P & I D No.:	SEE TABLE
4.	Location:	SEE CONTRACT MECHANICAL PROCESS DRAWINGS.
GAUGE		
5.	Type:	GEARLESS DIRECT-DRIVE NON-LIQUID FILLED
6.	Element:	HELICALLY WOUND BOURDON TUBE
7.	Element Material:	INCONEL X-750
8.	Range:	SEE TABLE
9.	Overpress. Limit:	FULL VACUUM AND/OR 150% OF MAX RANGE
10.	Accuracy:	± 0.5% AT MID SCALE
11.	Repeatability:	± 0.025% FULL SCALE
12.	Zero Adjustment:	EXTERNAL
13.	Span:	FACTORY SET
14.	Linearity:	FACTORY SET
15.	Shaft Attachment:	DIRECT SENSING COIL AND POINTER
16.	Shaft Bearing:	SYNTHETIC SAPPHIRE BOTH ENDS
17.	Fittings:	316 SS OR AS REQUIRED BY PROCESS
18.	Joints:	NICRO-BRAZED OR T.I.G. HELIARC WELDED
19.	Case Type:	SWIVEL FITTING WITH MOVEABLE FLANGE
20.	Case Material:	ABS PLASTIC
21.	Case Front:	REAR BLOWOUT
22.	Dial Diameter:	4-1/2 INCHES
23.	Socket Material:	316 STAINLESS STEEL
24.	Process Connection:	½ INCH NPT
25.	Lens:	ACRYLIC
26.	Mounting:	BACK SWIVEL FLANGE
PROCESS CONDITIONS		
27.	Fluid:	SEE TABLE
28.	Operating Temp.:	SEE TABLE
29.	Operating Pressure:	SEE TABLE
MISCELLANEOUS		
30.	Diaphragm:	PROVIDE EXTERNAL ISOLATION RING, PIPING AND VALVES, AS INDICATED ON THE CONTRACT MECHANICAL PROCESS DRAWINGS AND DETAILS. SEE DATA SHEET 1457.
31.	Snubber:	PROVIDE INTERNAL TO STEM
32.	Pulsation Damper:	INTERNAL TO STEM
33.	Manufacturer(s):	3D, PERMA-CAL OR EQUAL

TAG NO.	SERVICE	RANGE (GPM)	FLUID	P & I D
PI 0101	PS1.P-1 DISCHARGE	0 - 700	RWW	01 DI-601
PI 0102	PS1.P-2 DISCHARGE	0 – 700	RWW	01 DI-601
PI 0103	PS1.P-3 DISCHARGE	0 – 700	RWW	01 DI-601
PI 0201	PS2.P-1 DISCHARGE	0 – 700	RWW	02 DI-601
PI 0202	PS2.P-2 DISCHARGE	0 – 700	RWW	02 DI-601
PI 0301	PS3.P-1 DISCHARGE	0 – 400	RWW	03 DI-601
PI 0302	PS3.P-2 DISCHARGE	0 – 400	RWW	03 DI-601

PRESSURE ISOLATOR RING SPECIFICATION

DATA SHEET NO. 1457.1

GENERAL

1.	Tag Number:	SEE DATA SHEET 1454
2.	Service:	SEE DATA SHEET 1454
3.	P & I D No.:	SEE DATA SHEET 1454
4.	Location:	SEE MECHANICAL DRAWINGS

NOTES:

1. Manufacturers:
   a. Onyx
   b. Or an acceptable equivalent product.
2. 1-inch and Larger: Provide sensor/isolators that fit inside the bolt circle of 150-lb (Class 150).
3. 3/4-inch and Smaller: Provide sensor/isolators full flange or threaded as specified and indicated. For chemical system provide full flange, threaded connections are not acceptable.
4. Face to face length of the sensor: Conform to Specification MSS-SP67.
5. Type: Flow through design with flexible sleeve around full circumference. The centersection shall have a cavity behind the sleeve filled with silicone fluid to transfer pressure to the gauge.
6. Rigidly support all pressure instruments by a post at least 7/8 inch diameter welded to the isolator. On sensor rings with more than one instrument, provide all connections 1/2-inch NPT as a minimum. 1/4-inch NPT fittings are not acceptable.
7. Provide sensor/isolator rings that do not have any fill plugs or valves that can be inadvertently removed with the resultant loss of fill fluid. Pressure sensor/isolators using valves are not acceptable.
8. Provide liquid filled sensor/isolators permanently vacuum sealed at the factory with a modular seal consisting of a membrane and needle fitting to allow removal and replacement of pressure instruments without compromising the vacuum fill. Sensor/isolators using valves are not acceptable.
9. Provide the needle fitting with both 1/4-inch NPTF threads and 1/2-inch NPTM threads.
10. Provide the pressure sensor/isolator capable of operating under pressure with all pressure instruments removed with no loss of fill fluid and without the need for isolating valves.
11. Attach pressure instruments to the isolator with a hand tightened lock ring.
12. It shall be possible to remove or attach pressure instruments to the isolator without requiring the use of any tools.
13. Permanently fill the pressure sensor with high viscosity silicone instrument oil to damp out surges or pressure spikes without the requirement for a separate snubber.
14. Pressure rating: 200 psi minimum for all lines tested at 150 psi or less and 600 psi minimum per lines tested above 150 psi.
15. Materials:
    a. Process water:
       (1) Center – 316 stainless
       (2) End Plates – 316 stainless
       (3) Elastomer – EPDM
       (4) Fluid – silicone
       (5) Stinger – 316 stainless
       (6) Pipe – 316L stainless

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ATTACHMENT A

INSTRUMENTS PRODUCT SHEETS

DATA SHEET 416.1	MAGNETIC FLOW METER SPECIFICATION
DATA SHEET 853.1	LEVEL SWITCH (FLOAT TYPE) SPECIFICATION
DATA SHEET 873.1	SUBMERSIBLE WATER LEVEL SENSOR/TRANSMITTER SPECIFICATION
DATA SHEET 1452.1	PRESSURE SWITCH SPECIFICATION
DATA SHEET 1454.1	PRESSURE GAUGE SPECIFICATION
DATA SHEET 1457.1	PRESSURE ISOLATOR RING SPECIFICATION

MAGNETIC FLOW METER SPECIFICATION

DATA SHEET NO. 416.1

GENERAL

1.	Tag No.:	SEE TABLE
2.	Service:	SEE TABLE
3.	P & I D No.:	SEE TABLE
4.	Location:	SEE MECHANICAL DRAWINGS

CONNECTIONS

5.	Line Size:	SEE TABLE
6.	Line Material:	DUCTILE IRON
7.	Conn. Type:	FLANGED
8.	Conn. Material:	CARBON STEEL

PROCESS CONDITIONS

9.	Fluid:	SEE TABLE
10.	Maximum Flow:	SEE TABLE
11.	Max. Flow Velocity:	SEE TABLE
12.	Minimum Flow:	SEE TABLE
13.	Min. Flow Velocity:	SEE TABLE
14.	Operating Temp.:	40 TO 250 °F.
15.	Operating Pressure:	57 PSI

METER

16.	Meter Size:	SEE TABLE
17.	Tube Material:	304 STAINLESS
18.	Housing:	WELDED STEEL
19.	Liner Material:	INJECTION MOLDED HARD RUBBER OR EQUIVALENT
20.	Electrode Type:	FLUSH MOUNT
21.	Electrode Material:	316 STAINLESS OR EQUIVALENT
22.	Terminal Box:	DIE CAST ALUMINUM
23.	Enclosure Class:	NEMA 4X
24.	Power Supply:	120 VAC, 60 HZ
25.	Grounding Type:	STRAP AND RING

TRANSMITTER

26.	Type:	INTELLIGENT, MICROPROCESSOR BASED
27.	Mounting:	WALL MOUNTED
28.	Transmitter Range:	SEE TABLE BASED ON INSTRUMENT SPAN
29.	Enclosure Class:	NEMA 4X
30.	Power Supply:	120 VAC, 60 HZ
31.	Analog Output:	4 - 20 mADC
32.	Elect. Class:	SEE ELECTRICAL DESIGN FOR AREA CLASSIFICATION
33.	System Accuracy:	+/- 0.5% OF FLOW RATE AT VELOCITIES ABOVE 1 FOOT PER SECOND
34.	Sys. Repeatability:	+/- 0.1% OF FULL SCALE
35.	Empty Pipe Detect:	REQUIRED
36.	Local Display:	MULTI-LINE LC FOR MEASURED VARIABLE, DIAGNOSTICS PLUS BAR GRAPH AND KEY PAD
37.	Local Totalizer:	REQUIRED, 6 DIGIT, NON RESET
38.	Cable Length:	APPROX. 50 FEET PROVIDED BY METER MANUFACTURER

MISCELLANEOUS

39.	Manufacturer(s):	FOXBORO, E+H, KROHNE OR SIEMENS
40.	Model No.:	2000 SERIES, PROMAG W, ENVIROMAG OR MAG 5100

NOTES.

a. Provide grounding ring from meter manufacturer. Fabricated grounding rings from a third party shall not be accepted.
b. Provide meter manufacturers cable between the meter and the transmitter.
c. Wet calibrate all meters (at 3 points over the specified flow range) by gravimetric or volumetric methods that are traceable to NIST (National Institute Standard Testing).
d. Provide certificate of wet calibration to the engineer/owner prior to meter installation.
e. Provide, by the meter manufacturer, insitu calibration of all meters prior to system acceptance. Submit written calibration report from the manufacturer to the engineer.
f. PROVIDE 316 STAINLESS STEEL MOUNTING HARDWARE including all nuts and bolts connecting the meter to the process pipe.
g. Contractor to provide all power and signal cable in rigid conduit or liquid-tight conduit. See electrical specification for product specifications.
h. Contractor to provide grounding from ground rings to meter and meter to ground, using green size 10 AWG (6mm) ground wire. The Contractor shall install ground as directed by the meter manufacturer or to nearest water pipe. Contractor is responsible for all connections.
i. Remote communication must not interfere with the analog output signal. Use frequency shift keying (FSK) technique for communication.

TAG NO	SERVICE	LINE SIZE (in)	FLUID	MAX FLOW (gpm)	MAX VEL (fps)	Min FLOW (gpm)	Min VEL (fps)	METER SIZE (in)	P&I D
FE/FIT 0105	PUMP STATION 1 EFFLUENT	6	RWW	1100	12.48	160	1.82	6	01 DI-601
FE/FIT 0204	PUMP STATION 2 EFFLUENT	4	RWW	536	13.68	111	2.83	4	02 DI-601
FE/FIT 0304	PUMP STATION 3 EFFLUENT	4	RWW	305	13.84	54	2.45	4	03 DI-601

LEVEL SWITCH (FLOAT TYPE) SPECIFICATION

DATA SHEET NO. 853.1

GENERAL

1.	Tag Number:	SEE TABLE BELOW
2.	Service:	SEE TABLE BELOW
3.	P & I D No.:	SEE TABLE BELOW
4.	Location:	SEE ELECTRICAL DRAWINGS

FLOAT

5.	Dimensions:	APPROX. 6 INCH DIAMETER
6.	Material:	POLYPROPYLENE

SWITCH

7.	Type:	MICRO SWITCH STEEL BALL ACTIVATED
8.	Contact:	SPDT
9.	Rating:	5 AMPS AT 120 VAC
10.	Enclosure:	ENCAPSULATED
11.	Open/Close:	CLOSE ON INCREASING, OPEN ON DECREASING
12.	Mounting:	ADJUSTABLE CLAMP ON 1 INCH STAINLESS PIPE
13.	Elec. Class'tion:	SEE ELECTRICAL DRAWINGS

PROCESS CONDITIONS

14.	Operating Temp.:	40 TO 75 DEG. F.
15.	Operating Pressure:	ATMOSPHERIC

MISCELLANEOUS

16.	Interconn. Cable:	REQUIRED APPROX. 50 FEET
17.	Manufacturer(s):	COX OR KARI NO OR EQUAL
18.	Model No.(s):	OPTI-FLOAT OR KA SERIES NO OR EQUAL

NOTES

a. Provide 1-inch diameter SCH 40 316L SS pipe to mount the float switch(s).
b. Provide COX or KARI level switches as specified. Other manufacturers shall not be accepted based on performance.
c. Provide detailed instructions for proper installation of switches, enclosures and mounting hardware.
d. Provide 316 SS brackets and hardware to attach pipe to side of well or tank.
e. Provide a minimum of 3 brackets spaced a maximum of 10'-0" OC.
f. Provide all 316 SS mounting hardware to mount float switch(s) to 1-inch pipe. Mounting hardware shall allow for float level adjustment with hand tools.
g. Provide single sealed well/tank penetration for float switch(s) cables.
h. Provide 316 SS NEMA 4X or cast aluminum termination enclosure (based on area electrical classification). The enclosure shall provide termination for the float(s) and include isolation relays and intrinsic safety barriers.
i. Provide termination enclosure mounted on 316 SS UNISTRUT® supports for wall or floor mounting.

TAG NO.	SERVICE	P&ID
LSHH 0104	PUMP STATION 1 HIGH-HIGH LEVEL	01 DI-601
LSLL 0104	PUMP STATION 1 LOW-LOW LEVEL	01 DI-601
LSHH 0203	PUMP STATION 2 HIGH-HIGH LEVEL	02 DI-601
LSLL 0203	PUMP STATION 2 LOW-LOW LEVEL	02 DI-601
LSHH 0303	PUMP STATION 3 HIGH-HIGH LEVEL	03 DI-601
LSLL 0303	PUMP STATION 3 LOW-LOW LEVEL	03 DI-601

SUBMERSIBLE WATER-LEVEL SENSOR/TRANSMITTER SPECIFICATION

DATA SHEET NO. 873.1

GENERAL

1.	Tag Number:	SEE TABLE
2.	Service:	SEE TABLE
3.	P & I D No.:	SEE TABLE
4.	Location:	SEE TABLE

SENSOR AND TRANSMITTER

5.	Type:	HYDROSTATIC HEAD-PRESSURE TRANSDUCER
6.	Wetted Parts:	316 STAINLESS STEEL, VITON OR TITANIUM BASED ON CORROSIVE FLUID
7.	Diaphram:	316 STAINLESS STEEL OR HASTELLOY OR PLATINUM BASED ON CORROSIVE FLUID
8.	Analog Coms:	4 - 20 mADC / 10-30 VDC
9.	Digital Coms:	NONE REQUIRED.
10.	Cable:	PROVIDED BY SENSOR MANUFACTURE
11.	Cable Connection:	WATERTIGHT
12.	Cable Type:	POLYURETHANE
13.	Cable Length:	AS REQUIRED FOR INSTALLATION
14.	Pressure Range:	BASED ON TANK OR VESSEL DIMENSIONS W/ 200% OVER RANGE PROTECTION
15.	Oper. Temperature:	-20 TO 190 DEG. F.
16.	Zero Point Shift:	90% OF MEASURING RANGE

INDICATING DISPLAY

17.	Type:	INDICATING
18.	Display:	LCD
19.	Supply Voltage:	120 VAC
.20	Housing:	CAST ALUMINUM
21.	Calibration:	FIELD
22.	Enclosure:	IP66 NEMA 4X MINIMUM AND AS REQUIRED FOR ELECTRICAL AREA CLASSIFICATION.
23.	Elec. Class:	SEE ELECTRICAL

MISCELLANEOUS

24.	Manufacturer(s):	ENDRESS HAUSER (E+H) AMERICAN SENSOR TECHNOLOGIES (AST) OR APPROVED EQUAL

NOTES.

a. Provide lighting and surge protection
b. Provide manufacturers mounting hardware for transmitter and level transducer mounting. Submit mounting details with shop drawings.

TAG	SERVICE	P&ID
LE/LT 0104	PUMP STATION 1 LEVEL	01 DI-601
LE/LT 0203	PUMP STATION 2 LEVEL	02 DI-601
LE/LT 0303	PUMP STATION 3 LEVEL	03 DI-601

PRESSURE GAUGE SPECIFICATION

DATA SHEET NO. 1454.1

GENERAL

1.	Tag Number:	SEE TABLE
2.	Service:	SEE TABLE
3.	P & I D No.:	SEE TABLE
4.	Location:	SEE CONTRACT MECHANICAL PROCESS DRAWINGS.

GAUGE

5.	Type:	GEARLESS DIRECT-DRIVE NON-LIQUID FILLED
6.	Element:	HELICALLY WOUND BOURDON TUBE
7.	Element Material:	INCONEL X-750
8.	Range:	SEE TABLE
9.	Overpress. Limit:	FULL VACUUM AND/OR 150% OF MAX RANGE
10.	Accuracy:	± 0.5% AT MID SCALE
11.	Repeatability:	± 0.025% FULL SCALE
12.	Zero Adjustment:	EXTERNAL
13.	Span:	FACTORY SET
14.	Linearity:	FACTORY SET
15.	Shaft Attachment:	DIRECT SENSING COIL AND POINTER
16.	Shaft Bearing:	SYNTHETIC SAPPHIRE BOTH ENDS
17.	Fittings:	316 SS OR AS REQUIRED BY PROCESS
18.	Joints:	NICRO-BRAZED OR T.I.G. HELIARC WELDED
19.	Case Type:	SWIVEL FITTING WITH MOVEABLE FLANGE
20.	Case Material:	ABS PLASTIC
21.	Case Front:	REAR BLOWOUT
22.	Dial Diameter:	4-1/2 INCHES
23.	Socket Material:	316 STAINLESS STEEL
24.	Process Connection:	½ INCH NPT
25.	Lens:	ACRYLIC
26.	Mounting:	BACK SWIVEL FLANGE

PROCESS CONDITIONS

27.	Fluid:	SEE TABLE
28.	Operating Temp.:	SEE TABLE
29.	Operating Pressure:	SEE TABLE

MISCELLANEOUS

30.	Diaphragm:	PROVIDE EXTERNAL ISOLATION RING, PIPING AND VALVES, AS INDICATED ON THE CONTRACT MECHANICAL PROCESS DRAWINGS AND DETAILS. SEE DATA SHEET 1457.
31.	Snubber:	PROVIDE INTERNAL TO STEM
32.	Pulsation Damper:	INTERNAL TO STEM
33.	Manufacturer(s):	3D, PERMA-CAL OR EQUAL

TAG NO.	SERVICE	RANGE	FLUID	P & I D
PI 0101	PS1.P-1 DISCHARGE	0-100	RWW	01 DI-601
PI 0102	PS1.P-2 DISCHARGE		RWW	01 DI-601
PI 0103	PS1.P-3 DISCHARGE		RWW	01 DI-601
PI 0201	PS2.P-1 DISCHARGE		RWW	02 DI-601
PI 0202	PS2.P-2 DISCHARGE		RWW	02 DI-601
PI 0301	PS3.P-1 DISCHARGE		RWW	03 DI-601
PI 0302	PS3.P-2 DISCHARGE		RWW	03 DI-601

PRESSURE ISOLATOR RING SPECIFICATION

DATA SHEET NO. 1457.1

GENERAL

1.	Tag Number:	SEE DATA SHEET 1454
2.	Service:	SEE DATA SHEET 1454
3.	P & I D No.:	SEE DATA SHEET 1454
4.	Location:	SEE MECHANICAL DRAWINGS

A. Pressure Sensor Rings
   1. Manufacturers
      a. Onyx
      b. Or an acceptable equivalent product.
   2. 1-inch and Larger: Provide sensor/isolators that fit inside the bolt circle of 150-lb (Class 150).
   3. 3/4-inch and Smaller: Provide sensor/isolators full flange or threaded as specified and indicated. For chemical system provide full flange, threaded connections are not acceptable.
   4. Face to face length of the sensor: Conform to Specification MSS-SP67.
   5. Type: Flow through design with flexible sleeve around full circumference. The centersection shall have a cavity behind the sleeve filled with silicone fluid to transfer pressure to the gauge.
   6. Rigidly support all pressure instruments by a post at least 7/8-inch diameter welded to the isolator. On sensor rings with more than one instrument, provide all connections 1/2-inch NPT as a minimum. 1/4-inch NPT fittings are not acceptable.
   7. Provide sensor/isolator rings that do not have any fill plugs or valves that can be inadvertently removed with the resultant loss of fill fluid. Pressure sensor/isolators using valves are not acceptable.
   8. Provide liquid filled sensor/isolators permanently vacuum sealed at the factory with a modular seal consisting of a membrane and needle fitting to allow removal and replacement of pressure instruments without compromising the vacuum fill. Sensor/isolators using valves are not acceptable.
   9. Provide the needle fitting with both 1/4-inch NPTF threads and 1/2-inch NPTM threads.
   10. Provide the pressure sensor/isolator capable of operating under pressure with all pressure instruments removed with no loss of fill fluid and without the need for isolating valves.
   11. Attach pressure instruments to the isolator with a hand tightened lock ring.
   12. It shall be possible to remove or attach pressure instruments to the isolator without requiring the use of any tools.
   13. Permanently fill the pressure sensor with high viscosity silicone instrument oil to damp out surges or pressure spikes without the requirement for a separate snubber.
   14. Pressure rating: 200 psi minimum for all lines tested at 150 psi or less and 600 psi minimum per lines tested above 150 psi.
   15. Materials:
      a. Process water
         (1) Center – 316 stainless
         (2) End Plates – 316 stainless
         (3) Elastomer – EPDM
         (4) Fluid – silicone
         (5) Stinger – 316 stainless
         (6) Pipe – 316L stainless

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SECTION 13345

DATA NETWORK

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PART 1 - GENERAL

1.01 - SCOPE

A. This section is provided for reference only. Work required under this section will be provided under Contract No. 2019-01, Downtown Area WWTF and Effluent Disposal.

B. Fiber optic cables used with the WWTF and Collection System SCADA control system shall be provided under Contract No. 2019-01, Downtown Area WWTF and Effluent Disposal.

C. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 – SUBMITTALS – Not Used

1.05 - PRODUCT HANDLING – Not Used

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

C. Quality Assurance

1. Fiber optic cables and related equipment shall be the products of approved manufacturers. Fabrication of the fiber optic cables and related equipment shall utilize the most advanced commercial materials and manufacturing processes. Manufacturer shall be ISO 9001 and TL-9000 certified.

2. Fiber optic cable installation shall be performed by experienced fiber optic cable installers who shall have been regularly engaged in the installation of fiber optic cables for the last five (5) years at the minimum.

3. Fiber optic cable splicing and terminations shall be performed by experienced cable splicers who shall have been regularly engaged in splicing and termination of fiber optic cables for the last five (5) years at the minimum.

4. Retain the services of the fiber optic cable manufacturers technical representative to certify that the fiber optic cable installation is in accordance with the manufacturer’s installation requirements.

5. Retain the services of an independent testing firm who shall perform acceptance testing of the fiber optic cable installation. The testing firm shall have experience in the inspection and testing of cables of the specified type and shall be a member company of NETA.

6. All cables and terminations shall be identified at all locations. All cables shall terminate in an alphanumeric sequence at termination locations.

7. All Fiber Optic cable terminations shall comply with and be tested to ANSI/TIA/EIA 568-B standards for single-mode and multi-mode Fiber installation for Fiber Optics.
8. All optical fiber components (optical fiber, cable, connectors, patch panels, hardware and patch cords) shall be manufactured by a single company, unless otherwise noted, in order to ensure consistency and compatibility.

D. Equipment Identification

1. Each fiber shall be labeled at each termination point and all splice location including spares. Conductor or circuit identification shall be applied at specified points with circuit numbers or other identification stamped on terminal boards when provided, or on the cable itself in such a manner that the identification is visible around the cable's circumference.
2. Each fiber shall be identified in junction boxes, pull boxes, manholes, handholes, terminal boxes, and cabinets. Where no termination is made, use a plastic-coated, self-adhesive, wire marker. Where termination is made, use a plastic, pre-printed sleeve wire marker. Paper self-adhesive wire markers are not acceptable.

E. Shop Tests

1. Fiber optic cables and equipment shall be shop tested at the manufacturer's plant in accordance with the manufacturer's standard testing procedures. Shop tests shall be performed prior to shipment.
2. Submit manufacturer's shop test reports.

1.07 - REFERENCES

A. National Fire Protection Association (NFPA):

1. NFPA-70: National Electrical Code (NEC).

B. Underwriters Laboratories, Inc. (UL):

1. U.L. 1581 VW-1: Vertical Tray Cable Flame Test
2. U.L. 1666: Riser Cable
3. U.L. 508: Standards for Safety, Industrial Control Equipment

C. Institute of Electrical and Electronics Engineers (IEEE):

1. IEEE Standard 383: Flame Retardancy.
2. IEEE 802 (Series): Standards for Local and metropolitan Area Networks.
3. IEEE 1588: Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems.

D. American National Standards Institute (ANSI):

1. ANSI/ISA-99: Security for industrial Automation and Control Systems.

E. NETA: The International Testing Association Acceptance Testing Specification.

1. TIA/EIA-568-B/C (Series): commercial Building Telecommunications Cabling Standards.
2. TIA/EIA-569 (Series): commercial Building Standard for Telecommunications Pathways and Spaces.
3. TIA/EIA-526 (Series): Standard Test Procedures for Fiber Optic Systems.
4. TIA/EIA-604 (Series): Fiber Optic Connector Intermateability Standard (FOCIS).
5. Internet Engineering Task Force (IETF) RFC documents (various).

F. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.08 – WARRANTY – Not Used

PART 2 – PRODUCTS

2.01 - FIBER OPTIC CABLE AND APPURTENANCES

A. All fiber optic cable required under this contract will be provided under Contract No. 2019-01, Downtown Area WWTF and Effluent Disposal.

2.02 - CAT6 CABLE

A. All CAT6 cable required under this contract will be provided under Contract No. 2019-01, Downtown Area WWTF and Effluent Disposal.

2.03 - OPTICAL HARDWARE

A. All optical hardware required under this contract will be provided under Contract No. 2019-01, Downtown Area WWTF and Effluent Disposal.

2.04 - NETWORK EQUIPMENT ENCLOSURES

A. All network equipment enclosures required under this contract will be provided under Contract No. 2019-01, Downtown Area WWTF and Effluent Disposal.

2.05 - MANAGED ETHERNET SWITCHES

A. All managed Ethernet Switches required under this contract will be provided under Contract No. 2019-01, Downtown Area WWTF and Effluent Disposal.

2.06 – RADIO

A. All radio equipment required under this contract will be provided under Contract No. 2019-01, Downtown Area WWTF and Effluent Disposal.

PART 3 - EXECUTION

3.01 - GENERAL

A. All execution, including installation, terminations, checkout and testing required under this contract will be provided under Contract No. 2019-01, Downtown Area WWTF and Effluent Disposal.

3.06 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT

END OF SECTION

SECTION 14300

HOISTING EQUIPMENT

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PART 1 – GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide Hoisting Equipment as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

C. Provide and test hoisting equipment, motors, gear reducers, controls and appurtenances as indicated and in compliance with Contract Documents.

1. Rail and supporting beams included in building structure, refer to structural drawings.

2. Hoist capacities and operating data are indicated in the Hoisting Schedule.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Data regarding hoisting equipment characteristics and performance:
2. Certified setting plans, with tolerances, for anchor bolts.
3. Manufacturer's literature as needed to supplement certified data.
4. Operating and maintenance instructions and parts lists.
5. Listing of reference installations as specified with contact names and telephone numbers.
6. List of recommended spare parts other than those specified.
7. Shop and field inspection reports.
8. Motor shop test results.
9. Qualifications of field service engineer.
10. Recommendations for short and long-term storage.
11. Shop and field testing procedures, equipment to be used.
12. Special tools.
13. Number of service person-days provided and per diem field service rate.
14. Manufacturer’s product data, specifications and color charts for shop painting.
15. The latest ISO 9001 series certification.

16. Provide Certificate of Responsibility and Certificate of Design. See SECTION 01300, SUBMITTALS for Certificate Forms.

17. Provide scaled drawing height and weight of equipment serviced by the hoisting equipment including hook height and travel dimensions.

18. Material Certification:

a. Provide certification from the equipment manufacturer that the materials of construction specified are recommended and designed for the service conditions specified and indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and designed for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the Owner.

b. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and designed for the service conditions specified and indicated.

C. A copy of the contract mechanical process, electrical and instrumentation drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with “No changes required” or provide a statement that no changes are required.

1. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.

D. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.

1. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.

2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

1.05 - PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer’s written recommendations.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

C. Comply with the requirements specified in SECTION 01610, DELIVERY, STORAGE AND HANDLING.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents.

B. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

C. The design conditions and other pertinent requirements for the equipment specified in this section are indicated on the Contract Drawings.

D. Comply with the requirements specified in SECTION 01400, QUALITY ASSURANCE.

E. Permanently mark the capacity of the hoist and trolley on each hoist, in easy to read letters and in a prominent position.

F. Provide only safety type hooks.

G. Provide hoists so that hook can reach the floor at the lowest level of the lift.

H. Do not use hoists for construction purposes of any nature.

I. Hoists shall be manufacturer's standard cataloged product and modified to provide compliance with the drawings, specifications and the service conditions specified and indicated.

J. Welding: In accordance with American Welding Society Code D1.1.

K. Provide shop tests as specified.

L. Hoisting equipment manufacturer shall provide hoists, motors, gear reducers, switches, and controls regardless of manufacturer as a complete integrated package to ensure coordination, compatibility and operation of the systems.

M. Services of Manufacturer's Representative as stated in SECTION 01400, QUALITY ASSURANCE and as specified herein.

N. Provide services of factory-trained Service Technician, specifically trained on type of equipment specified:

1. Service Technician must be present on site for all items listed below. Person-day requirements listed are exclusive of travel time, and do not relieve Contractor of the obligation to place equipment in operation as specified.

2. Installation: Inspect grouting, location of anchor bolts; setting, leveling, alignment, field erection; coordination of piping and electrical:

   a. 2 person-days.

3. Functional Testing: Calibrate, check alignment and perform a functional test. Tests to include all items specified.

   a. 2 person-days.

4. Performance Testing: Field performance test equipment specified.

   a. 2 person-days.

5. Vendor Training: Provide classroom and field operation and maintenance instruction including all materials, slides, videos, handouts and preparation to lead and teach classroom sessions.

   a. 1 person-days.

6. Credit to the Owner, all unused service person-days specified above, at the manufacturer’s published field service rate.

7. Any additional time required of the factory trained service technician to assist in placing the equipment in operation, or testing or to correct deficiencies in installation, equipment or material shall be provided at no additional cost to the Owner.

O. Manufacturer of hoisting equipment shall have a minimum of five (5) operating installations with hoists of the size specified and in the same service as specified operating for not less than five (5) years.

1.07 - REFERENCES

A. American Bearing Manufacturers Association (ABMA):

1. 9: Load Ratings and Fatigue Life for Ball Bearings.

2. 11: Load Ratings and Fatigue Life for Roller Bearings.

B. American Society of mechanical Engineers (ASME):

1. B30.16: Overhead Hoists (Underhung) Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings

C. American Welding Society (AWS):

1. D1.1: Structural Welding Code Aluminum.

D. National Electric Code (NEC).

E. National Electrical Manufacturers Association (NEMA):

1. MG1: Motors and Generators.

F. Occupational Safety and Hazard Association (OSHA):

1. 29 CFR 1910.179: Overhead and Gantry Cranes.

G. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - SYSTEM DESCRIPTION

A. Hoisting equipment capacities and operating data are indicated in the Hoist Schedule.

2.02 - SEISMIC DESIGN REQUIREMENTS

A. Conform to the requirements indicated on the structural drawings and as specified in SECTION 01900, SEISMIC AND WIND REQUIREMENTS.

B. The Contractor shall conform to the seismic design requirements for this project and for the work of this specification section.

C. Provide all equipment bases, anchorage, supports and foundations designed in accordance with the seismic requirements indicated and specified.

D. Additionally, provide with the Certificate of Unit Responsibility, certification for all equipment signed by a registered structural engineer stating that computations were performed and that all components have been sized for the seismic forces specified and indicated.

2.03 - PORTABLE DAVIT (DAV.HST-1)

A. Manufacturer:

1. Thern

2. Or an acceptable equivalent.

B. Portable davit crane consisting of a mast, boom, handle, screw jack, crank operated winch, drum, wire rope and load hook. The crane to be capable of rotating 360 degrees. The boom shall telescope to four indexed positions, boom height shall be capable of adjustment under load, and crane shall be capable of being taken apart for storage or transport.

C. Capacity: Minimum 1000-lb rating with boom fully extended and 2000-lb with boom fully retracted.

D. Provide 45 ft of wire rope and a swiveling eye hook.

E. Provide a manual spur gear hand winch with auto disc brake and gear covers.

F. Provide flush bases as indicated on the Mechanical Process drawings. Provide a plastic cap for each base.

1. Mount each base with 316 stainless steel anchors.

G. Materials:

1. Crane, winch, 1/4” wire rope, hook, and base: Type 316 stainless steel

PART 3 - EXECUTION

3.01 - VERIFICATION OF CONDITIONS

A. Before the start of the work of this Section, verify that the project is ready for this work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this work and coordinate the work with them.

3.02 - INSTALLATION

A. Install items in accordance with manufacturer's printed instructions and as indicated and specified.

B. Check horizontal and vertical alignment of track and rails.

C. Erect rack level throughout, with section ends machined fitted and spliced with web-type couplings to provide flush level connections. Maximum gap between adjacent ends not exceeding 1/16-inch.

D. Do not use cast fittings.

3.03 - PAINTING

A. Primer and Finish Paint: Shop apply to all exterior ferrous surfaces, high solids epoxy in accordance with SECTION 09940, SHOP PAINTING.

B. Surface preparation, mixing and application and safety requirements shall be in accordance with the paint manufacturer’s printed instructions and as specified.

C. Ferrous surfaces which are not to be painted shall be given a shop applied coat of grease or rust resistant coating.

D. Provide additional shop paint coating for touch-up to all surfaces after installation and testing is completed and equipment accepted.

E. After installation and testing, apply touch-up paint to all scratched, abraided and damaged shop painted surfaces. Coating type and color shall match shop painting.

3.04 - CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment.

B. Spillage of lubricants used in servicing the system shall be cleaned from all equipment and concrete surfaces.

3.05 - MANUFACTURER’S FIELD SERVICES

A. Manufacturer’s Field Services shall be provided as specified herein.

3.06 - MANUFACTURER’S TRAINING

A. Manufacturer’s training shall be provided as specified herein.

3.07 - LUBRICATION REQUIREMENTS

A. All lubricating oils required for the first year of operation shall be provided.

3.08 - SPARE PARTS

A. Comply with the requirements specified in SECTION 01600, CONTROL OF MATERIALS.

B. Provide spare parts that are identical to and interchangeable with similar parts installed.

3.09 - FIELD TESTING

A. Provide as specified herein. Perform all tests with instrumentation controls and motor controls. Perform testing in accordance with OSHA 29 CFR 1910.179 and as specified herein.

B. After installation of hoist equipment, and after inspection, operation, testing and adjustment have been completed by manufacturer's field service technician, conduct test for each hoist in presence of the Engineer to determine its ability to operate at rated speeds and capacity under conditions specified and indicated. During tests, observe and record, capacity and motor inputs. Promptly correct or replace all equipment not conforming to the requirements of this section revealed by or noted during tests, at no additional cost to the Owner, and repeat tests until specified results are obtained. Contractor to provide all labor, weights and materials for conducting tests.

1. Provide a 60-minute test for each hoist.

2. Running test shall consist of moving hoist and trolley through two complete cycles. The first cycle will be with no load. For the second cycle, the unit will be loaded with 100 percent of the specified load rating.

3. Test and simulate all limit switches, locking and safety devices.

C. Make all adjustments to place equipment in specified working order at time of above tests.

D. After three (3) unsuccessful testing attempts, remove and replace equipment at no additional cost to the Owner with equipment that will meet all requirements specified and indicated.

3.10 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 15056

PIPE SUPPORTS

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PART 1 – GENERAL

1.01 - SCOPE

A. Attention is directed to the DOCUMENT 00700. GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

B. Design, and provide a complete system of pipe supports with inserts, bolts, nuts, restraining and hanger rods, washers, miscellaneous steel, sliding Teflon plates, and accessories as indicated and in compliance with Contract Documents. The term pipe support includes hangers, guides, restraints, anchors and saddles.

C. Provide all support systems and the design of all support systems for all piping as specified herein. The Contractor shall provide pipe support locations, configurations and details through accepted shop drawing submittals stamped by a Registered Professional Engineer as specified herein.

D. The Contractor shall be responsible for the proper design, fabrication, location, shop drawings and installation of all temporary and permanent pipe supports in accordance with the specified requirements.

E. Pipe support locations and types for piping 1/2-inch and larger shall be determined by the Contractor using the guidelines for support spacing specified herein and other criteria contained in this pipe support specification. Guidelines for pipe supports may need to be adjusted based upon field coordination, field routing, or other considerations outlined herein such as structural load limits. The Contractor may revise the pipe support locations and details through accepted shop drawing submittals stamped by a Registered Professional Engineer as specified herein. The Contractor is responsible for the proper design, installation and fabrication of all pipe supports in accordance with the specified requirements. For pipe supports 1/2-inch and larger pipe support shop drawings together with a marked up piping drawing showing support number, location and typical type shall be submitted by the Contractor for acceptance.

F. The Contractor shall be responsible for coordinating all pipe support designs for all trades to ensure compliance with all of the requirements of this specification, including but not limited to the total limitations specified herein.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and paymet for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include but are not limited to the following:

1. Pipe support drawings specified herein and including data for accessory items for acceptance prior to fabrication. The Contractor shall submit pipe support coordination drawings including all piping and pipe supports for all trades.

    a. Detailed drawing of the device with dimensions.

    b. A table of applied forces and moments.

    c. A complete bill of materials.

    d. A unique identification and revision level.

    e. Stamp of a Registered Professional Engineer, registered in the state where this project is being constructed, experienced in pipe support design and pipe stress analysis as specified herein.

    f. Detailed connections to existing structure.

    g. Indicate all welds, both shop and field, by Standard Units of Measurement as specified in AWS D1.1.

2. Welding Procedure: Submit description required to illustrate each welding procedure to be performed in the specified work.

3. Welding Equipment: Submit descriptive data for welding equipment, including type, voltage and amperage.

4. Qualification for Welders: Provide certification that welders to be employed in work have satisfactorily passed AWS or ASME qualification tests. If recertification of welders is required, retesting is the Contractor's responsibility at no additional cost to the Owner.

5. Pipe support manufacturers' qualifications as specified herein.

    a. List of at least five (5) successful pipe support projects and current addresses and telephone numbers of persons in charge of representing the owner or the owner of those construction projects during the time of pipe support design, fabrication and installation.

    b. Qualification of manufacturers' Registered Professional Engineer, registered in the state where this project is being constructed, who stamps and seals shop drawings and designs.

6. Coordination drawings for pipe supports shall include as a minimum the following information.

    a. Coordination drawings shall include all pipe supports covered by specifications.

    b. These coordination drawings will be used by the Contractor to ensure that the pipe supports do not obstruct access, access for equipment operation or removal including all mechanical and electrical equipment, panels, valves, gauges, and instrumentation.

    c. The Contractor shall be responsible for including and coordinating the work of all subcontractors into the coordination drawings.

    d. Prepare reproducible coordination drawings, indicating equipment, piping, valves, expansion joints, ductwork, conduit, cable trays, junction boxes, lighting fixtures, sleeves, inserts, embedments, supports, hangers and appurtenances at not less than 1/4-inch scale. Drawings shall show beams, columns, ceiling heights, wall, floors, partitions and structural features as indicated on the contract drawings. Individual pipes and conduit 2-inches or less in diameter that will be field routed need not be shown on coordination drawings.

    e. Coordination drawings shall include large-scale details as well as cross and longitudinal sections required to fully delineate all conditions. Particular attention shall be given to the location, size, and clearance dimensions of equipment items, shafts, operators and necessary maintenance access.

f. Make all minor changes in duct, pipe or conduit routings that do not affect the intended function, but items may not be resized or exposed items relocated without the approval of the Owner. No changes shall be made in any wall locations, ceiling heights, door swings or locations, window or other openings or other features affecting the function or aesthetic effect of the building. If conflicts or interferences cannot be resolved, the Owner shall be notified. Any problems of coordination that require architectural or structural changes of design shall be submitted to the Owner for resolution.

g. After the reproducible drawings have been coordinated and all changes have been made, the drawings shall be signed by the Contractor and all subcontractors indicating that all work on that drawing has been coordinated with all associated vendors and subcontractors and all conflicts have been resolved.

h. Relocation of any duct, pipe, conduit or other material that has been installed without proper coordination among all trades shall be performed at no additional cost to the Owner.

7. Written notification of any deviations from the requirements of this specification.

8. Support documentation and justification as specified.

9. Certificates of Design signed by a Registered Professional Engineer for all pipe supports.

10. Manufacturer's product data and specifications for shop painting.

11. Material Certification:

a. Provide certification from the manufacturer that the materials of construction specified are recommended and suitable for the service conditions specified and indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the Owner.

b. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated.

12. A copy of the contract mechanical process, and structural drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with "No changes required" or provide a statement that no changes are required.

a. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.

b. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.

c. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.

d. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

1.05 - PRODUCT HANDLING

A. Comply with the requirements specified in SECTION 01610, DELIVERY, STORAGE AND HANDLING.

1.06 - DESIGN CRITERIA

A. Design criteria as specified herein.

1.07 - QUALITY ASSURANCE

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE and as specified.

B. Provide manufacturer's certification in writing, that materials meet or exceed minimum requirements as specified.

C. Welder Qualifications:

1. Quality and certify welding procedures, welders, and operators in accordance with ANSI B31.1, paragraph 127.5 for shop and project site welding of piping work.

D. Pipe supports: All supports and parts shall conform to the latest requirements of the Code for Pressure Piping ASME/ANSI B31.1 and Manufactures Standardization Society (MSS) Standard Practice SP-58, SP-69, SP-89 and SP-90 except as supplemented or modified by the requirements of this specification.

E. Structural Concrete: Conform to the requirements of SECTION 03300, CAST-IN-PLACE CONCRETE. Concrete strength: 4,000 PSI unless noted otherwise.

F. Conform to the requirements of the latest edition of the AISC Manual of Steel Construction for miscellaneous and supplementary steel. Tube steels are ASTM A500 Grade B, structural shapes A36, plates A-572 or equal. Stainless steel structural members shall conform to ASTM requirement Type 316L.

G. Pipe Support Manufacturer Qualifications:

1. Must possess a written quality assurance program.

2. Have a minimum of 5 years experience in the design and fabrication of pipe supports.

3. Have completed the design and fabrication of at least 5 successful pipe support projects of equal size, complexity, and systems as this project within the past 10 years.

4. Retains the services of a Registered Professional Engineer, registered in the state where this project is being constructed, with a minimum of ten years experience in the design of piping systems and pipe supports.

5. Manufacturers' Standardization Society (MSS) Member.

6. Have a field service technician on staff with at least 5 years experience in resolving field installation, interference and interface problems associated with the design, installation and manufacture of pipe supporting components.

H. Hanger inspections shall be performed in accordance with MSS-SP-89 and ASME B31.1.

1.08 - WARRANTY – Not Used

1.09 - REFERENCES

A. The American Society of Mechanical Engineers (AMSE):

1. B31.1: Power Piping.

B. ASTM International (ASTM):

1. A36: Standard Specification for Carbon Structural Steel

2. A307: Standard Specification for Carbon Steel Externally Threaded Standard Fasteners

3. A312: Seamless and Welded Austenic Stainless Steel Pipe

4. A500: Cold Formed Welded and Seamless Carbon Steel Structural Tubing.

5. A572: Specification for Steel Plate.

6. E165: Practice for Liquid Penetrant Inspection Method.

7. E709: Practice for Magnetic Particle Examination.

C. American Welding Society (AWS):

1. D1.1: Structural Welding

D. Canadian Standards Association (CSA):

1. 40.20: General Requirements for Rolled or Welded Structural Quality Steel
2. 40.21: Structural Quality Steel
3. Welding Procedure Specifications.

E. Fluid Sealing Association: Technical Handbook.

F. Manufacturers' Standardization Society (MSS):

1. SP-58: Pipe Hangers and Supports - Materials and Design.
2. SP-69: Pipe Hangers and Supports - Selection and Application.
3. SP-89: Pipe Hangers and Supports - Fabrication and Installation Practices.
4. SP-90: Guidelines on Terminology for Pipe Hangers and Supports.

G. National Association of Expansion Joint Manufacturers: Standards of the Expansion Joint Manufacturers Association, Inc.

H. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - MATERIALS

A. Provide materials used in pipe supports, which are compatible with the pipes to which they are attached. Provide Type 316L stainless steel supports for all stainless steel piping. Copper plated pipe supports are not acceptable.

B. Allowable materials: As indicated in ANSI B31.1 Appendix A and MSS-SP-58 Table 2.

C. Provide Type 316L stainless steel for pipe supports, hangers, guides, restraints, and anchors that are exterior or interior submerged, in potentially wetted areas in wet wells, channels, tanks, and screening areas and in chemically corrosive atmospheres.

D. Provide only new material. Previously used and/or scrap material is not acceptable.

E. Provide tube steels that are ASTM A500 Grade B, Structural shapes A-36, plates A-572 or equal.

F. Provide sliding Teflon plates. The sliding surfaces shall be a nominal 3/8-inches glass filled Teflon bonded to stainless steel backup plate with a 10 gauge minimum thickness. The bearing pad upper and lower units shall be as follows: Conslide Type CSA elements as manufactured by Con-Serv. Inc., Balco TFE Slide Bearing Plates 10N-cs as manufactured by Balco Inc., or Dynalon Slide Bearings as manufactured by JVI, Inc. or acceptable equivalent product.

1. The blended TFE material used for this bearing shall be composed of virgin (unreprocessed) TFE resin tested per ASTM D1457 and reinforcing agents milled glass fibers. This structural material shall have the following representative mechanical and physical properties:
2. Tensile strength -2,000 psi.
3. Elongation –225 percent
4. Specific Gravity -2.17 to 2.22
5. The coefficient of friction shall average 0.06 under compressive load of 2,000 psi .
6. The compressive creep shall be a minimum of 2 percent at 2,000 psi and 70 degrees F.
7. The elements shall be flat, clean and prepared for installation in the structure. Slots and holes shall be fabricated in the bearing manufacturer's plant.

G. Concrete anchor bolts - Hilti Kwik-Bolt II Stud Anchors, Rawl Bolt, Phillips Wedge Anchors, or equal.

2.02 - DESIGN, LOCATION, AND TYPE OF PIPE SUPPORTS

A. Design and provide pipe supports for piping 1/2-inch and larger to include the following loads:

1. Gravity Force: This force includes the weight of pipe, pipe contents (hydro load), valves, in-line equipment, insulation and any other weight imposed on the piping and/or pipe support.

2. Thermal Expansion Force: This force is developed by the restraint of free end displacement of the piping due to thermal growth.

3. Hydrostatic/Dynamic Forces: These forces are developed due to the internal pressure (positive and negative) during operation of the piping system. These forces include the forces due to water hammer, pressure pulses due to rapid valve closure, fluid discharge resulting from pump startup, operation of positive displacement pumps, etc.

4. Wind Loadings: Wind loadings.

B. Provide supports, guides, anchors, flexible couplings and expansion joints in accordance with the coupling and joint manufacturers' specifications and requirements.

C. For all pump suction and discharge nozzles provide an anchor located between the pump nozzles and the nearest expansion joint or non-rigid coupling.

D. Where possible, provide pipe supports, which are the manufacturers' standard products.

1. Provide pipe supports with individual means of adjustment for alignment.

2. Provide pipe supports complete with appurtenances including locking and adjusting nuts.

3. Hanger rods shall be subjected to tension only.

4. Where lateral or axial pipe movement occurs, provide hangers for the necessary swing without exceeding 4 degrees. Provide base supports designed using pipe slides. The bearing surfaces: 0.06 coefficient of friction or less.

5. Provide concrete inserts capable of supporting the design loads.

6. Metal framing systems will be acceptable to support piping 2 inch and smaller.

7. Provide insulated piping supported using rigid load bearing insulation (baton board type) with 16 gauge shields to fit between the insulation and the support. Shields to encompass a minimum 1/3 of the pipe circumference and be 12 inch in length.

8. Provide load-bearing insulation capable of supporting the load, as a minimum on the bottom 60 degrees of the pipe support. Cope insulation and adjust to avoid interference of steel structures.

9. Provide supplementary steel as needed.

10. Do not support pipes from other pipe, conduits or metal stairs.

11. Chain, strap, T-bar, perforated bar and/or wire hangers are not acceptable.

12. Contact between piping and dissimilar metals such as hangers, building structural work or equipment subject to galvanic action is not acceptable.

13. All pipe supports located in fluid flow shall be supplied with double nutting.

E. Provide thrust anchors to resist thrust where required. Wall pipes may be used as thrust anchors if so designed. Welded attachments shall be of material comparable to that of the piping, and designed in accordance with governing codes.

F. Provide expansion joints where indicated and where required based on Contractor's design of the pipe support system. Indicate expansion joints on submittal drawings.

G. For piping 2-inch and smaller provide manufacturer's standard supports and standard spacing guidelines

H. Pipe supports connected to structural framing and slabs are subject to the following limitations:

1. Less than 100 lb horizontal load per support.
2. For a maximum of one pipe support per footof slab width perpendicular to the span.
3. Piping not supported from floors by metal framing must meet the limitations as specified above.

I. All outside above ground supports shall be Type 316L stainless steel as specified herein.

J. Provide pipe supports that do not overload or over stress the piping, equipment, or structure that they are supporting or to which they are attached. Allowable pipe stress to be within ANSI B31.1 code allowable.

K. The Contractor shall provide the services of a field service technician (preferably from the pipe support manufacturer) to field coordinate the locations of supports and resolve interferences and conflicts encountered during installation.

2.03 - FABRICATION

A. Provide pipe supports formed in accordance with paragraph 5.1 of MSS-SP-58.

B. Providing welding in accordance with Structural Welding Code.

C. Provide dimensional tolerances as specified in MSS-SP-89.

D. Provide threading and tapping in accordance with MSS-SP-89.

2.04 - SHOP PAINTING

A. Primer and Finish Paint: Shop apply to all exterior ferrous surfaces, high solids epoxy in accordance with SECTION 09940, SHOP PAINTING.

B. Ferrous surfaces which are not to be painted shall be given a shop applied coat of grease or rust resistant coating.

C. Provide additional shop paint coating for touch-up to all surfaces after installation and testing is completed and equipment accepted.

PART 3 - EXECUTION

3.01 - INSTALLATION

A. Install items in accordance with manufacturers' printed instructions and as indicated and specified herein.

B. Perform welding in accordance with Structural Welding Code:

1. Visually inspect welding while the operators are making the welds and again after the work is completed in accordance with AWS D1.1 Section 6.0. After the welding is completed, hand or power wire brush welds, and clean them before the Qualified Inspector makes the check inspection. The Qualified Inspector shall inspect welds with magnifiers under light for surface cracking, porosity, and slag inclusions; excessive roughness; unfilled craters; gas pockets; undercuts; overlaps; size and insufficient throat and concavity. The Qualified Inspector shall inspect the preparation of grove welds for throat opening and for snug positioning for back-up bars.
2. Nondestructive evaluation of welds connecting structural steel members subjected to critical stresses: Perform in accordance with the weld quality and standards of acceptance in AWS D1.1.
3. Magnetic Particle Inspection: Perform in accordance with ASTM E709.
4. Liquid Penetrant Inspection: Perform in accordance with ASTM E165.
5. For weld areas containing defects exceeding the standards of acceptance in accordance with AWS D1.1, Section 3.7. Provide additional testing of the repaired area at no additional cost to the Owner.
6. Test Locations: As selected by the Owner.
7. Correct any deficiencies detected as directed by the Engineer at no additional cost to the Owner.

C. Proceed with the installation of the pipe supports only after required building structural work has been completed and concrete support structure has reached its 28-day compressive strength as specified in SECTION 03300, CAST-IN-PLACE CONCRETE.

D. Install pipe supports to comply with MSS-SP-89. Group parallel runs of horizontal piping to be supported together on trapeze type hangers.

E. Install pipe supports to provide indicated pipe slopes. Do not exceed maximum pipe deflection allowed by ANSI B31.1.

F. For exposed continuous pipe runs, install pipe supports of same type and style as installed for adjacent similar piping.

G. Install pipe supports to allow controlled movement of piping systems. Permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Piping to be free to move when it expands or contracts except where fixed anchors are indicated or required by the Contractor's pipe support systems. Where hanger rod swing length cannot be provided or where pipe movement based on expansion of 1 inch/100 feet, for each 100 degrees F change in temperature exceed 1/2-inch, provide sliding supports.

I. Prevent contact between dissimilar metals. Where concrete or metal support is used, place 1/8-inch thick Teflon, neoprene rubber, or plastic strip under piping at point of bearing. Cut to fit entire area of contact between pipe and pipe support.

J. Prevent electrolysis in support of copper tubing by use of pipe supports which are plastic coated. Electrician's tape is not an acceptable isolation method.

K. Apply an anti-seize compound to nuts and bolts on all pipe supports.

L. Locate reinforcing steel in concrete structure with x-ray prior to drilling for embedment plates and anchor bolts. Avoid contact or interference with reinforcing steel.

3.02 – PAINTING

A. After installation, paint Pipe Supports in accrodacne with SECTION 09941, FIELD PAINTING.

3.03 - CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment.

B. Spillage of lubricants used in servicing the system shall be cleaned from all equipment and concrete surfaces.

3.04 - MANUFACTURER'S FIELD SERVICES

A. Manufacturer's Field Services shall be provided as specified herein.

3.05 - MANUFACTURER'S TRAINING – Not Used

3.06 - LUBRICATION REQUIREMENTS – Not Used

3.07 - SPARE PARTS – Not Used

3.08 - INSTALLATION OF BUILDING ATTACHMENTS

A. Support piping from structural framing, unless otherwise indicated.

B. Concrete Inserts:

1. Use existing embedded concrete items whenever possible.

2. Use expansion anchors only when existing embedded attachment points are not available or unsuitable. Attach to hardened concrete or completed masonry.

3.09 - THRUST ANCHORS AND GUIDES

A. Thrust Anchors:

1. Center thrust anchors between expansion joints and between elbows and expansion joints for suspended piping. Anchors must hold pipe rigid to force expansion and contraction movement to take place at expansion joints and/or elbows and to preclude separation of joints.

2. Restraining rod size and number shall be as indicated and adhere to manufacturers recommendations as a minimum.

B. Pipe guides: Provide adjacent to sliding expansion joints in accordance with recommendations of the National Association of Expansion Joint Manufacturers and the specific joint manufacturer.

3.10 - PIPE SUPPORTS

A. Where piping of various sizes is to be supported together, space supports for the largest pipe size and install intermediate supports for smaller diameter pipes.

B. Provide minimum of two pipe supports for each pipe piece.

C. Where pipe connects to equipment, support pipe independently from the equipment. Do not use equipment to support piping.

D. Provide pipe supports so that there is no interference with maintenance or removal of equipment.

E. Unless otherwise indicated or authorized by the Engineer, place piping running parallel to walls approximately 1-1/2 inch out from face of wall and at least 3 inches below ceiling.

F. Pedestal pipe supports: adjustable with stanchion, saddle, and anchoring flange. Provide grout between baseplate and floor.

G. Piping supports for vertical piping passing through floor sleeves: use hot dipped galvanized steel riser clamps.

H. Support piping to prevent strain on valves, fittings, and equipment. Provide pipe supports at changes in direction or elevation, adjacent to flexible couplings, adjacent to non-rigid joints, and where otherwise indicated. Do not install pipe supports in equipment access areas or bridge crane runs.

I. Stacked horizontal runs of piping along walls may be supported by metal framing system attached to concrete insert channels.

J. Do not support piping from other piping.

K. Designs generally accepted as exemplifying good engineering practice, using stock or production parts, shall be utilized whenever possible.

L. Whenever possible, pipe attachments for horizontal piping shall be pipe clamps.

M. All rigid rod hangers shall provide a means of vertical adjustment after erection.

N. Where the piping system is subjected to shock loads, such as disturbances due to pump discharge or thrust due to actuation of safety valves, hanger design shall include provisions for rigid restraints or shock absorbing devices.

O. Hanger rods shall be subject to tensile loading only. At hanger locations where lateral or axial movement is anticipated suitable linkage shall be provided to permit rod swing.

P. Hanger spacing shall not exceed the spacing listed below:

1. In the case of concentrated loads the supports shall be placed as close as possible to the load to reduce the bending stress.

2. Where changes in direction of the piping system occur between supports, the total length between supports shall be kept to less than three-fourths of the full span. When practical, a support shall be placed immediately adjacent to any change in direction of the piping system.

Q. Where practical, riser piping shall be supported independently of the connected horizontal piping. Pipe support attachments to the riser piping shall be riser clamp shear lugs. Welded attachments shall be of material comparable to that of the piping, and designed in accordance with governing codes. If friction is relied upon to support riser piping proper justification and documentation shall be submitted to ensure that enough friction force is provided to resist the applied loading.

R. Hanger components shall not be used for purposes other than for which they were designed. They shall not be used for rigging and erection purposes.

S. All threads shall be UNC unless otherwise specified.

T. TFE slide bearing plates with steel backup plates shall be stitch weld attachments to the structure. A 1/8-inch fillet weld, 1/2-inch long every 3 inches on center each side of an element shall be used unless otherwise indicated or specified by the manufacturers' written recommendations. Bearing elements with slots or holes shall be stitch welded in place for location. The TFE surfaces of the bearings shall be maintained clean and free from grit, dirt or grease.

3.11 - INSULATED PIPING

A. Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed allowable pipe stresses.

B. Where vapor barriers are indicated on water piping, install coated protective shields.

3.12 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 15101

PROCESS VALVES AND APPURTENANCES

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PART 1 – GENERAL

1.01 - SCOPE

A. The Work of this section includes furnishing all labor, materials, tools and equipment necessary to provide Process Valve and Appurtenances as specified and/or as shown on drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications

C. Provide and process valves and appurtenances as indicated and in compliance with Contract Documents.

1. Provide sizes and capacities as indicated or specified.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025 – MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Data, regarding valve characteristics and performance including Cv.

2. Shop drawing data for accessory items.

3. Manufacturer's literature as needed to supplement certified data.

4. Operating and maintenance instructions and parts lists.

5. Listing of reference installations as specified with contact names and telephone numbers.

6. Valve shop test results.

7. Qualifications of field service technician.

8. Shop and Field inspections reports.
9. List of recommended spare parts other than those specified.
10. Recommendations for short and long term storage.
11. Special tools.
12. Shop and field testing procedures and equipment to be used.
13. Number of service technician days provided and per diem field service rate.
14. Manufacturer’s product data and specifications for shop painting.
15. Provide a layout drawing, plan and section showing orientation of plug, gate, check, ball valves and actuators and nearest obstructions for each valve.
16. Manufacturer's product data and specifications for shop painting.
17. Provide a listing of the materials recommended for each service specified and indicated. Provide documentation showing compatibility with process fluid and service specified and indicated.
18. The latest ISO 9001 series certification or quality system plan.
19. Material Certification:
    a. Provide certification from the equipment manufacturer that the materials of construction specified are recommended and suitable for the service conditions specified and indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the Owner.
    b. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated.

C. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations and clarifications from the specified requirements.
1. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.
2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specification and justification are resubmitted with the entire package.

1.05 - PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer’s written recommendations.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

C. Comply with the requirements specified in Section 01610 and as specified.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents.

B. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

C. The design conditions and other pertinent requirements for the equipment specified in this section are indicated on the Contract Drawings.

D. Comply with the requirements specified in SECTION 01400, QUALITY ASSURANCE.

E. Provide enclosures for the area classifications specified and indicated.

F. Contractor responsible for verifying outside diameter of pipe to be tapped.

G. Services of Manufacturer's Representative as stated in SECTION 01400, QUALITY ASSURANCE and specified herein.

H. Manufacturer of valve shall have a minimum of five (5) operating installations with pumps of the size specified and in the same service as specified operating for not less than five (5) years.

I. If equipment proposed is heavier, taller, different laying length or requires more operating space than specified and indicated; provide all structural, architectural, mechanical, electrical and plumbing revisions at no additional cost to the Owner.

1. If equipment is heavier than specified, the Contractor shall provide all hoisting equipment sized to maintain the minimum safety factor between the specified maximum equipment weight and the lifting capacity of the hoisting equipment indicated and specified.

1.07 - REFERENCES

A. American Society of Mechanical Engineers (ASME)

1. B1.20.7: Hose Coupling Screw Threads.
2. B16.1: Standard for Cast Iron Pipe Flanges and Flanged Fittings, 125 lb.
3. B16.4: Cast-Iron Threaded Fittings, Class 125 and 250.
4. B16.10: Face-to-Face and End-to-End Dimensions of Ferrous Valves.

B. ASTM International (ASTM)

1. A48: Standard Specification for Gray Iron Castings.
2. A126: Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
3. A536: Standard Specification for Ductile Iron Castings.

C. American Water Works Association (AWWA)

1. C500: Metal-Seated Gate Valves for Water Supply Service.
2. C504: Rubber-Seated Butterfly Valves.
3. C509: Standard Specifications for Resilient-Seated Gate Valves for Water and Sewage Systems.
4. D102: Coating Steel Water-Storage Tanks.

D. NSF International (NSF)

1. 61: Drinking water system components Health effects

E. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - MATERIALS

2.01 - ECCENTRIC PLUG VALVES

A. Manufacturers:

1. DeZurik.
2. Val-Matic.
3. Omni Valve

B. Type: Non-lubricated, eccentric.

C. Body Working Pressure

1. Cast Iron, ASTM A126 Class B or Ductile Iron, ASTM A536, Grade 64-45-12.

a. Valves 4-inch through 12-inch: 175 psi.

D. Ends

1. Grooved: ANSI/AWWA C606 for ductile iron valves.

2. Flanged: ANSI B16.1 Class 125 pound for cast iron valves.

3. Buried Valves: Mechanical Joint.

E. Valve Ports

1. Provide rectangular ported valves, circular ports are not acceptable.

2. All valves 100% port area.

F. Valve Seats

1. Coat plug with seat material specified. Bolted systems are not acceptable.

a. Seat Material:

(1) Neoprene or Buna-N synthetic rubber.

2. Provide valves with one piece coated plugs with mating seats of 90 percent, minimum, pure nickel 1/8-inch welded into the body of valves.

3. Provide valves with seats clamped to valve with mating seat of 90 percent, minimum, pure nickel welded to the valve body.

G. Upper and Lower Plug Journal Bearings

1. Removable, permanently lubricated stainless steel bushings for valves 20-inch and smaller.

2. Provide grit seals for upper and lower plug shafts for all valves.

H. Stem Seals

1. Adjustable multiple V-packing.

2. Replaceable and adjustable without valve disassembly.

3. Provide valves with two sets of packing rated for vacuum service for all pump suction isolation service and for services where a vacuum is specified and indicated.

I. Operators for Valves 4-inch and larger

1. Manually Operators

a. Gear operated with handwheels, levers are not acceptable.

b. Provide gear operators rated for bi-directional shutoff at the valve working pressure rating as specified herein.

c. Gear operators: Totally enclosed worm gear, traveling nut type is not acceptable. Provide permanently lubrication, watertight and dustproof, with adjustable open and closed stops and plug position indicator.

d. Provide all work gears designed and certified to withstand input loads up to 300-feet-pounds minimum at the stops without damage.

e. Buried or submerged valves: Provide watertight gear operator with handwheel operated floorstand where indicated. Gear operator to be totally enclosed and gasketed with Type 316 stainless steel hardware.

2. All buried valves to open clockwise.

J. Shop Testing

1. Provide all plug valves tested and certified bubble tight in both directions at the full rated working pressure as specified herein.

K. Shop Painting

1. Provide epoxy painting as specified herein.

2. Provide fusion bonded epoxy, 12 mils inside and out.

2.02 - RUBBER FLAPPER CHECK VALVES

A. Manufacturers

1. Val-Matic.

2. DeZurik APCO.

3. Crispin.

B. Materials

1. Body and Cover: Ductile Iron ASTM A536 Grade 65-42-12.

2. Rubber Flapper: Buna N 70 Durometer ASTM 2000-BG encapsulating an ASTM A36 steel plate.

3. Hinge Pin: AISI 1018.

C. Provide valves with a full pipe size flow area.

D. Provide valves 4-inch and larger capable of passing a 3-inch sphere.

E. Provide a threaded connection with bronze plug on cover and on the bottom of the valve.

F. Working Pressure

1. 2-inch through 24-inch: 250 psi.

2. 30-inch and 36-inch: 150 psi .

G. Ends: Flanged ANSI B16.1, Class 150.

H. Provide seating surface at a 45 degree angle such that the flapper travels a maximum of 35 degrees from full closed to full open position.

I. Provide valve with cover designed for removal of the valve internals without removing the valve from the pipeline.

J. Position Indicator

1. Provide a mechanical indicator to provide disc position for valves 4-inch (100 mm) and larger.

2. Provide the indication with continuous contact with the disc.

3. Provide a limit switch for remote indication of valve position. Provide limit switches in accordance with SECTION 13300, INSTRUMENTATION AND CONTROL SYSTEM - GENERAL.

K. Backflow Device

1. Provide a screw type rising stem backflow device located on the bottom of the check valves.

2. Provide a stainless steel T-handle device with bronzed bushings.

2.03 - DUCK BILL CHECK VALVES

A. Manufacturers

1. Proco
2. Tideflex
3. Flowrox
4. Wapro

B. Service

1. Process Drains:
    a. Material: EPDM.
        (1) Provide flanged or slip on type valve with Type 316 stainless steel clamps as indicated.
        (2) Provide inline type with flanged connection or insertable as indicated.

2.04 - EXTENSION STEMS

A. Provide where indicated and required for operation of all valves

B. Material:

1. Stems: Type 316L solid stainless steel bar or Schedule 40 Type 316L pipe
    a. Minimum Size: 1.25 inch (32 mm) diameter, Slenderness ration <200
2. Connectors, thrust relief assemblies, torque tube assemblies, universal joints and operating nuts: Type 316 or Type 316L stainless steel
3. Miter gears: Cast iron with 2 part epoxy coating

2.05 - STEM GUIDES

A. Manufacturer

1. Trumbull Industries.

B. Provide valve stem guides where indicated and as required by the valves manufacturer.

C. Stem Guide Spacing: 6 to 8 feet (1.8 to 2.5 metres), maximum slenderness ratio of 200.

D. Stem Guides for Stems 2-inch (50 mm) and Smaller:

1. Materials
    a. Stem Guide: Cast Type 316 stainless steel with 2 to 36 inch (50 to 900 mm) adjustment.
    b. Bushing: Bronze, NSF 61
    c. Hardware: Type 316 stainless steel.

E. Stem Guides for Stems 2-1/8-inch (54 mm) to 4 inch (100 mm):

1. Materials
    a. Stem Guide: Ductile Iron 65-45-12 with 2-3/4 to 17-1/4 inch (70 to 438 mm) adjustment.
    b. Bushing: Split type, Bronze, NSF 61
    c. Hardware: Type 316 stainless steel.

2.06 - FLOOR BOXES

A. Manufacturer

1. Trumbull Industries.

B. Provide position indicators installed on all multi-turn valves and quarter turn valves with gear boxes 3-inch and larger.

1. Type: Planetary gear design

C. Materials

1. Provide the sun gear, planet gear, ring gears, and scale plate constructed of Delrin.

2. Housings of carbon steel or aluminum are not acceptable.

3. Hardware and Fasteners: Type 316 stainless steel.

D. Position Indicator Design Features

1. Provide the position indication to show the position of the valve, from fully open to fully closed, identified at ground level.

2. Movement of the indicating arrow must be visible through a window covering a minimum of 300 degrees of the circumference of the indicator.

3. Size of the characters and numerals: minimum 3/16 inch.

4. Provide the top scale plate with markings representing the number of turns, contain the word “CLOSED”, and a directional arrow.

5. Provide permanently recessed, embossed or engraved markings in the scale plate. The use of adhesive labels is not acceptable.

6. Provide the “OPEN” line marked on a transparent polycarbonate window, field adjusted for the number of turns of each valve size.

7. Provide the position of the adjustable “OPEN” window secured to the top of the scale plate by the outside diameter of three Type 316 stainless button head cap screws.

8. Provide all adapters to secure the position indicator, for installation in either a valve box floor box or wall bracket as indicated and required.

9. Provide the position indicator and adapter with matching flat sides to prevent rotation of the indicator during operation.

E. Buried Valves

1. Provide the position indicator installed in a valve box within 6 inches of grade.

2.07 - SHOP PAINTING

A. Coat internal and external ferrous surfaces of valve with NSF Certified Epoxy in accordance with ANSI/NSF Std. 61, and in conformance to AWWA D102 Inside System No. 1 for all valves not specified to have a fusion bonded epoxy coating.

B. Process Valve Color: Red.

PART 3 - EXECUTION

3.01 - VERIFICATION OF CONDITIONS

A. Before the start of the work of this Section, verify that the project is ready for this work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this work and coordinate the work with them.

3.02 - INSTALLATION

A. Prior to installation, protect stored valves and appurtenances from damage due to exposure to sunlight, heat, dirt, debris, freezing and thawing, vandalism, etc.

B. Clean all debris, dirt, gravel, etc, from inside of piping before placing valves in place.

C. Erect and support valves in respective positions free from distortion and strain on appurtenances during handling and installation. Inspect material for defects in workmanship and material. Clean out debris and foreign material from valve openings and seats, test operating mechanisms to check functioning, and check nuts and bolts for tightness. Repair, valves and other equipment which do not operate easily or are otherwise defective at no additional cost to the Owner.

D. Set plumb and support valves in conformance with instructions of manufacturer. Shim valves mounted on face of concrete vertically and grout in place. Install valves in control piping for access.

E. Provide bolted split sleeve coupling or flexible type grooved coupling on downstream side of buried valves to assist in valve removal.

F. Where indicated provide Type 316 stainless steel stem extension to operating floor elevation as shown and provide the bevel gear operator with a fabricated steel floorstand and handwheel.

3.03 - FIELD TOUCH-UP PAINTING

A. After installation and accepted testing, apply touch-up paint to all scratched, abraided and damaged shop painted surfaces. Coating type and color shall match shop painting.

3.04 - CLEAN UP – NOT USED

3.05 - MANUFACTURER’S FIELD SERVICES

A. Manufacturer’s Field Services shall be provided as specified herein.

3.06 - MANUFACTURER’S TRAINING

A. Manufacturer’s training shall be provided as specified herein.

3.07 - LUBRICATION REQUIREMENTS

A. All lubricating oils required for the first year of operation shall be provided.

3.08 - SPARE PARTS

A. Comply with requirements specified in SECTION 01600, CONTROL OF MATERIALS.

3.09 - CHECK VALVES

A. Install swing check valves horizontally in pipelines unless otherwise indicated.

3.10 - PLUG VALVES

A. Install valves in horizontal piping with shaft horizontal such that in open position, plug is located in upper part of valve body. Orient valves so that in closed position, flow is against the face of the plug.

3.11 - FIELD TESTING

A. Pressure test valves with pipeline pressure testing.

B. Test functions of each valve.

C. Make all adjustments necessary to place valves in specified working order at time of above tests.

D. Remove all replace valves and appurtenances at no additional cost to the Owner with equipment that will meet all requirements specified and indicated if unable to demonstrate to the satisfaction of the Engineer that valves will perform the service specified, indicated and as submitted and accepted.

3.12 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 15370

PROCESS PIPING AND APPURTENANCES

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PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide Process Piping and Appurtenances as specified herein and/or as shown on the Contract Drawings.

B. Provide and test process piping and appurtenances as indicated and in compliance with Contract Documents.

C. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Submit manufacturer's certificates of conformance.
2. Submit certified copies of test reports.
3. Piping layouts in full detail.
4. Location of pipe hangers and supports.
5. Large scale details of wall penetrations and fabricated fittings.
6. Schedules of all pipe, fittings, special castings, flexible connectors, adapters, couplings, expansion joints, and other appurtenances.
7. Reports as required for welding certifications per ASME B31.1 Paragraph 127.6.

8. Catalog cuts of joints, couplings, harnesses, expansion joints, gaskets, fasteners and other accessories.
9. Grooved joint couplings and fittings: Provide product submittals with products specifically identified by the manufacturer's style or series designation.
10. Brochures and technical data on coatings and linings and proposed method for application and repair.
11. Manufacturer's descriptive literature and technical data on insulation and proposed method of installation.
12. Shop drawing data for accessory items.
13. Manufacturer's literature as needed to supplement certified data.
14. Operating and maintenance instructions and parts lists.
15. Schematic control and power wiring diagrams.
16. Shop and Field inspections reports.
17. List of recommended spare parts other than those specified.
18. Recommendations for short and long term storage.
19. Special tools.
20. Shop and field testing procedures and equipment to be used.
21. Provide a listing of the materials recommended for each service specified and indicated. Provide documentation showing compatibility with process fluid and service specified and as indicated.
22. The latest ISO 9001 series certification or quality system plan.
23. Material Certification:
    a. Provide certification from the piping and equipment manufacturers that the materials of construction specified are recommended and suitable for the service conditions specified and as indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified. And indicated including an installation list of a minimum of five (5) installations in operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the Authority.
    b. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated.
24. A copy of the contract mechanical process, civil, structural, electrical and instrumentation drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with "No changes required".
25. Failure to include all drawings applicable to the equipment specified in this section will result in submittal return without review.
26. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations and clarifications from the specified requirements.
27. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.
28. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specification and justification are resubmitted with the entire package.

1.05 - PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer's written recommendations.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

C. Provide in accordance with SECTION 01610, DELIVERY, STORAGE AND HANDLING.

D. During loading, transportation and unloading, prevent damage to pipes and coatings. Load and unload each pipe under control at all times. Under no circumstances will a dropped pipe be used unless inspected and accepted by Engineer. Place skids or blocks under each pipe in the shop and securely wedge pipe during transportation to protect pipe, lining, and coating.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents.

B. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

C. The design conditions and other pertinent requirements for equipment specified in this section are indicated on the Contract Drawings.

1.07 - QUALITY ASSURANCE

A. Welder Qualifications:

1. Qualify and certify welding procedures, welders, and operators in accordance with ANSI B31.1, for shop and project site welding of piping work.

2. Qualification for welders: Welding shall be performed by welders holding current certification for the welding procedures in use.

3. Visually inspect welding while the operators are making the welds and again after the work is completed. After the welding is completed, hand or power wire brush welds and clean them before the inspector makes the check inspection. Inspect welds for defects exceeding tolerances allowed by code under which the weld was made. Repair all defects exceeding tolerance.

B. Provide all grooved joint couplings, fittings, valves, and specialties to be the products of a single manufacturer. Grooving tools used must be of the same manufacturer as the grooved components.

1. Provide all castings used for coupling housings, fittings, and valve bodies date stamped for quality assurance and traceability.

C. Job Conditions:

1. Coordinate dimensions and drillings of flanges with flanges for valves, pumps, and other equipment to be installed in piping system.

1.08 - REFERENCES

A. American Society of Mechanical Engineers (ASME):

1. B16.1: AN Standard for Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800

2. B16.3: Malleable Iron Threaded Fittings Classes 150 and 300

3. B16.5: AN Standard for Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys

4. B16.9: Factory-Made Wrought Buttwelding Fittings

5. B31.1: Power Piping

B. ASTM International (ASTM):

1. A47: Standard Specification for Ferritic Malleable Iron Castings
2. A53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
3. A105: Standard Specification for Carbon Steel Forgings for Piping Applications
4. A139: Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)
5. A181: Standard Specification for Carbon Steel Forgings, for General-Purpose Piping
6. A193: Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
7. A194: Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
8. A197: Standard Specification for Cupola Malleable Iron
9. A216: Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service
10. A240: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
11. A256: Standard Method of Compression Testing of Cast Iron
12. A269: Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
13. A278: Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650°F
14. A307: Standard Specification for Carbon Steel Externally Threaded Standard Fasteners
15. A312: Seamless and Welded Austenic Stainless Steel Pipe
16. A351: Standard Specification for Castings, Austenitic, for Pressure-Containing Parts
17. A449: Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
18. A536: Ductile Iron Castings
19. B62: Standard Specification for Composition Bronze or Ounce Metal Castings
20. C177: Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
21. C1136: Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
22. D256: Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
23. D570: Standard Test Method for Water Absorption of Plastics
24. D638: Standard Test Method for Tensile Properties of Plastics
25. D696: Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between-30 Degree C and 30 Degree C with a Vitreous Silica Dilatometer
26. D790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
27. D792: Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
28. D1330: Standard Specification for Rubber-Sheet Gaskets
29. D1457: Standard Specification for Polytetrafluoroethylene (PTFE) Molding and Extrusion Materials

30. D1599: Standard Test for Short-Time Rupture Strength of Plastic Pipe, Tubing and Fittings
31. D1784: Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
32. D1785: Standard Specification for Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Plastic Pipe, Schedules 40, 80 and 120
33. D2000: Rubber Products in Automotive Applications
34. D2105: Standard Test for Longitudinal Tensile Properties of Reinforced Thermosetting Plastic Pipe and Tube
35. D2412: Standard Test for External Loading Properties of Plastic Pipe by Parallel-Plate Loading
36. D2467: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
37. D2564: Standard Specification for Solvent Cements for Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Plastic Pipe and Fittings
38. D2855: Standard Practice for Making Solvent Cemented Joints with Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Pipe and Fittings
39. D2996: Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
40. D3035: Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
41. D3350: Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
42. D5685: Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe Fittings
43. E84: Standard Test Method for Surface Burning Characteristics of Building Materials
44. F441: Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
45. F593: Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
46. F1476: Standard Specification for the Performance of Gasketed Mechanical Couplings for Use In Piping Applications.

C. American Welding Society (AWS):
   1. B3.0: Welding Procedure and Performance Qualification

D. American Water Works Association (AWWA):
   1. C219: Bolted, Sleeve-Type Couplings for Plain-End Pipe
   2. C606: Grooved and Shouldered Joints

E. Expansion Joint Manufacturers Association Standards.

F. Fluid Sealing Association - Technical Handbook.

G. Manufacturer's Standardization Society (MSS):
   1. SP-67: Butterfly Valves
   2. SP-69: Pipe Hangers and Supports - Selection and Application

H. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - DUCTILE IRON PIPE AND FITTINGS

A. Provide in accordance with SECTION 02615, DUCTILE IRON PIPE AND FITTINGS.

2.02 - STAINLESS STEEL PIPE AND FITTINGS 2-1/2-INCH AND LARGER

A. Provide in accordance with SECTION 15066, STAINLESS STEEL PIPE AND FITTINGS.

2.03 - PVC PIPE AND FITTINGS

A. Schedule 80

B. Material: Type I, Grade I Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454 per ASTM D1784.

C. Provide pipe and fittings manufactured in compliance to ASTM D1785 meeting and/or exceeding the Quality Assurance test requirements of this standard with regard to material, workmanship, burst pressure, flattening, and extrusion quality.

D. Provide pipe and fittings manufactured in the USA, using domestic materials, by an ISO 9002 certified manufacturer. Store all pipe shall be stored indoors after production at the manufacturing site until shipped from factory.

E. Provide standard lengths of pipe sizes 10-inch and larger beveled each end by the pipe manufacturer.

F. Provide pipe and fittings with the National Sanitation Foundation (NSF) seal of approval for potable water applications.

G. Joining:

1. Solvent cementing process.
2. Provide flanges at valves, pumps and equipment only or as indicated and specified.
3. Provide Type 316 stainless steel flange bolting and hardware for all piping system except sodium hypochorite use titanium.

2.04 - PRESSURE GAUGES

A. Gauges:

1. Non-liquid filled type.
2. Helical wound bourdon tube, Inconel X-750.
3. Welded parts: Type 316 stainless steel.
4. Bearings: Precision Sapphire Type.
5. 1/2-inch NPT bottom male thread connection.
6. Accuracy: 1/2 percent of scale range.
7. 4-1/2-inch diameter with ABS plastic case.
8. Provide external adjustment.
9. Pipe and Fittings: Schedule 5 Pressfit or Schedule 40 threaded or socket welded, Type 316L stainless steel.
10. Pump Discharge Gauges: Provide gauges with range to cover the normal operating range, above the pump shutoff head and the range of pressures that will result from flushing.

B. Pipe and fittings: Type 316L stainless steel, provide as specified herein.

C. Ball valves: General service stainless steel ball valves in accordance with Section.

D. Pressure Sensor Rings:

1. 1-inch and Larger: Provide sensor/isolators that fit inside the bolt circle of 150-lb (Class 150) or 300-lb (Class 300) ANSI flanges as required.
2. 3/4-inch and Smaller: Provide sensor/isolators full flange or threaded as specified and indicated. For chemical system provide full flange, threaded connections are not acceptable.
3. Face to face length of the sensor: Conform to Specification MSS-SP67.
4. Type: Flow through design with flexible sleeve around full circumference. The center section shall have a cavity behind the sleeve filled with silicone fluid to transfer pressure to the gauge.
5. Rigidly support all pressure instruments by a post at least 7/8 inch diameter welded to the isolator. On sensor rings with more than one instrument, provide all connections 1/2-inch NPT as a minimum, 1/4-inch NPT fittings are not acceptable.
6. Provide sensor/isolator rings that do not have any fill plugs or valves that can be inadvertently removed with the resultant loss of fill fluid. Pressure sensor/isolators using valves are not acceptable.
7. Provide liquid filled sensor/isolators permanently vacuum sealed at the factory with a modular seal consisting of a membrane and needle fitting to allow removal and replacement of pressure instruments without compromising the vacuum fill. Sensor/isolators using valves are not acceptable.
8. Provide the needle fitting with both 1/4-inch NPT(F) threads and 1/2-inch NPT(M) threads.
9. Provide the pressure sensor/isolator capable of operating under pressure with all pressure instruments removed with no loss of fill fluid and without the need for isolating valves.
10. Attach pressure instruments to the isolator with a hand tightened lock ring.
11. It shall be possible to remove or attach pressure instruments to the isolator without requiring the use of any tools.
12. Permanently fill the pressure sensor with high viscosity silicone instrument oil to damp out surges or pressure spikes without the requirement for a separate snubber.
13. Pressure rating: 200 psi minimum for all lines tested at 150 psi or less and 600 psi minimum per lines tested above 150 psi.
14. Provide gauges as specified herein. Provide all other types of instruments indicated and specified in accordance with Section13300.
15. Materials:
    a. Pressure sensor/isolator rings: Provide materials suitable for the service conditions specified and indicated, as a minimum provide the following

Service	Body & Plates	Sleeve
Water	Type 316L Stainless Steel	Natural Rubber
Wastewater	Type 316L Stainless Steel	Natural Rubber

2.05 - PRESSURE AND FLOW INSTRUMENTATION

A. Provide in accordance with SECTION 13300, INSTRUMENTATION AND CONTROL SYSTEM - GENERAL.

2.06 - COUPLINGS-SLEEVE TYPE

A. Manufacturers:
1. Romac
2. Smith Blair
3. Viking Johnson
4. Dresser

B. Provide couplings meeting AWWA C219

C. Couplings 12-inch and smaller:

1. End rings and center rings: ASTM A536 ductile iron, fusion bonded epoxy coated

2. Gaskets: Buna-N, NSF 61 approved

3. Hardware: Type 316 stainless steel

D. Couplings 14-inch and larger:

1. End rings and center rings: ASTM A36 steel, fusion bonded epoxy coated

2. Gaskets: Buna-N, NSF 61 approved

3. Hardware: Type 316 stainless steel

E. Bridles and tierods: Minimum 3/4-inch diameter, except where tierods replace flange bolts of smaller size, in which case fit with nut on each side of pair of flanges.

1. Provide as indicated

2.07 - WALL AND FLOOR SLEEVES

A. Materials:

1. Floor Sleeves:

a. Schedule 40 Galvanized steel ASTM A53 GRB

2. Wall Sleeves Between a Dry Area and a Wet Area (Tank, Channel etc)

a. Schedule 40 Type 316L stainless steel

3. Wall Sleeves Between Dry Area or Between Dry Area and Ground

a. Schedule 40 Galvanized steel ASTM A53 GRB

B. Water Stops: Provide water stops welded on both sides. Provide water stops 1/4-inch thick and 2-inch high and centered on the wall thickness.

C. Provide modular, mechanical type seals, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening.

D. Provide the elastomeric elements sized and selected per manufacturer's recommendations and have the following properties as designated by ASTM. Coloration shall be throughout elastomer for positive field inspection. Each link shall have a permanent identification of the size and manufacturer's name molded into it.

E. Temperature Range: -40 to +250 degrees F.

1. Material: EPDM, ATSM D2000 M3 BA510

2. Color: Black

F. Modular seal pressure plates: Molded of glass reinforced Nylon Polymer with the following properties:

1. Izod Impact – Notched: 2.05ft-lb/in. per ASTM D256

2. Flexural Strength @ Yield: 30,750 psi per ASTM D790

3. Flexural Modulus: 1,124,000 psi ASTM D790

4. Elongation Break: 11.07 percent per ASTM D638

5. Specific Gravity:1.38 per ASTM D792

G. Hardware: Type 316 stainless steel.

2.08 - TRANSITION COUPLINGS

A. Provide coupling in accordance with AWWA C219 as specified herein

B. Sizes: 2-inch through 24-inch .

C. Materials:

1. End rings and center rings: Ductile iron ASTM A536.

2. Gaskets: Virgin Styrene Butadiene Rubber(SBR) suitable for potable water and wastewater service, ASTM D2000 MBA 710.

3. Provide 5/8-inch , Type 316 Stainless steel bolts and nuts

D. Working Pressure: 250 psi .

E. Lining and Coating: Fusion bonded epoxy in accordance with AWWA C213.

2.09 - DISMANTLING JOINTS

A. Materials:

1. Flanged Spool: AWWA Class D steel ring flange compatible with ANSI class 125 and 150 bolt circles. Provide pipe of ASTM A36 plate 1 percent cold expanded to size.

2. End Ring and Body: ASTM A36 steel

3. Gaskets: ASTM 2000 Virgin NBR suitable for wastewater service

4. Bolts and Nuts: Type 316 stainless steel

5. Tie Rods: Type 316 stainless steel

B. Assembly Tolerance: 3 inches

C. Coating: Fusion bonded epoxy, NSF 61 certified

D. Pressure Rating: 150 psi working pressure

E. Manufacturers

1. Romac

2. Viking Johnson

2.10 - SHOP PAINTING

A. Provide in accordance with SECTION 09940, SHOP PAINTING.

PART 3 - EXECUTION

3.01 - VERIFICATION OF CONDITIONS

A. Before the start of the work of this Section, verify that the project is ready for this work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this work and coordinate the work with them.

3.02 - INSTALLATION OF PIPE

A. Install pipelines parallel to building walls wherever possible. Install piping to lines and grades indicated and support. Where temporary supports are used, provide temporary supports as specified in SECTION 15056, PIPE SUPPORTS to prevent shifting or distortion of pipe. Provide for expansion.

B. Slope piping toward low points and provide for draining at low points.

C. Before assembly, remove debris from inside pipes and fittings.

D. Before flanges pieces are assembled, remove rust resistant coating from machined surfaces, clean gaskets and smooth burrs. Make up flanged joints tight, and prevent strain upon valves or other pieces of equipment.

1. Bolt threads must fully engage the nuts. At a minimum the bolt must be flush with the nut and no more than 1/2-inch excess thread protruding from the nut.

E. Install grooved joints in accordance with the manufacturer's written recommendations.

1. Grooved ends: Clean and free from indentations, projections, or roll marks.

2. Gaskets: Molded and produced by the coupling manufacturer of an elastomer suitable for the service pecified and indicated.

3. The coupling manufacturer's factory trained representative shall provide on-site training for the contractor's field personnel in the use of grooving tools and installation of product. The representative shall periodically visit the job site to ensure best practices in grooved product installation are being followed.

F. Install tierods, pipe clamps or bridles when sleeve type couplings or fittings are used in piping system as indicated, and at changes in direction or other places to prevent joints from pulling apart under pressures indicated in the Process Pipe Schedule.

G. Examine pieces for damage. Do not install pieces that are damaged according to Engineer. If any damaged piece should be discovered after having been installed, remove and replace with a sound piece at no additional cost to the Authority.

H. Handle pipe with equipment such as nylon slings and padded skids, designed to prevent damage to the coating. Repair abrasions and injuries to the coating prior to the application of insulation or prior to the application of final field coating.

I. Support piping laid in trenches in trench on bed of selected backfill material which maintains desired line and grade.

J. Use dielectric bushings or unions when ferrous pipes join nonferrous pipes carrying liquid either underground or elsewhere.

K. Welding in accordance with AN Standard B31 and AWS B3.0.

3.03 - PAINTING

A. Provide in accordance with SECTION 09941, FIELD PAINTING.

3.04 - CLEAN UP

A. Prior to Start-up and field testing, all foreign matter shall be removed from the equipment.

B. Spillage of lubricants used in servicing the system shall be cleaned from all equipment and concrete surfaces.

3.05 - MANUFACTURER'S FIELD SERVICES

A. Manufacturer's Field Services shall be provided as specified herein.

3.06 - MANUFACTURER'S TRAINING

A. Manufacturer's training shall be provided as specified herein.

3.07 - LUBRICATION REQUIREMENTS

A. All lubricating oils required for the first year of operation shall be provided.

3.08 - SPARE PARTS – Not Used

3.09 - WALL SLEEVE SEALS:

A. Expand rubber against pipe and sleeve by tightening bolts when assembled around pipe and inserted in wall.

3.10 - TEMPORARY PLUGS

A. Close open ends of pipe with temporary plugs or caps when pipe installation is not in progress. Use watertight plugs for exterior, buried piping and if water or debris is in trench when work is resumed, do not remove until adequate provision has been made to prevent any water or debris entering pipe even if it necessitates dewatering trench.

3.11 - PHYSICAL CHECKOUT, FIELD AND FUNCTIONAL TESTING

A. Clean dirt, dust, oil, grease and other foreign material, before pressure and leakage tests.

B. Water for testing provided by the Contractor.

C. Pressure and Leakage Tests:

1. Provide temporary testing plugs or caps; pressure pumps, pipe connections, meters, gages, equipment, and labor.

2. Test pipelines in sections of acceptable length.

3. Fill section of pipe with water and expel air.

4. Pressure and leakage test consists of first raising pressure (based on elevation of lowest point of section under test and corrected to gage location) to pressure in psi numerically equal to test pressures indicated in the Process Pipe Schedule.

5. No visible leakage in joint is acceptable.

6. If unable to achieve and maintain specified pressure for one hour with no additional pumping, section has failed to pass test.

7. If section fails pressure and/or leakage test, locate, uncover, and repair or replace defective pipe, fitting, or joint, and conduct additional tests and repairs until section passes test at no additional cost and without any time extensions.

D. Make piping connections to equipment with pipe in a free supported state and without application of vertical or horizontal forces to align piping with the equipment flanges.

E. Do not cover joints in underground piping with backfill material until piping has successfully passed pressure test.

F. Test pressures as indicated in Process Pipe Schedule.

G. Repair faulty joints even to extent of disassembling and remaking joint, remove defective pipe and fittings and replace in manner satisfactory to the Owner.

3.12 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 15855

FIBERGLASS REINFORCED PLASTIC DUCT, DAMPERS AND APPURTENANCES

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PART 1 – GENERAL

1.01 - SCOPE

A. The Work of this section includes furnishing all labor, materials, tools and equipment necessary to provide Fiberglass Reinforced Plastic Duct Dampers and Appurtenances as specified and/or as shown on drawings.

B. Provide duct and dampers for odor abatement systems with all appurtenances to make it operable, as indicated and in compliance with Contract Documents.

C. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all the sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 – DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accoirdance with the provisions of the DOCUMENT 00700, GENEREAL CONDITIONS, and SECTION 01300, SUBMITTALS.

1. Submittals required under this section include, but are not limited to the following.

a. When the Contractor proposes tanks which requires an arrangement differing from that indicated on the drawings or specified, prepare and submit for review detailed structural, mechanical, and electrical drawings and equipment lists, utilities consumption schedule and operating instructions, showing all necessary changes and embodying all special features of the equipment he proposes to furnish. Make changes, if accepted at no additional cost to Owner.

b. Certified shop and working drawings. Drawings for the duct and dampers shall also include a complete description of the laminate construction as specified within this section and be accompanied by a detailed postcure procedure that will be utilized.

c. Drawings shall include plan views, sectional views, title block, and details of all related items. In cases where certain information is Proprietary and is omitted, provided a statement indicating that the information is proprietary and is being omitted.

d. Files shall include Tag Names, Parts List (identifying each component), Dimensions, and connection sizes.

e. Files shall be drawn to scale.

f. Drawings shall be in conformance with all other requirements as specified in this specification.

2. A letter from the resin supplier stating that the material used for this project will comply with the specification and meet all corrosion requirements.

3. Design calculations performed by the manufacturer and stamped by a Professional Engineer for record purposes.

4. Samples, representative of the ductwork, construction method and material used to be supplied on this project.

5. Schematic and wiring schematic with interconnection diagram showing description of operations. List component identification of schematic diagrams as stated herein, along with component instruction manual references.

6. Manufacturer's literature and specifications. Show catalog dates.

7. Operating and maintenance instructions and parts list.

   a. In operating instructions incorporate a functional description of entire system including system schematics.

   b. In maintenance instructions, clearly define requirements for particular system and show special calibration and test procedures.

8. Clearly mark all drawings and data to show only items applicable to work. Show all data, nozzle schedule, bill of materials, rated capacities, material of construction, layouts and construction details of all components. Show dimensions, mounting and external connection details on all drawings.

9. Number and identify all equipment to correspond with terminology on drawings. Also use these numbers on all submittals sheets and shop drawings.

10. Four copies of manufacturer's recommended regeneration instructions, procedures and safety precautions. Provide detailed instructions for particular system as required.

11. List of 5 operating installations to demonstrate compliance with the requirements of Paragraph 1.07.H.

    a. Provide current (verified) contact information for each installation.

12. Paint manufacturer's product data and specifications indicated conformance to shop painting requirements specified including statement of compliance for compatibility.

13. Manufacturer's literature as needed to supplement certified data.

14. Two (2) sample cutouts demonstrating 100 mils (liner, and filament wound structural laminate. Samples to be a minimum of 8-inch diameter cut out, and a 12-inch diameter piece of duct at least 12 inches (300 mm) long complying with RTP-1 visual level I.

15. Copies of burial calculations for at least 3 sizes of duct between 12-inch and 48-inch .

16. Submit details of:

    a. Resin Type

    b. Types and amounts of filler

    c. Corrosion liner description

    d. Reinforcement types for hand lay-up or chopped laminates

e. For filament-wound laminates:

(1) Helix angle

(2) Glass content range

(3) Strand yield

(4) Strand by inch in the winding band

(5) Ply thickness

(6) Amount of chop or unidirectional roving interspersed with winding, if any, and location within laminate.

f. For all Fabricated parts:

(1) Construction type

(2) Laminate thickness

(3) Ply sequences

(4) Glass content range

g. For all secondary overlays (both interior and exterior):

(1) Laminate thickness

(2) Ply sequences and widths

(3) Construction details for all other special configurations and fabricated parts.

17. Shop test results.
18. Motor shop test results.
19. Qualifications of field service technician.
20. Schematic control and power wiring diagrams.
21. Shop and Field inspections reports.
22. List of recommended spare parts other than those specified.
23. Recommendations for short and long term storage.
24. Special tools.
25. Shop and field testing procedures and equipment to be used.
26. Number of service technician days provided and per diem field service rate.
27. Manufacturer’s product data, specifications, and color charts for shop painting.
28. Provide a listing of the materials recommended for service specified and indicated. Provide documentation showing compatibility with process fluid and service specified and as indicated.
29. The most recent ISO 9001 series certification.
30. Material Certification:

a. Provide certification from the manufacturer that the materials of construction specified are recommended and suitable for the service conditions specified and indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of three (3) years. Provide proposed materials at no additional cost to the Owner.

b. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated.

31. A copy of the contract mechanical process, electrical and instrumentation drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with "No changes required".

    a. Failure to include all drawings applicable to the equipment specified in this section will result in rejection of the entire submittal with no further review.

32. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations and clarifications from the specified requirements.

    a. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.

    b. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in rejection of the entire submittal with no further review and consideration.

1.05 - PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer's written recommendations.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

C. Comply with the requirements specified in SECTION 01610, DELIVERY, STORAGE AND HANDLING.

1.06 - DESIGN CRITERIA

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer's written recommendations.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

C. The design conditions and other pertinent requirements for the equipment specified in this section are indicated on the Contract Drawings.

1.07 - QUALITY ASSURANCE

A. Do work required by and in accordance with applicable State and local codes; arrange for permits, inspections and tests required by these codes; and provide complete systems ready for use. Provide tanks and accessories that conform to applicable safety standards including those for safety of personnel.

B. Provide components to manufacturer's standard for service intended unless otherwise required.

C. Provide components and accessories of manufacturers' latest and proven design.

D. The drawings and specifications direct attention to certain required features of the tanks, but do not purport to cover details entering into its design, construction and installation; nevertheless, provide tanks so that systems will be complete and ready for operation.

E. Provide field services as required for installation, with factory-trained technician to assist in determining location.

F. Coordinate the work schedule of other parts of the chemical systems manufacturer's service personnel during construction, testing, start-up, and acceptance, to coordinate with the tank manufacturer.

G. Upon completion of the installation, provide services of above serviceman for field testing.

H. Turn on no form of energy to any part of system prior to receipt by Engineer of certified statement of approval of installation from Contractor containing his supplier's authorization to energize system unless done by the supplier's servicemen may do so for purposes of checkout.

1.08 - REFERENCES

A. Air Movement and Control Association (AMCA):

1. 500D: Laboratory Methods of Testing Dampers for Rating.

B. American Society of Mechanical Engineers (ASME):

1. B-16.5: Pipe Flanges and Flanged Fillings NPS 1/2 Through NPS 24 Metric/Inch Standard.
2. RTP-1: Reinforced Thermoset Plastic Corrosion Resistant Equipment.

C. American Society for Testing and Materials (ASTM):

1. C582: Standard Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment.
2. D2310: Standard Classification for machine-Made “Fiberglass” Pipe.
3. D2412: Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
4. D2996: Standard Specification for Filament Wound “Fiberglass” (Glass Reinforced Thermosetting-Resin) Pipe.
5. D3567: Practice for Determining Dimensions of Fiberglass (Glass-Fiber Reinforced-Thermosetting-Resin) Pipe and Fittings.
6. D3982: Standard Specification for Contact Molded Fiberglass Duct and Hoods.
7. E84: Standard Test Method for Surface Burning Characteristics of Building Materials.

D. National Bureau of Standards (NBS):

1. PS 15: Custom Contact Molded Reinforced Chemical Resistant Process Equipment.

E. NSF International (NSF):

1. 61: Drinking Water System Components - Health Effects

F. Occupational Safety and Health Association (OSHA):

1. 29 CFR Part 1910.27: Fixed Ladder
2. 29 CFR Part 1926.104: Safety Belts, Life Lines and Lanyards
3. 29 CFR Part 1926.500: Fall Protection
4. 29 CFR Part 1926.501: Fall Protection
5. 29 CFR Part 1926.502: Fall Protection

G. Sheet Metal and Air Conditioning Contractors’ National Association (SMACNA):

1. 1884: Fiberous Glass Duct Construction Standards.

H. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - FRP DUCT

A. Materials and Fabrication:

1. Type: Filament wound rated at design pressures as specified and indicated.
2. Minimum wall thickness, in accordance with SMACNA Table 5-7 and as specified:
    a. 2-inch through 14-inch: 0.145-inch.
    b. 16-inch through 22-inch: 0.180-inch.
    c. 24-inch through 30-inch: 0.220-inch.
    d. Wall thickness of the duct furnished shall not at any point be less than specified minimum wall thickness when measured in accordance with ASTM D3567.
    e. Rectangular ductwork thickness: As specified in SMACNA and as specified and indicated. In no case shall the rectangular duct thickness be less than substituting the long side of the rectangular duct for the round equivalent thickness.
3. Grade: Type 1, Grade 2 RTRP, Class E per ASTM D2310 and D2996.
4. Provide all ducts designed for not less than 20 inches water column pressure, and 15 inches water column vacuum.
5. The design, applicable construction, and inspections shall be in accordance with SMACNA, and visual inspection criteria in accordance with ASME RTP-1. Table 6, Visual Level II.
6. Provide a minimum structural safety factor of 4 in the design of all ducting.
7. Maximum deflection of rectangular ducts under deadload and operating conditions: Not to exceed 1 percent of the width of the longest side.
8. Resin: Hetron FR992, Derakane (Ashland Inc.) 510 or equal, selected to meet the exposures and temperatures of the air to be exhausted.
9. Minimum barcol hardness: 36.
10. Fillers other than antimony trioxide added for flame retardancy are not acceptable and should not exceed 5 percent by weight.
11. A thixotropic agent for viscosity control may be used as recommended by the resin manufacturer. No thixotropic agent is to be used in the corrosion liner or on surfaces to be in contact with the corrosive environment.
12. Flame spread rating: 25 or less per ASTM E84.
13. Catalyst: DHD9 or Hi-Point 90 per resin manufacturer.
14. Corrosion liner:
    a. Inner surface: One ply of 10 mils thick minimum C-glass surfacing veil saturated with vinylester resin.
    b. Provide the surface veil overlapped a minimum of 1 inch with two (2) layers of 1-1/2 oz./sq. ft. chopped strand mat following the surface veil layers.
    c. Corrosion liner is to gel completely before proceeding with structural laminates. In no case shall the interruption exceed 12 hours.
    d. Total liner thickness: 100 mils minimum.

e. No thixotropic agent or fire retardant additive is to be used in the liner resin.

f. Corrosion liner: Not less than 20 percent or more than 30 percent glass by weight.

g. Provide liner passing ASME RTP-1 Table 6, level II visual inspection. Total glass content 25 percent to 30 percent.

15. Structural layer: Filament wound of Hetron FR992, or Derakane 510 premium grade, vinylester resin and Type E 250 strand yield continuous glass roving.

a. Band width: 2.25 inches using (7) strands per inch.

b. Filament winding cycle thickness: 0.06 inches maximum.

c. Glass content 55 percent to 65 percent.

d. Winding angle: 65 degrees ± 2 degrees for increased vacuum service.

16. Provide the exterior of all laminates containing sufficient resin to insure a relatively smooth surface free from exposed glass fibers or sharp projections.

17. Provide an ultraviolet stabilizer added to the final coat of resin that also incorporates paraffinated wax curing elements.

18. Provide ductwork located outdoors with an exterior colored surface coat.

a. Color: White or as selected by Owner.

19. Provide ductwork located indoors with two (2) coats of PPG Speedhide 42-7 Intumescent paint to provide a class 1 flame and smoke rating.

20. ASTM E84 Steiner Tunnel test results shall be attached as part of the submittal packet.

21. Standard lengths: Provide in accordance with the manufacturers published product data sheets and accepted shop drawings.

22. Duct stiffness: Minimum rated stiffness in accordance with ASTM D2412 for the pipe laying conditions.

23. Markings on duct and spool pieces shall be in accordance with shop drawings.

2.02 - FITTINGS AND JOINTS

A. Fittings:

1. Hand-layup construction fabricated from the same resin and have the same strength as the FRP ductwork.

2. Internal diameter of all fittings: Equal to the adjacent duct.

3. Tolerance on angles of all fittings: +/- 1 degree for 24 inch diameter and smaller and +/- 1/2 degree for 30 inch diameter and larger.

B. Elbows:

1. Radius: 1.5 times the diameter.

2. 24-inch and smaller: Smooth radius.

3. 30-inch and larger: Mitered.

4. Bends 30 degrees and less: 1 miter, 2 piece

5. Bends 31 degrees to 60 degrees: 2 miter, 3 piece

6. Bends 61 degrees to 90 degrees: 4 miter, 5 piece

C. Turning Vanes:

1. Provide turning vanes and splitters at all single mitered bends 46 degrees and greater and similar fittings that are not one-piece smooth radius fittings per SMACNA standards.

2. Turning Vanes: Filament wound and reinforced with unidirectional glass, metallic vanes are not acceptable.

D. Flange Joints:

1. Provide flanged connections at flexible connectors, expansion joints, vessels, grease filters, fans, and other locations as indicated.

2. Flanges:

a. Hand lay-up construction with dimensions in accordance with NBS PS 15-69 and the Duct Dimension Schedule.

b. Flanges 24-inch and smaller: One piece integral, SMACNA Thermoset Duct construction manual and supplied undrilled for field drilling and alignment.

3. Flanges shall be drilled in accordance with NBS PS 15-69 -Table 2. acks of flange face shall be flat so that washer seats fully on bolt face and flange backing.

4. Flange Faces: Perpendicular to the axis of the duct within 1/2 degree.

5. Flange Faces: Flat to within +/- 1/32 inch for sizes 18-inch and smaller and flat within +/- 1/16 inch for sizes 20-inch and larger.

6. Gaskets: EPDM, full face, minimum 1/8-inch thick.

7. Hardware: Type 316 stainless steel.

E. Duct Joints:

1. Butt and wrap joint type connections.

2. Fittings: Butt and wrap joint type connections.

3. Apply adhesive material for field joining in rolls and resin containers no larger than five gallons.

4. Provide all joints per SMACNA standard, and per manufacturer’s laminate schedule and procedures.

2.03 - EXPANSION JOINTS

A. Expansion Joints:

1. Provide expansion joints where indicated and where required for flexibility and to accommodate the duct support system.

2. Provide flanged joints where connecting ductwork to vessels, grease filters, fans, equipment and other locations as indicated.

3. Provide slip-type joints where flanges joints are not specified or indicated.

4. Type: W-design configuration with integral flanges suitable for service with FRP duct under the conditions specified and indicated.

5. Material: EPDM

6. Backing Rings: 3/8-inch thick, 2 inches wide, Type 316 stainless steel.

7. Extension: 3 inches .

8. Compression: 2.5 inches .

9. Lateral Offset: 2.5 inches .

10. Thickness: 1/4-inch minimum.

11. Bolts, Nuts and Washers: Type 316 stainless steel.

B. Manufacturers:

1. RM-Holz (Holz Rubber Company, Inc.)
2. Metraflex, Inc.
3. Garlock (EnPro Industries)
4. Mercer Rubber Company

2.04 - DUCT DRAINS

A. Provide 1 inch minimum CPVC pipe and CPVC ball valve trapped duct drains on all low points in all main, branch and riser ducts to allow removal of condensate.

1. Provide piping in accordance with SECTION 15370, PROCESS PIPING AND APPURTENANCES and valves in accordance with SECTION 15101, PROCESS VALVES AND APPURTENANCES.

B. For ducts located outdoors insulate the drains, trap and piping with 1-inch (25 mm) of insulation in accordance with SECTION 15370, PROCESS PIPING AND APPURTENANCES.

2.05 - DAMPERS

A. Provide factory fabricated dampers conforming to AMCA 500D requirements and as specified.

B. Provide FRP dampers manufactured from the same materials and resin as specified for duct.

C. Materials and Construction:

1. Blades: Two (2) piece, molded including blade stiffeners. Provide damper blade offset 5 degrees in the closed position to form a normal stop.
2. Axle: Pultruded FRP made of the same resin as specified for the duct and continuous strand roving.
3. Control Shaft: Provide axle extending 6 inches (150 mm) beyond frame, full length vinylester with Type 316 stainless steel pins embedded transverse of axle.
4. Bearings: Molded PTFE with 10 percent carbon and graphite fill.
5. O-Rings: Viton.
6. Metallic parts in contact with the air stream are not acceptable.

D. Provide the following type of dampers for the service specified:

1. Balancing:
   a. Opposed multi-blade type.
2. Isolation:
   a. Butterfly type constructed of one gauge heavier than respective duct.
   b. Provide dampers equipped with full circumference extruded double tadpole blade seals.
   c. Butterfly damper leakage: Not to exceed 2.9 cfm/sq. ft. against 26 inches W.C.
3. Volume damper:
   a. Butterfly type, locking quadrant of same material as duct.

E. Provide manual dampers with lever type, locking quadrant operator Identified with OPEN and CLOSE positions.

F. Where indicated, provide electric motor operators as specified herein.

G. Dampers shall be of self-supporting construction and shall not deflect or deform while free standing.

H. Dampers shall have flanged ends for connection to ductwork and equipment.

I. Manual Operators:

1. Dampers 16-inch and larger: Provided gear operators with an epoxy coating.

2. Dampers 14-inch and smaller: Provide hand quadrant actuators fabricated of Type 316 stainless steel with a 5-stage locking quadrant indicator.

J. Balancing Dampers:

1. Manual: Provide a fully adjustable slot with an extra hole drilled in the handle for contractor to "drill and pin-in place" once system is balanced so handle cannot vibrate loose.

2. Electric: Provide as specified.

K. Chain wheel operators: Provide galvanized steel chainwheels with galvanized steel chain and chain guides for all dampers with operator or gear operators higher than 6.5 feet above operating floor level.

1. Provide chain that reaches to within 3 feet of the operating floor level.

2. For dampers with gear operator mount with chainwheel in the vertical position.

3. Provide in accordance with SECTION 15101, PROCESS VALVES AND APPURTENANCES.

L. Electric Motor Actuators:

1. Provide in accordance with SECTION 15109, ELECTRIC MOTOR ACTUATORS AND APPURTENANCES.

2. For fan inlet service provide modulating actuators.

2.06 - AIR INLETS

A. Material compatible with ductwork system specified.

B. Provide Type 316L stainless steel wire mesh bird screen for all fresh air intakes.

C. Each air exhaust from each of the tanks shall have a volume damper as indicated and specified.

2.07 - DUCT SYSTEM SUPPORTS

A. Duct Support:

1. Provide supports for all ducts designed and furnished by the duct system supplier in accordance with SECTION 15056, PIPE SUPPORTS and as specified herein.

2. Provide hanger spacing as indicated in ASTM D3982.

3. Provide ductwork supported from structure by straps or rods. Provide Type 316L stainless steel angle iron brackets to support ducts where structure is not available.

4. For exterior duct, design and provide free standing duct supports to meet specified duct spacing requirements and specified loads.

5. Provide anchors, inserts or clamps to secure hangers to structures. Provide Type 316 stainless steel anchors, screws and bolts. Provide in accordance with manufacturers recommendations and Factory Mutual limitations and restrictions.

B. Provide all duct supports shall be designed to withstand seismic loads as indicated and specified.

PART 3 - EXECUTION

3.01 - VERIFICATION OF CONDITIONS – Not Used

3.02 - INSTALLATION

A. General:

1. Install ducts, dampers and appurtenances in accordance with manufacturer's recommendations.

2. Prior to installation, inspect each duct length and all fittings, flush clean of any debris or dust, and straightened, if not true. All duct and fittings shall be equally cleaned before assembly.

3. Provide all materials and equipment required.

3.03 - PAINTING

A. Primer and Finish Paint: Shop apply to all exterior ferrous surfaces, high solids epoxy in accordance with SECTION 09940, SHOP PAINTING.

B. Ferrous surfaces which are not to be painted shall be given a shop applied coat of grease or rust resistant coating.

C. Provide additional shop paint coating for touch-up to all surfaces after installation and testing is completed and equipment accepted.

D. After installation and accepted testing by the Engineer Contractor shall apply touch-up paint to all scratched, abraided and damaged shop painted surfaces. Coating type and color shall match shop painting.

3.04 - CLEAN UP

A. Prior to start-up and field testing all foreign matter shall be removed from the equipment.

B. Spillage of lubricants used in servicing the system shall be cleand from all equipment and concrete surfaces.

3.05 - MANUFACTURER'S FIELD SERVICES

A. Manufacturer's Field Services shall be provided as specified herein.

3.06 - MANUFACTURER'S TRAINING – Not Used

3.07 - LUBRICATIONS REQUIREMENTS- Not Used

3.08 - SPARE PARTS

A. Provide in accordance with SECTION 01600, CONTROL OF MATERIALS and as specified herein.

B. Provide spare parts that are identical to and interchangeable with similar parts installed.

C. Provide the following spare parts, all identical and interchangeable with similar parts installed in Work:

1. Two spare gaskets of all types, materials and sizes.

2. One (1) set of all special tools.

3.09 - DUCTWORK

A. Assemble per SMACNA, Standards as specified hereinbefore.

B. Do not exceed 6-feet spacing of hangers on horizontal ducts; 4-feet on vertical ducts.

C. Support ductwork from structure by 16-gauge straps. Use hanger material compatible with ducts; use angle brackets to support vertical ducts.

D. Use anchors, inserts or clamps to secure hangers to structures; use stainless steel anchors if drilled-in type are installed.

E. Install duct connections to masonry openings airtight. Pack the space between the sleeve and framed prepared opening and the duct and the duct insulation with mineral wool or other FM approved fire resistant material.

F. Flanged connections to equipment, 3-inch minimum length.

G. FRP ductwork:

1. Joints, finished joints in accordance with NBS PS 15-69 Standards.

3.10 - SYSTEM TESTING

A. Test at 1.5 times the system design pressure specified and indicated.

B. Determine leakage by loss of pressure, soap solution, chemical indicator, or other positive and accurate method. All fixtures, devices, or other accessories connected to the lines and which would be damaged if subjected to the test pressure shall be disconnected and ends of the branch lines plugged or capped as required during the testing procedures.

3.11 - SYSTEM BALANCING

A. Adjust manual and automatic control devices to balance air flows so they perform as indicated and specified.

B. Balance air systems so each outlet is within 10-percent and each fan is within 5-percent of values indicated.

C. Submit report to the Owner outlining balancing procedures used; report to include:

1. Type of measuring devices used.
2. Air quantities at each outlet, damper and fan.
3. Fan speeds.
4. Fan suction and discharge pressures.
5. Air quantities through fan, by test and by summation of air quantities at outlets.

D. Make all adjustments necessary to place equipment in specified working order at time of above tests.

E. Remove all replace equipment at no additional cost to the Owner with equipment that will meet all requirements specified and indicated if unable to demonstrate to the satisfaction of the Engineer that equipment will perform the service specified, indicated and as submitted and accepted.

3.12 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 15857

ODOR CONTROL SYSTEMS – CARBON

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PART 1 – GENERAL

1.01 - SCOPE

A. The Work of this section includes furnishing all labor, materials, tools and equipment necessary to provide Odor Control systems as specified and/or as shown on drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

C. Provide carbon odor control systems as indicated and in compliance with Contract Documents.

D. Scope includes

1. Furnish, install and test an odor abatement system cable of handling and removing 99 percent of 25 PPM hydrogen sulfide and sewage vapors, complete, with all appurtenances to make it operable, as indicated and as specified.

2. Obtain all state, local or federal permits.

1.02 – MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. When the Contractor proposes tanks which requires an arrangement differing from that indicated on the drawings or specified, prepare and submit for review detailed structural, mechanical, and electrical drawings and equipment lists, utilities consumption schedule and operating instructions, showing all necessary changes and embodying all special features of the equipment he proposes to furnish. Make changes, if accepted at no additional cost to Owner.

2. Certified shop and working drawings. Drawings for the vessels and fans shall also include a complete description of the laminate construction as specified within this section and be accompanied by a detailed postcure procedure that will be utilized.

   a. Drawings shall include plan views, sectional views, title block, and details of all related items. In cases where certain information is Proprietary and is omitted, provided a statement indicating that the information is proprietary and is being omitted.

   b. Files shall include Tag Names, Parts List (identifying each component), Dimensions, and connection sizes.

   c. Files shall be drawn to scale.

   d. Drawings shall be in conformance with all other requirements as specified in this specification.

3. The Contractor shall submit Certificates of Analysis from the activated carbon supplier indicating the proposed carbon meets the specifications. Test Reports on the representative samples of GAC shall contain the following information.

   a. Hydrogen sulfide (H_2S) capacity, (g/mL)

   b. Mesh size confirmation

   c. Moisture, (percent as packed)

4. Provide a written statement certifying that the sample of the carbon material is representative of the carbon media that will be shipped and installed under this contract.

5. Schematic and wiring schematic with interconnection diagram showing description of operations. List component identification of schematic diagrams as stated herein, along with component instruction manual references.

6. Manufacturer’s literature and specifications. Show catalog dates.

7. Operating and maintenance instructions and parts list.

   a. In operating instructions incorporate a functional description of entire system including system schematics.

   b. In maintenance instructions, clearly define requirements for particular system and show special calibration and test procedures.

8. Clearly mark all drawings and data to show only items applicable to work. Show all data, nozzle schedule, bill of materials, rated capacities, material of construction, layouts and construction details of all components. Show dimensions, mounting and external connection details on all drawings.

9. Number and identify all equipment to correspond with terminology on drawings. Also use these numbers on all submittals sheets and shop drawings.

10. Four copies of manufacturer’s recommended regeneration instructions, procedures and safety precautions. Provide detailed instructions for particular system as required.

11. List of 5 operating installations of similar units. Provide current (verified) contact information for each installation.
12. Submit details of:
    a. Resin Type
    b. Types and amounts of filler
    c. Corrosion liner description
    d. Reinforcement types for hand lay-up or chopped laminates
13. Shop test results.
14. Motor shop test results.
15. Qualifications of field service technician.
16. Schematic control and power wiring diagrams.
17. Shop and Field inspections reports.
18. List of recommended spare parts other than those specified.
19. Recommendations for short and long term storage.
20. Special tools.
21. Shop and field testing procedures and equipment to be used.
22. Number of service technician days provided and per diem field service rate.
23. Manufacturer's product data, specifications, and color charts for shop painting.
24. Provide a listing of the materials recommended for service specified and indicated. Provide documentation showing compatibility with process fluid and service specified and as indicated.
25. Material Certification:
    a. Provide certification from the manufacturer that the materials of construction specified are recommended and suitable for the service conditions specified and indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of three (3) years. Provide proposed materials at no additional cost to the Owner.
    b. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated.
26. A copy of the contract mechanical process, electrical and instrumentation drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with "No changes required".
    a. Failure to include all drawings applicable to the equipment specified in this section will result in rejection of the entire submittal with no further review.

27. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations and clarifications from the specified requirements.

    a. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.

    b. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in rejection of the entire submittal with no further review and consideration.

1.05 – PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer's written recommendations.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

C. Comply with the requirements specified in SECTION 01610, DELIVERY, STORAGE AND HANDLING.

1.06 – DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents.

B. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

C. The design conditions and other pertinent requirements for the equipment specified in this section are indicated on the Contract Drawings.

1.07 - QUALITY ASSURANCE

A. Comply with the requirements specified in SECTION 01400, QUALITY ASSURANCE.

B. Systems shall be the product of one manufacturer.

C. Systems shall be manufacturer’s standard cataloged product and modified to provide compliance with the drawings, specifications and the service conditions specified and indicated.

D. Do work required by and in accordance with applicable State and local codes; arrange for permits, inspections and tests required by these codes; and provide complete systems ready for use. Provide tanks and accessories that conform to applicable safety standards including those for safety of personnel.

E. Provide components to manufacturer's standard for service specified and indicated unless otherwise required.

F. Provide components and accessories of manufacturers' latest and proven design.

G. Coordinate the work schedule of other parts of the chemical systems manufacturer's service personnel during construction, testing, start-up, and acceptance, to coordinate with the tank manufacturer.

H. Services of Manufacturer's Representative as stated in SECTION 01400, QUALITY ASSURANCE and as specified herein.

I. Provide services of factory-trained Service Technician, specifically trained on type of equipment specified:

    1. Service Technician must be present on site for all items listed below. Person-day requirements listed are exclusive of travel time, and do not relieve Contractor of the obligation to place equipment in operation as specified.

    2. Installation: Inspect grouting, location of anchor bolts; setting, leveling, alignment, field erection; coordination of piping, electrical and miscellaneous utility connection - 1 person-day.

3. Functional Completion Testing: Calibrate, check alignment and perform a functional test with water. Tests to include all items specified – 1 person-day.
4. Field Performance Testing: Field performance test equipment specified – 1/2 person-day.
5. Vendor Training: Provide classroom and field operation and maintenance instruction including all materials, slides, videos, handouts and preparation to lead and teach classroom sessions – 1/2 person-day.
6. Credit to the Owner, all unused service person-days specified above, at the manufacturer's published field service rate.
7. Any additional time required of the factory trained service technician to assist in placing the equipment in operation, or testing or to correct deficiencies in installation, equipment or material shall be provided at no additional cost to the Owner.

J. Manufacturer of systems shall have a minimum of five (5) operating installations with an equal or greater flow rate of the size specified and in the same service as specified operating for not less than five (5) years.

K. If equipment proposed is heavier, larger, different rotation, or discharge arrangement than specified and indicated; provide all structural, architectural, mechanical, electrical and plumbing revisions at no additional cost to the Owner.

1. If equipment is heavier than specified, the Contractor shall provide all hoisting equipment sized to maintain the minimum safety factor between the specified maximum equipment weight and the lifting capacity of the hoisting equipment indicated and specified.

1.08 – REFERENCES

A. Air Movement and Control Association (AMCA):

1. 210 Test Code
2. 300 Test Code
3. 500D: Laboratory method for Testing Dampers for Rating.

B. American Society for Testing and Materials International (ASTM):

1. A36: Standard Specification for Carbon Structural Steel.
2. C582: Standard Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment
3. D2867: Standard Test Method for Moisture in Activated Carbon.
4. D3299: Standard Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks.
5. D4097: Standard Specification for Contact-Molded Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks.
6. D4167: Standard Specification for Fiber-Reinforced Plastic Fans and Blowers
7. D5158: Standard Method for Determination of Particle Size of Powered Activated Carbon by Air Jet Sieving
8. D6646: Standard Test Method for Determination of the Accelerated Hydrogen Sulfide Breakthrough Capacity of Granular and Pelletized Activated Carbon
9. E84: Standard Test method for Surface Burning Characteristics of Building Materials.

C. Fiberglass Reinforced Plastics Institute, Inc. (FRPI):

1. Laminate Certification Manual.

D. National Bureau of Standards (NBS):

1. PS 15: Custom Contact Molded Reinforced Chemical Resistant Process Equipment.

E. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.09 - SPECIAL TOOLS

A. Provide one 40-inch (1 meter) long grain sampler for obtaining carbon samples from adsorber vessel. Sampler to consist of two polished brass telescoping slotted tubes.

PART 2 - PRODUCTS

2.01 – ACTIVATED CARBON

A. Provide activated carbon to fill each reactor vessel.

B. The activated carbon shall be virgin, un-impregnated granular activated carbon, derived from bituminous, sub-bituminous or lignite coal.

C. The activated carbon shall be suitable for vapor phase adsorption of Hydrogen Sulfide and other odor causing compounds such as mercaptans typically found in vapors emitted by the wastewater treatment process.

D. Activated carbon shall conform to the following minimum requirements:

H2S breakthrough capacity (Per ASTM D6646)	g H2S removed/cc	0.2 minimum
Moisture (per ASTM D2867)	wt. percent	8 maximum
Mesh size (per ASTM D5158)		
Greater than 4 Mesh	percent	10 maximum
Less than 8 Mesh	percent	5 maximum

E. Submit a certificate certifying that the carbon meets the specified requirements.

2.02 – SEISMIC DESIGN REQUIREMENTS

A. Conform to the requirements indicated on the structural drawings and as specified in SECTION 01900, SEISMIC AND WIND REQUIREMENTS.

B. The Contractor shall conform to the seismic design requirements for this project and for the work of this specification section.

C. Provide all equipment bases, anchorage, supports and foundations designed in accordance with the seismic requirements indicated and specified.

D. Additionally, provide with the Certificate of Unit Responsibility, certification for all equipment signed by a registered structural engineer stating that computations were performed and that all compounds have been sized for the seismic forces specified and indicated.

2.03 - ADSORBER VESSEL

A. Provide carbon bed adsorber of polyethylene or HDPE.

B. Provide equipment suitable for continuous exposure to saturated hydrogen sulfide gas. Provide a certification from the resin manufacturer listing the nomenclature, composition, and characteristics of the resin supplied with the submittal data.

C. Equip adsorber with anchor pads, bolts, washers, and lifting lugs necessary for field erection. Anchor bolts and washers 316 stainless steel, 1/2-inch minimum bolt.

D. Provide three samples probes at 9-inch intervals below the top of each carbon, extending into the carbon bed 1 foot minimum. Probe sized for adequate extraction of air samples from the carbon bed and be nonblinding. Extend probes outside the vessels wall and blocked off with a ball valve and cap.

E. Carbon bed support system as recommended by the manufacturer.

2.04 - STATIC GROUNDING OF CARBON BED

A. Include provisions to adequately ground the carbon bed. Details should be submitted to demonstrate that the carbon bed will be adequately grounded. Provide stainless steel 2-hole ground pads at each vessel and associated grounding materials and hardware for connection to the system grounding grid.

2.05 - PVC DUCTWORK

A. Provide in accordance with SECTION 15370, PROCESS PIPING AND APPURTENANCES.

2.06 - MOTORS

A. Provide in accordance with SECTION 01171, ELECTRIC MOTORS and as specified and indicated.

B. Horsepower rating of motors: Not less than maximum brake horsepower requirements of fans under any condition of operation specified and indicated without operating in the motor service factor.

C. Motor enclosure and speed: As indicated in the Fan Schedule.

D. Provide flex-coupled motors with base supports.

E. In addition to the requirements for bearings specified under Electric Motors in SECTION 01171, ELECTRIC MOTORS, provide motors with ball or roller bearings. Provide vertical motors with at least one bearing designed for thrust with bearings. Provide bearing with a minimum B-10 life of 100,000 hours.

F. Overall sound-pressure level of each motor shall not exceed 88 decibels when measured on flat network using an octave-band frequency analyzer conforming to ANSI S1.11. Determine overall sound-pressure level as average of four or more readings at evenly spaced points, 3 feet 0.9 motors from motor.

G. Operate without overheating at the speeds specified and indicated.

H. Service Factor: 1.15.

I. Premium efficiency with nominal and minimum efficiencies per NEMA MG1.

J. Rating: 460V, 3-phase, 60 Hertz.

K. Insulation: Class F with Class B temperature rise, 40 degrees C ambient.

L. Site Altitude: 3,300 feet above sea level.

2.07 - GASKETING AND SEALING

A. Flanged nozzles: Viton or hypalon full face gaskets of 50 to 60 Shore “A” Durometer hardness.

B. Fabricated gaskets: Machine-made or die-stamped with inside and outside edges parallel or concentric, as applicable. Make bolt holes oversized to prevent crimping of gasket when installed.

2.08 - CARBON ADSORBER ACCESSORIES

A. Overflow, and drain connections furnished with Schedule 80 CPVC pipe, fittings and ball valves. Provide clear PVC pipe for overflow.

B. Piping: Provide in accordance with SECTION 15370, PROCESS PIPING AND APPURTENANCES.

C. Valves: Provide in accordance with SECTION 15101, PROCESS VALVES AND APPURTENANCES.

D. Provide a Magnehelic differential pressure gauge installed on the housing to indicate differential pressure across each carbon bed. Tank mount with enclosure, calibrated in inches of water and column.

E. Blank flanges, material same as vessel, with bolts for air inlet connection.

F. Lifting and hold down lugs.

2.09 - CENTRIFUGAL FANS

A. Single-width, single-inlet, multiblade design, backward-inclined blades. Drive motor, fan and casing mounted on vessel lid.

1. Construct fan of aluminum with epoxy coating. Encase Type 316 stainless steel shaft in FRP sleeve.

2. Flanged inlet and outlet connections.

3. Provide a casing drain with ball valve and cap

4. Shaft Seal: Viton

5. Fan Shaft shall be ground and polished Type 316 stainless steel. Bearings shall be located in an enclosed drive compartment and shall be heavy-duty, self-aligning, with extended lube tubes for continuous service, with a minimum of 50,000 hrs. L10 life. A neoprene shaft seal shall be located where the shaft enters the inner bearing housing with a neoprene shaft slinger between the seal and wheel.

B. Fan Assembly:

1. Dynamically balanced and completely assembled at the factory prior to shipping. All fans shall meet balance requirements of the Acoustical Society of American Standards. Fan construction shall conform to ASTM Standard D4167 for fiber reinforced plastic fans and blowers. Fan performance shall be tested in an AMCA Registered Test Laboratory in accordance with AMCA 2010 Test Code for air performance and AMCA 300 Test Code for sound. Fans shall be licensed to bear the AMCA Certified Air Performance Rating Seal.

C. Accessories:

1. Provide electrical grounding of fan housing to motor frame.

2. Provide Type 316 stainless steel hardware.

D. Provide motors in conformance with Section 01171, ELECTRIC MOTORS and as specified and indicated.

2.10 - ENCLOSURE

A. Provide the enclosure of materials compatible with the environment in which it is operating and enclosing the entire fan assembly.

B. Fabricate the exterior of the enclosure of fiberglass or Type 316 stainless steel.

C. Provide an enclosure of unitized welded, bolted or screwed panel construction.

D. Access Covers:

1. Provide hinged access covers on all sides and top of the enclosure with lockable latches, locks and keys, 2 sets.

2. Checking, changing and adding lubricant to be capable of being performed without unmounting or removing enclosure and without the use of tools to open the enclosure.

E. Cooling and Insulation

1. Fabricate the enclosure to that the air is controlled and directed over the motor. Interior surface of the enclosure: 2-inch urethane foam with a protective film that is washable and free of perforations and/or materials that would accumulate oil and dust.

2. Provide air circulation fan and thermostat.

F. Provide the enclosure as an integral part of the blower assembly and if size permits ship the blower assembly with the enclosure mounted so that factory quality, as tested, shall be consistent with all units.

2.11 - SHOP PAINTING

A. Primer and Finish Paint: Shop apply to all exterior ferrous surfaces, high solids epoxy in accordance with SECTION 09940, SHOP PAINTING.

B. Ferrous surfaces which are not to be painted shall be given a shop applied coat of grease or rust resistant coating.

C. Provide additional shop paint coating for touch-up to all surfaces after installation and testing is completed and equipment accepted.

2.12 - INTERCONNECTING DUCTWORK

A. Provide the ductwork assembly and design compatible with the fan and vessel.

2.13 – CONTROL PANEL – Not Used.

2.14 - EQUIPMENT SCHEDULE

A. Manufacturers

1. ECS Environmental
2. Pure Air
3. Purafil
4. Or an acceptable equivalent.

B. Carbon Adsorber

1. System Air Flow Capacity: 50 to 175 cfm (m^3/min)
2. Carbon Volume: 9.5 pounds
3. Number of Vessels: 1 per pump station
4. Number of Beds/Vessel: 2
5. Vessel Diameter: 24 inches
6. Vessel Overall Height: 54 inches
7. Vessel Pressure Drop at Design Flow Rate: 4 inches WC

C. Fans

1. Quantity: 1 per unit
2. Fan Rating: As indicated on Fan Schedule
3. Motor HP: As indicated on the Fan Schedule.
4. Motor Enclosure: TEFC
5. Motor Speed: 1800 rpm
6. Drive Type: Direct

PART 3 - EXECUTION

3.01 - VERIFICATION OF CONDITIONS

A. Before the start of the work of this Section, verify that the project is ready for this work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this work and coordinate the work with them.

3.02 - INSTALLATION

A. General

1. Install equipment and appurtenances in accordance with manufacturer's recommendations.

2. Provide all materials and equipment required.

3.03 - PAINTING

A. After installation and approved testing by the Engineer. Contractor shall apply touch-up paint to all scratched, abraided and damaged shop painted surfaces. Coating type and color shall match shop painting.

3.04 – CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment.

B. Spillage of lubricants used in servicing the system shall be cleaned from all equipment and concrete surfaces.

3.05 – MANUFACTURER'S FIELD SERVICES

A. Manufacturer's Field Services shall be provided as specified herein.

3.06 – MANUFACTURER'S TRAINING

A. Manufacturer's training shall be provided as specified herein.

3.07 – LUBRICATION REQUIREMENTS

A. All lubricating oils required for the first year of operation shall be provided.

3.08 - SPARE PARTS

A. Provide in accordance with SECTION 01600, CONTROL OF MATERIALS and as specified herein.

B. Furnish and deliver to Owner at site of Work the following spare parts, all identical and interchangeable with similar parts installed in Work:

1. One of each type pressure gauge, with diaphragm seals or plain, as necessary.

2. Two spare gaskets of all types, materials and sizes.

3. Complete set of replacement belts.

3.09 - ADSORBER

A. Install adsorber and all components in accordance with manufacturer's recommendations.

B. Install adsorber on a concrete pad as indicated on the drawings.

3.10 - FIELD AND FUNCTIONAL TESTING

A. After installation, perform all of the following full operational tests in presence of the Owner. Furnish all labor, materials and equipment required for such tests.

1. Adsorber Vessel:

a. Factory test with water to the height of the overflow or the straight side height of the vessel, greater amount. Submit test data.

b. The water level must be unchanged after 24 hours with no visible signs of leakage or wall deflection exceeding 1/4 percent of span.

2. Start-up:

a. Provide the services of a factory-trained service technician, certified by the manufacturer to service the type of equipment herein specified, to assist in start-up operation.

b. Tests to be performed consist of start-up and operation of entire system at design capacity, and verification of operation of drives and other components, without, overheating, leakage, cracking of parts, structural damage, jamming, binding, or other defects.

c. During tests, make observations of fan head, capacity, and motor input. Promptly correct or replace all equipment not conforming to the requirements of this section revealed by or noted during tests at no additional cost to the Owner.

3. In case of failure to demonstrate ability to function as indicated and specified, modify, rebuild or replace equipment or parts thereof at no additional cost to Owner, until equipment is in accordance with specifications. After three (3) unsuccessful test attempts, replace non-conforming equipment at no additional cost to the Owner. Repeat tests until specified requirements have been met, at no additional cost to the Owner.

3.11 - SYSTEM TESTING

A. Following the Owner approval of start-up results, provide services of an independent State qualified air testing laboratory to measure and report on efficiency and performance of the odor control system. Submit testing procedures of testing laboratory to the Owner at least 15 days prior to tests. Have manufacturer's service technician present during system testing.

3.12 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 16050

ELECTRICAL WORK – GENERAL

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PART 1 - GENERAL

1.01 - SCOPE

A. Provide operational systems for both normal and standby electric power systems, normal and emergency lighting systems, grounding systems, radio system and other specified systems, including the installation and wiring of miscellaneous equipment and devices. Perform all Work and testing as indicated and specified to provide operationally ready electrical systems.

1. Provide conduit, wiring and connections for power, motors, motor controllers, control devices, lighting, control panels, instrumentation and alarms and for equipment furnished by others as indicated on the Contract Drawings.

2. Provide temporary circuits, overcurrent devices, conduit and wiring, and other temporary electrical equipment required to complete the Work of DIVISION 16, ELECTRICAL WORK. All other temporary electrical Work including site temporary power service shall be provided under SECTION 01500, TEMPORARY FACILITIES.

3. Engage the services of an Independent Electrical Testing Firm to perform the field inspections, tests and adjustments specified in SECTION 16998, FIELD INSPECTION AND ACCEPTANCE TESTS.

4. Install all raceways and equipment to meet the seismic requirements of SECTION 01900, SEISMIC AND WIND REQUIREMENTS. Raceways supports and equipment anchoring shall be provided as specified in SECTION 16110, ELECTRICAL RACEWAY SYSTEMS.

5. All electrically powered equipment and devices provided under other Sections are connected to electrical systems as part of the Electrical Work, as indicated. Provide all conduits, wiring and wiring terminations as indicated.

6. Provide all supervision, labor, materials, tools, test instruments or other equipment or services and expenses to test, adjust, set, calibrate, functionally and operationally check all Work and components of the various electrical systems and circuitry throughout the installation.

7. Provide pump station electrical enclosures and components as indicated. Coordinate enclosure size required to contain the components provided under Division 16 and Division 13.

B. Provide set up, and maintain all derricks, hoisting machinery, staging, and planking and perform all hoisting required to complete the Electrical Work.

C. General Contractor to provide earth and rock excavation, backfill, concrete masonry, concrete reinforcement, and construction joints required for Electrical work.

D. Obtain all necessary permits required to complete the work of DIVISION 16, ELECTRICAL WORK.

E. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish

proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Shop Drawings and Data: Include manufacturer's drawings, bills of material, panel and equipment layouts, catalog data, schematics diagrams, interconnection diagrams, wiring diagrams and other documentary or descriptive information for each assembly submitted in one package.
    a. Bills of material: Include a numbered list of all components, with manufacturer's name, catalog number, rating, and other identification. Place item number or identification on all other drawings where item appears.
    b. Submit equipment installation instructions in separate submittals from other shop drawings.
    c. Mark shop drawings and data submitted showing only items applicable to specific contract.
    d. Make submission of drawings for those components where dimensions of equipment, location of conduit entrances, are required to facilitate construction in accordance with the construction schedule.
    e. Include one-line diagrams, schematic diagrams, wiring diagrams, control sequence diagrams, relay diagrams, and metering. Submit only completed drawings showing all local and remote devices associated with each item. Submit one complete package of shop drawings. Partial submittals will be returned without action.
    f. Submit time-current characteristic curves for all circuit breakers and fuses.
    g. Submit instruction manuals for installation, operation, and maintenance of equipment, and parts list. Mark standard publications forming a part of this contract. Cross out, blank out, or otherwise delete non-applicable items. Submittals which do not clearly indicate items and features provided will be rejected.
    h. Install permanent nameplates on all devices or pieces of equipment for which use or identification is not readily apparent, such as starters, relays, contactors, pushbuttons, indicating lights, and switches. Make sure position of nameplates are readable after equipment installation.
    i. Provide services of the manufacturer's representative as specified in the applicable specification sections.
2. Submit inspection and testing forms for all electrical distribution equipment to be inspected and tested under this section.

3. Submit data sheets for the insulation resistance testing of conductors and equipment prior to performing operating testing. List all cables and equipment to be tested.

4. Provide space on data sheet forms to enter the results of testing, instruments used with serial numbers, and name of personnel performing testing. This data to be filled out during testing.

1.05 - PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed according to the written recommendations of the supplier and as to not to degrade quality, serviceability or appearance.

1.06 - DESIGN CRITERIA

A. The Diesel Generator Systems shall be supplied under SECTION 11398, DIESEL ENGINE-GENERATOR SET AND APPURTENANCES. Provide all conduit, wiring and terminations for system operation as indicated.

B. Provide conduit, wiring and terminations for all field-mounted instruments furnished and mounted under other Divisions, including process instrumentation primary elements, transmitters, local indicators and control panels. Install vendor furnished cables specified under SECTION 13300, INSTRUMENTATION AND CONTROL SYSTEM – GENERAL.

C. Provide conduits, wiring and terminations for power feeders for HVAC equipment provided under DIVISION 15, MECHANICAL and as shown on the electrical drawings.

D. Provide and install control stations shown on the electrical drawings local to equipment supplied under other divisions.

E. Provide and install safety disconnect switches shown on the electrical drawings local to equipment supplied under other divisions.

F. Motors shall be provided by the Contractor under SECTION 01171, ELECTRIC MOTORS. All associated conduit, wire and terminations of motors shall be provided under DIVISIONS 16, ELECTRICAL WORK.

1.07 - REFERENCES

A. National Electrical Safety Code (NESC)

B. Occupational Safety and Health Administration (OSHA)

1. OSHA Part 1910; Subpart S, 1910.308

2. OSHA Part 1926; Subpart V, 1926.950 through 1926.960

C. National Fire Protection Association (NFPA)

1. ANSI/NFPA 70B: Electrical Equipment Maintenance

2. NFPA 70E: Electrical Safety Requirements for Employer Workplaces

3. ANSI/NFPA 70: National Electrical Code

4. ANSI/NFPA 780: Lightning Protection Code

5. ANSI/NFPA 101: Life Safety Code

D. National Electrical Manufacturers Association (NEMA)

E. American National Standards Institute (ANSI)

1. ANSI C2: National Electrical Safety Code

2. ANSI Z244-1: American National Standard for Personnel Protection

F. Insulated Cable Consultants Association (ICEA)

G. Instrument Society of America (ISA)

H. Underwriters Laboratories (UL)

I. Factory Mutual (FM)

J. International Electrical Testing Association (NETA) – Acceptance Testing Specification for Electric Power Distribution Equipment and Systems (STD)

K. Institute of Electrical and Electronics Engineers (IEEE)

L. Massachusetts Electrical Code

M. All inspections and tests shall utilize the following references:

1. Project Design Specifications
2. Project Design Drawings
3. Project Short Circuit and Coordination Study
4. Manufacturer’s shop drawings submittals and instruction manuals applicable to each particular apparatus

1.08 - QUALITY ASSURANCE

A. Install electrical Work in conformance with latest rules and requirements of National Fire Protection Association Standard No. 70 (National Electrical Code) and the Massachusetts Electrical Code.

1.09 - INTERFERENCE AND ERRONEOUS LOCATIONS

A. Verify in field, all data and final locations of Work installed under other Sections required for placing of electrical Work.

B. Do not run conduit in floor slabs or walls of buildings unless indicated.

1.10 - APPROVAL AND MARKING EQUIPMENT

A. All devices and materials shall be listed and/or labeled by Underwriters' Laboratories, Inc., wherever standards have been established by that agency. Where Underwriters' Laboratories listing is not available for equipment, submit certified test reports of recognized, independent testing laboratory, approved by the local inspecting authority, indicating that equipment is in conformance with local code requirements or any other applicable requirements.

B. Mark equipment, devices and material with name or trademark of manufacturer and rating in volts and amperes and other information on a nameplate.

1.11 - ELECTRICAL SYSTEM STUDIES

A. Provide electrical system studies as specified in SECTION 16359, ELECTRICAL SYSTEM STUDIES. The specialty firm performing the study shall have no contractual or business ties with the electrical distribution system supplier.

B. The electrical system protection trip settings resulting from the study shall be provided to the electrical testing firm specified under SECTION 16998, FIELD INSPECTION AND ACCEPTANCE TESTS to adjust and set the electrical system parameters in the field.

C. The Arc Flash Labels shall be generated by the specialty firm under SECTION 16359, ELECTRICAL SYSTEM STUDIES and installed in the field by the Contractor under DIVISION 16, ELECTRICAL WORK.

1.12 - ELECTRIC SERVICE

A. Electrical power system for the facility shall operate at 480 volt, 3-phase, 4-wire, 60-Hertz.

1. Provide electrical low voltage distribution system that operates on 120/208 volt, 3-phase, 4 wire, 60-Hertz obtained from the power system by step down transformer(s).

1.13 - INCOMING ELECTRIC SERVICE

A. Contact the following organization for coordinating the incoming power requirements for the project:

EVERSOURCE

Ms. Kathleen White

484 Willow Street

Yarmouth, MA 02673

Kathleen.white@eversource.com

(508) 790-9021

B. The organization identified above will furnish and install:

1. Pad-mounted transformer, including metering equipment.
2. Primary cable.
3. Connection and terminations of all primary cables at the service transformer.

C. The following shall be furnished and installed under this division.

1. Concrete pad for transformer in accordance to Eversource standards.
2. Primary and secondary concrete encased ductlines including manholes and handholes.
3. Secondary cables of sufficient length for termination at the transformer.
4. Connection and terminations of all secondary cables at the service transformer.
5. Grounding at pad.

1.14 - HAZARDOUS AREAS

A. Equipment, materials and installation in areas designated as hazardous shall comply with NEC Articles 500, 501, 502 and 503.

B. Equipment and materials installed in hazardous areas shall be UL listed for the hazardous area classification.

1.15 - CODE, INSPECTION AND FEES

A. Equipment, materials and installations shall comply with the requirements of the local authority having jurisdiction.

B. Obtain all permits and arrange for all inspections.

1.16 - TESTS AND SETTINGS

A. Test systems and equipment furnished under DIVISION 16, ELECTRICAL WORK and replace all defective Work and equipment at no additional cost. Refer to the individual equipment sections and SECTION 16998, FIELD INSPECTION AND ACCEPTANCE TESTS for additional specific testing requirements. Employ the services of an Independent Testing Company, other than the manufacturer of the electrical distribution system, to perform the tests specified.

B. Field testing and commissioning shall be performed in accordance with the latest revisions of NETA Standard ATS “Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems” and SECTION 16998, FIELD INSPECTION AND ACCEPTANCE TESTS.

C. A typed test report for each component tested shall be submitted. The firm doing the testing shall include, in the report, their opinion whether or not the equipment being tested complies with the specification. Any discrepancies shall be noted in the concluding summary of the report. Test report forms shall be in compliance with NETA standards. Five complete copies shall be provided. Reports shall be signed by the person in charge of the field testing, an officer of the firm performing the tests and an officer of the Electrical Subcontractor.

D. In addition to the specific testing requirements listed in the individual sections, the following tests and settings shall be performed:

1. Mechanical inspection, testing and settings of circuit breakers, disconnect switches, motor starters, overload relays, control circuits and equipment for operation.

2. Check the full load current draw of each motor. Check ampere rating of thermal overloads for motors and submit a typed record of the same, including MCC cubicle location and driven load designation, motor service factor, horsepower, and Code letter. If incorrect thermal overloads are installed replace same with the correct size overload.

3. Check power and control power fuse ratings. Replace fuses if they are found to be of the incorrect size.

4. Check settings of the motor circuit protectors. Adjust settings to allow the motor to be started when under load conditions.

5. Check motor nameplates for correct phase and voltage.

6. Check rotation of motors prior to testing the driven load.

7. Check interlocking, control and instrument wiring for each system and/or part of a system to prove that the system will function as indicted by control schematic and wiring diagrams.

8. Inspect each piece of equipment in areas designated as HAZARDOUS to make sure that installed equipment has rating as specified in Paragraph 1.14.

9. Verify all terminations at transformers, equipment, panels and enclosures by producing a 1, 2, 3 rotation on a phase sequenced motor when connected to “A”, “B” and “C” phases.

1.17 - INTERPRETATION OF DRAWINGS

A. Coordinate the conduit installation with other trades and the actual supplied equipment. Coordinate equipment conduits top and/or bottom entries as required for the equipment installation and as specified and indicated on the Contract Drawings.

B. Install each 3-phase circuit in a separate conduit unless otherwise indicated.

C. Install all conduits and wiring system as indicated on and matching the Contract drawings. Conduits shall not be combined unless otherwise indicated on Contract drawings.

D. Conduit shown exposed shall be installed exposed; conduit shown concealed should be installed concealed.

E. All fittings and boxes shall be provided for a complete raceway installation.

F. Verify the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installations.

G. Except where dimensions are shown, the locations of equipment, fixtures, and outlets indicated are approximate only. Obtain information relevant to the placing of electrical Work and in case of any interference with other Work.

H. Circuit layouts are not intended to show the number of fittings, pull boxes, or other installation details. Furnish all labor and materials to install and place in operation all power, lighting and other electrical systems indicated.

I. Raceways and conductors for the fire alarm and telephone systems are not indicated. Interconnection descriptions are indicated in their Riser Diagrams as indicated. Provide raceways and conductors, as required by the system manufacturer, for a complete and operating system. Raceways shall be installed concealed in all finished spaces and installed exposed in process spaces.

J. Raceways and conductors for lighting, switches, receptacles, and other miscellaneous low voltage power and signal systems as specified are not indicated. Raceways and conductors shall be provided for lighting, switches and receptacles for a complete and operating system.

1.18 - PHASE BALANCING

A. The drawings do not attempt to balance the electrical loads across the phases. Circuits on motor control centers and panelboards shall be field connected to result in evenly balanced loads across all phases.

B. Field balancing of circuits shall not alter the conductor color coding requirements as specified in SECTION 16120, ELECTRIC WIRES AND CABLES.

1.19 - SIZE OF EQUIPMENT

A. Investigate each space in the structure through which equipment must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.

B. The equipment shall be kept upright at all times during storage and handling.

C. Equipment shall not be physically larger than what is shown on the Contract Drawings.

1.20 - EQUIPMENT IDENTIFICATION

A. Identify equipment furnished under DIVISION 16, ELECTRICAL WORK with the name of the equipment it serves. Switchboard, motor control centers, control panels, panelboards, junction or terminal boxes shall have nameplate designations as indicated. Equipment nomenclature and identification system shall be as specified herein.

B. Nameplates shall be engraved, laminated plastic, 1/16-in. thick by 3/4-in by 2-1/2-in. with 3/16-in. high white letters on a black background.

C. Nameplates shall be screw mounted to NEMA 1 enclosures. Nameplates shall be bonded to all other enclosure types using a waterproof epoxy adhesive. Two-sided foam adhesive tape shall not be used. Where the equipment size does not have space for mounting a nameplate the nameplate shall be permanently fastened to the adjacent mounting surface.

1.21 - SEQUENCING AND SCHEDULING DEMOLITION WORK

A. Remove and demolish equipment and materials in such a sequence that the existing and proposed plant will function properly with no disruption of power. Obtain Owner's consent before removing any circuit from continuous service.

1.22 – FAULT CURRENT AND ARC FLASH HAZARD LEVEL LABELING:

A. Provide label describing fault current availability at the meter socket. Affix label to meter socket.

B. Provide label describing the arc flash hazard at the required equipment. Label shall display the following information:

1. Available incident energy and the corresponding working distance
2. Minimum arc rating of clothing
3. Required level of personal protective equipment (PPE)
4. Highest hazard/risk category for the equipment
5. Nominal system voltage
6. Arc flash boundary
7. Shock hazard

C. Perform a calculation to determine the arc flash hazard level at the panelboards

D. Acquire the utility fault current availability from the utility.

E. Use arc flash tables in NFPA 70E.

PART 2 – PRODUCTS – Not Used

PART 3 - EXECUTION

3.01 - REMOVAL AND RELOCATION OF MATERIAL AND EQUIPMENT

A. Carefully dismantle and salvage electrical equipment, switches, fixtures, conduits, cables, wiring, boxes, as necessary to carry out proposed changes. Rehabilitate and relocate items of equipment as required and as indicated or specified.

B. Remove from site and dispose of material and equipment removed.

3.02 - DEMOLITION

A. Survey the existing electrical systems and equipment identified for removal with representatives from the other trades and civil site work prior to performing any demolition work. Identify all conduit and equipment to be removed with tags or paint.

B. Where equipment is to be removed all associated ancillary components (e.g. supports, handholes, poles, fixtures, etc.) and associated wiring and conduit shall also be removed.

C. Equipment, building or structures scheduled for complete demolition shall be made safe from electrical shock hazard prior to demolition. Disconnect and remove all electrical power, communications, controls, alarm and signal system.

D. Existing underground electrical systems feeding equipment, building or structures scheduled for complete demolition shall be made safe, disconnected and removed.

E. Equipment scheduled to be turned over to the Owner shall be carefully disconnected, removed and delivered to the Owner where indicated. Provide labor, hoisting and transportation of the equipment. All other miscellaneous electrical materials, devices, etc., associated with the equipment being turned over shall be demolished and removed from the site.

F. Remove electrical work associated with equipment scheduled for demolition except those portions to remain or be reused.

G. Unless otherwise specifically noted, remove unused exposed conduit and support systems back to point of concealment including abandoned circuit above accessible ceiling finishes. Removed unused wiring back to source (or nearest point of usage).

H. Disconnect and remove abandoned electrical equipment unless otherwise indicated or specified.

I. Disconnect and remove abandoned luminaries. Remove brackets, stems, hangers and other accessories.

J. Repair adjacent construction and finishes damaged during demolition and extension work.

K. Where electrical systems pass through the demolition areas to serve other portions of the premises, they shall remain or be suitably relocated and the system restored to normal operation.

L. Trace out existing wiring that is to be relocated or removed and perform the relocation or removed work as required for a complete operating and safe system.

M. Remove exposed conduits, wireways, outlet boxes, pull boxes and hangers made obsolete by the alterations, unless specifically designated to remain. Patch surfaces and provide blank covers for abandoned outlets which are removed.

3.03 - PROTECTION OF ELECTRICAL EQUIPMENT

A. Store equipment in compliance with manufacturer’s recommendations and as specified herein.

B. Protect electrical equipment from the weather, especially from water dripping or splashing upon it, at all times during shipment, storage, and construction.

C. Do not store equipment outdoors.

D. Where equipment is installed or stored in moist areas, or unheated buildings, provide acceptable means to prevent moisture damage. Provide uniformly distributed source of heat in electrical equipment to prevent condensation and damage to electrical insulation systems.

3.04 - DEFECTIVE OR DAMAGED EQUIPMENT

A. Damaged equipment shall not be used. Equipment damaged in shipment, storage, installation or through other means shall be replaced without additional cost.

B. All equipment showing signs of damage shall be rejected regardless of dielectric test results.

C. All electrical equipment is considered “in storage” regardless of location until first energized. Manufacturer’s recommendations for storage precautions, conditions and care shall be followed.

D. Equipment that found to be damaged or failed the field inspection and acceptance tests specified under SECTION 16998, FIELD INSPECTION AND ACCEPTANCE TESTS shall be replaced at no additional cost.

3.05 - STARTING EQUIPMENT DATA LIST

A. Obtain data from the equipment supplier shop drawing submittals or equipment nameplates and prepare a complete tabulation of all motors over 1/3 hp, electric heaters over 1 kW, air conditioning units and starting equipment, to be furnished on the project.

1. Include in tabulation form the following information:
    a. Name and identification of equipment.
    b. Manufacturer.
    c. Horsepower or kilowatt rating.
    d. Voltage.
    e. Phase.
    f. Speed.
    g. Full load current.
    h. Locked rotor current or code letter.
    i. Type of enclosure (open drip-proof, totally enclosed, fan cooled, etc.).
    j. NEMA size of starter or contactor.
    k. Overload heater size.
    l. Type of starter (full-voltage, reduced-voltage, autotransformer, etc.).
    m. Breaker trip setting or fuse size.
    n. Voltage of starter operating coil.
    o. If starter is at a motor control center, list motor control center number.
2. Final acceptance of the electrical system is contingent upon submittal of the complete motor and equipment tabulation.
3. Arrange tabulation in groups by building location.
4. Furnish six copies of the tabulation to the Engineer when a submission is made.

3.06 - EQUIPMENT ENCLOSURE

A. The equipment enclosure classification of the facility areas is indicated within the Area Classification Schedule shown on the drawings. Provide all equipment, devices, installations and material meeting the requirements of this schedule.

3.07 - AS BUILT DRAWINGS

A. At the completion of the Project, provide two sets of contract drawings that are marked to show the as-installed equipment, devices, conduits, underground duct lines locations, layouts, wiring and any revisions to the Contract Drawings occurred during construction. As built drawings markup shall be complete and provide a detailed and accurate representation of as installed field conditions of all equipment provided under this Contract.

3.09 - INSTALLATION

A. Provide conduit, wire and field connections for all motors, motor controllers, control devices, control panels and electrical equipment furnished under other Divisions.

1. All dimensions shall be field verified at the job site and coordinated with the Work of all other trades.

2. Provide electrical installation working drawings containing the following:

a. Concealed and buried conduit layouts, shown on floor plans. The layouts shall include locations of process equipment, motor control centers, transformers, panelboards, control panels and equipment, motors, switches, motor starters, junction or pull boxes, instruments and other electrical devices connected to concealed or buried conduits.

b. Coordinate all Work with other divisions.

3.10 - SLEEVES AND FORMS FOR OPENINGS

A. Provide and place all sleeves for conduits penetrating floors, walls, partitions. Locate all slots for electrical Work and form before concrete is poured.

B. Exact locations are required for stubbing-up and terminating concealed conduit. Obtain shop drawings and templates from equipment vendors or other Subcontractors and locate the concealed conduit before the slab is poured.

C. Seal all openings, sleeves, penetration and slots as specified in SECTION 16110, ELECTRICAL RACEWAY SYSTEMS.

3.11 - CUTTING AND PATCHING

A. Arrange installation of all Work such that cutting and patching is not required.

B. Do not cut joints, beams, girders, columns or any other structural members.

3.12 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTACT CLOSEOUT.

END OF SECTION

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SECTION 16110

ELECTRICAL RACEWAY SYSTEMS

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PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide Raceway Systems, with Matching Accessories, Fittings and Boxes as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

C. All raceway runs are indicated diagrammatically to outline general routing of raceway. Unless specifically identified for installation in concrete walls or slabs, raceways shall be run exposed with raceway supporting systems. Avoid interfering with pipes, ducts, structural members, or other equipment.

D. Raceways and conductors between lighting, switches, receptacles and other miscellaneous low voltage and signal systems as specified and indicated are not shown on the Plan View Drawings. Raceways and conductors shall be provided for complete and operating systems. Conduit and wiring descriptions are indicated on the Riser Diagrams for power and instrumentation Systems. Raceways shall be installed exposed unless otherwise indicated. Avoid conflicts with HVAC ducts, equipment hatches, doors, windows, structural beams and process equipment.

E. Provide raceway systems in accordance with the following:

1. In NEMA 1, NEMA 4 or NEMA 12 areas, use galvanized rigid steel raceway systems, fittings and accessories.

2. In chemical areas and those areas designated NEMA 4X, use PVC coated rigid steel raceway systems, fittings and accessories.

3. In classified hazardous areas designated as Class I, Division 1 and Class I, Division 2, use PVC coated rigid steel raceway systems, fittings and accessories with tapered threads and sealing fittings as required by the Massachusetts Electrical Code for hazardous applications.

F. All raceway systems shall be installed in accordance with the criteria described in this section.

1. Use Type 316 stainless steel support systems for exterior application, hazardous areas, NEMA 4 and in NEMA 4X areas.

2. NEMA 1 and NEMA 12 areas shall use hot dipped galvanized steel support systems.

G. Aluminum conduit and boxes shall not be used.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

1. Submit shop drawings and manufacturer’s product data for all raceway systems, accessories, supports and miscellaneous hardware in accordance with the requirements of SECTION 16050, GENERAL ELECTRICAL.
2. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance.
    a. Failure to include a copy of the marked-up specification sections will result in return of the entire submittal without further review and consideration until the marked-up specification are re-submitted with the entire package.

1.05 - PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

B. The design conditions and other pertinent requirements for the equipment are listed on the Contract Drawings.

1.07 - REFERENCES

A. National Fire Protection Association (NFPA):

1. National Electrical Code (NEC)

B. Massachusetts Electrical Code

C. Underwriter's Laboratories, Inc. (UL):

1. U.L.-1: Electrical Flexible Metal Conduit
2. U.L.-6: Rigid Metal Electrical Conduit
3. U.L.-360: Electrical Liquid-Tight Flexible Steel
4. U.L.-651: Schedule 40 and 80 PVC Conduit
5. U.L.-886: Electrical Outlet Boxes and Fittings for Use in Hazardous Locations, Class 1, Groups A, B, C, and D and Class 11, Groups E, F, and G

D. National Electrical Manufacturers Association (NEMA):

1. RN-1: Polyvinylchloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
2. TC-2: Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)

1.08 - SEISMIC REQUIREMENTS

A. All raceways shall be supported to Massachusetts Electrical Code requirements and conform to the requirements as indicated on the structural drawings and as defined in SECTION 01900, SEISMIC AND WIND REQUIREMENTS.

PART 2 - PRODUCTS

2.01 - ACCEPTABLE MANUFACTURERS

A. Rigid Metal Conduit and polyvinylchloride-coated rigid steel conduit

1. Triangle/PWC, Inc.
2. Perma-Cote Industries.
3. Republic Steel Corporation.
4. Robroy Industries.
5. Or equal.

B. Polyvinylchloride (PVC) Conduit

1. Triangle/PWC, Inc.
2. Robroy Industries.
3. Carlon Electrical Sciences, Inc.
4. Or equal.

C. Flexible Conduit

1. American Flexible Conduit Company.
2. Anamet, Inc.
3. Electri-Flex Company.
4. International Metal Hose Company.
5. Or equal.

D. Boxes and Fittings

1. O.Z./Gedney Company.
2. Crouse-Hinds Electrical Construction Materials.
3. Appleton Electric Company.
4. Or equal.

E. Fiberglass-Reinforced Polyester Boxes

1. Crouse-Hinds Electrical Construction Materials.
2. Fibox.
3. Hoffman Engineering Company.
4. Vynckier Enclosure Systems.
5. Or equal.

F. Support Systems

1. Michigan Hanger Co., (O-Strut).
2. Thomas & Betts (Superstrut).
3. Unistrut Corp.
4. Or equal.

2.02 - MATERIALS AND COMPONENTS

A. Rigid Metal Conduit

1. Provide galvanized rigid metal conduit, each with a coupling on one end and thread protector on other end.
2. Hot-dip galvanize rigid steel conduit over entire length, along interior and exterior surfaces, including threads. Conduit shall conform to U.L.-6.

B. Flexible-Metal Conduit

1. Provide flexible-metal conduit for use in NEMA-1 and NEMA-12 dry areas and match fittings, size, and material to rigid conduit to which it is connected. Flexible-metal conduit shall conform to U.L.-1.
2. Provide liquid-tight PVC coated flexible-metal conduit for use in NEMA-4 damp areas consisting of flexible-metal conduit, with liquid-tight, sunlight-resistant jacket extruded over the conduit. All fittings and accessories shall be PVC coated. Provide stainless steel, braided flexible conduit in NEMA 4X, corrosive areas. On larger than 1-1/4-in., furnish separate external ground wire. Liquid-Tight flexible-metal conduit shall conform to U.L.-360.
3. Provide stainless steel braided flexible conduit in all hazardous areas.

C. Polyvinylchloride (PVC) Conduit

1. Provide PVC conduit, Schedule 40 conforming to NEMA Standard TC-2 and UL-651. PVC Schedule 40 conduit shall not to be used unless embedded in concrete and unless otherwise indicated on the drawings.

D. Polyvinylchloride-Coated Rigid Steel Conduit

1. Provide polyvinylchloride-coated (PVC-Coated), rigid steel conduit conforming to NEMA Standard RN-1 consisting of hot-dipped galvanized rigid steel conduit, with a polyvinylchloride jacket bonded to the outside of all conduit surfaces with a nominal thickness of 40 mils meeting the requirements of NEMA RN-1, 3.1. The adhesive strength of the bonding to equal or exceed tensile strength of the coating. Provide couplings and fittings for this conduit conforming to the requirements of NEMA RN-1, 3.5.

2. A two-part urethane coating shall be applied to the interior of all conduit and fittings at a two-mil thickness. The interior coating shall be flexible to allow field bending without cracking or flaking.

E. Boxes

1. In NEMA 1 and NEMA 12 areas, provide standard, sheet-metal, outlet and junction boxes constructed of code-gauge, galvanized sheet steel. Size each box by the Massachusetts Electric Code.

2. Provide boxes containing fixture studs for hanging fixtures. Use concrete-tight boxes for installation in concrete. Do not use shallow boxes unless building construction is such that it is impossible to use standard-depth boxes.

3. Provide outlet boxes and fittings for hazardous locations conforming to U.L.-886 for class, group, and division indicated. Outlet boxes and fittings for hazardous areas shall also meet requirements of NEMA 4 areas.

4. Provide boxes and covers for polyvinylchloride-coated steel conduit made of fiberglass reinforced resin or, in classified areas and outside, galvanized cast iron, with a polyvinylchloride factory-applied coating over the galvanizing. Provide coating thickness of 40- mil. Boxes shall have hubs with extruded sleeves extending beyond the hub in the same manner as specified for conduit couplings. Provide cover screws of Type 316 stainless steel.

5. Provide cast boxes with covers or device plates that can be used for the area classification. Use cover screws of Type 316 stainless steel or high brass for iron boxes.

6. Provide boxes for use with polyvinylchloride conduit made of polyvinylchloride for use as junction boxes and provide high impact strength fiberglass-reinforced polyester boxes for use as device boxes, pull boxes, and terminal boxes. Size each box as required by the Massachusetts Electrical Code.

7. Where designated in the drawings, provide pull boxes above or below motor control center installations 20 inches by 20 inches by 12 inches deep. Boxes of dimensions 10 inches by 10 inches by 6 inches deep and larger shall be hung from ceilings constructed of angle or channel frames. Provide neoprene gaskets for sealing. Sectionalize covers longer than 36-in. to facilitate handling and gasket sectionalized covers where covers meet, using angle iron or channel cross members at the joint. Sheet metal shall be No. 12-gauge galvanized sheet steel. Fabricate interior angles and supports of galvanized steel. Provide each box with a grounding lug for connection to the nearest ground bus. Current capacity of ground lug shall be that required by the Massachusetts Electrical Code for the largest feeder entering the equipment.

8. Provide terminal blocks in all terminal boxes, panels, and instrumentation cabinets/panels requiring terminations as indicated or by wiring diagrams for equipment actually purchased. All terminals shall be rated 600V, 20 amp. All terminals shall be screw type with provisions for white markers.

9. In NEMA 4 and NEMA 4X areas, provide 316L stainless steel outlet and junction boxes. Size each box as required by the Massachusetts Electric Code.

F. Fittings

1. Provide cast-iron fittings of malleable iron or a mixture of gray iron and cast steel.
2. Provide expansion fittings where conduits cross expansion joints. Equip these fittings with grounding straps, clamps, and copper bonding jumpers.
3. For PVC conduit, provide PVC fittings that can be solvent welded to match conduit.
4. Provide PVC-coated coupling and fittings for PVC-coated conduit with an integral, bonded, overlapping pressure-sealing sleeve of the same thickness as conduit coating. Provide extended sleeves one pipe diameter or 2-in. (whichever is less) beyond the end of the coupling so sleeve of coupling makes a watertight fit with the plastic jacket on the conduit when coupled together. Sealing sleeves at threaded connections shall seal out vapors and liquids.
5. Provide PVC coated fittings and accessories with PVC-coated rigid galvanized steel conduit.

G. Supports

1. Provide raceway component supports which are meant to function with the raceway and will support the raceway as indicated and meet the NEC and manufacturer's requirements.
2. Provide Type 316 stainless steel hangers, threaded rods, channels, straps, clips, and clamps for raceways provided in hazardous areas, NEMA-4 and NEMA-4X areas. Provide stainless steel bolts, nuts and washers.
3. Provide hot dipped galvanized steel support system for raceways installed exposed in NEMA-1 and NEMA-12 areas.
4. Provide support for flexible conduit with components which do not compress and do not deform conduit.

PART 3 - EXECUTION

3.01 - INSTALLATION

A. Provide all material, equipment, and labor to install the electrical raceway systems as indicated and as specified herein.

B. Perform all Work in accordance with the Massachusetts Electric Code.

C. Use no conduit less than 3/4-in. in diameter.

D. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's printed instructions.

3.02 - METHODS OF RESTRAINING RACEWAYS

A. Utilize threaded rod with rod stiffeners and transverse channel braces at 45 degrees angle, at 15-ft. on center, maximum, and on one side of rod support.

B. Utilize longitudinal bracing with channel braces at 30 feet on center, maximum.

C. Strap raceways directly to transverse channel braces, using pipe strap with both ends of strap bolted into the channel brace.

D. Do not rigidly brace raceways to different parts of a building that may respond differently during an earthquake. Seismic restraints shall not limit expansion and contraction of the raceway support system.

E. Provide flexible connections for conduits 2-in. outside diameter or greater than when terminating to fixed equipment to prevent loss of raceway integrity in the event of an earthquake.

3.03 - INSTALLATION OF FITTINGS

A. Install expansion fittings and bonding jumpers wherever conduits cross structural expansion joints. Keep the fittings in line with conduit and install with regard to temperature so that full working range of expansion is available.

B. Do not install fittings to replace elbows and pull boxes. Use oversize fittings whenever large cable is installed, in order to maintain bending radius.

C. Terminate ends of all floor conduits installed for future use with couplings and readily removable plugs set flush with finished floor surface. Cap spare wall conduits at wall where they enter building.

D. Equip ends of all conduits with conduit fittings. Fit conduits terminating at motor control center or power distribution equipment, or in box above or below, with grounding type bushings, or solidly ground by locknuts or other fittings. Connect each grounding bushing to ground bus by a bare or green-covered copper wire. Do not use ground wire smaller than 12 awg. Install ground wire larger than 12 gauge when indicated. Where conduits terminate in unprotected areas or where bonding is required over expansion joint, flexible conduit or equivalent; use ground wires No. 6 Awg. copper or larger. Copper bonding jumpers are required over expansion joints.

E. Terminate conduits entering gasketed sheet-metal boxes or gasketed sheet-metal equipment enclosures with gasketed hubs.

F. Terminate conduits entering non-gasketed sheet-metal boxes or enclosures with double locknuts and insulated bushings, or equivalent.

G. Make joints tight. Use raceway fittings compatible with raceway use and location.

3.04 - INSTALLATION OF RACEWAYS

A. Install exposed raceways parallel or at right angles to walls and ceiling beams. Make all changes in directions with bends, elbows, and pull boxes. Space parallel runs evenly throughout. Attach in place with hangers and fasteners. Ground raceways by connection to grounded enclosures, bonding, or other means, to obtain permanent low resistance path to ground throughout installation. Raceway sections in single run and in parallel runs shall be of same type and finish.

1. Run parallel or banked raceways together, on common supports.

2. Install raceways level and square. Provide minimum 7 ft. headroom.

B. Support raceways concealed above suspended ceilings from slab above ceiling in same manner as exposed raceways. Do not support raceways from ceiling supports.

C. Provide cast-in-place inserts in concrete to support all runs, unless otherwise permitted. Use stainless steel sleeve type concrete anchors for installing boxes, and conduit supports. Provide Type 316 stainless steel nuts, bolts, and washers, for use with concrete anchors. Wedge inserts shall not be used.

D. Support conduits by hangers or pipe straps spaced according to Massachusetts Electrical Code, but in no case more than 10 feet on centers.

E. Stub-Up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with PVC coated rigid steel conduit. Flexible metal conduit may be used 6 inches above the floor.

F. Provide sleeves passing through exterior walls and slabs which are wall entrance seals of watertight construction. Furnish watertight seal between slab and sleeve, and between sleeve and conduit or cable. Use wall-entrance seals of malleable iron with watertight sealing gland which may be tightened any time after installation.

G. Do not use dissimilar metals in conjunction with each other. Use insulation between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. Maintain electrical continuity of system. Use bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers as insulation.

H. Install fittings to match raceway being used.

I. Install expansion fittings wherever conduits cross structural expansion joints. Keep fittings in line with conduit and install with regard to temperature so that full working range of expansion is available.

J. Where conduits pass through firewalls, grout hole around the conduit to the full depth of the material penetrated using U.L. listed fire stop material.

K. Provide separate metallic raceways for all low voltage instrumentation raceways 50 volts and below shielded wiring, data highway wiring, and fire alarm wiring and install 12-inches from control and power raceways.

L. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely, and install the locknuts with dished part against the box; use two locknuts, one inside and one outside the box.

M. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

N. Install pull wires in all empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line having 200-lb. tensile strength. Leave 12 inches of slack at each end of the pull wire.

O. Keep raceways 6 inches away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.

P. Complete raceway installation before beginning conductor installation.

Q. Use temporary closures to prevent foreign matter from entering raceway.

R. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

S. Conduit in transition (from below to above grade, through walls and through concrete) shall be PVC coated rigid galvanized steel (PVC-RGS). The transition shall be made below grade at the final sweep before the transition for exposed conduit. PVC-RGS conduit shall extend one (1) foot minimum above transition finished floor.

3.05 - BENDS

A. Make all bends to prevent distortion of circular cross section. Field bent conduit shall have an inside radius of nine diameters.

B. The maximum number of bends in any single conduit run shall be in accordance with the Massachusetts Electrical Code requirements.

3.06 - CUTTING, THREADING AND CONNECTING

A. Make all field cuts in conduits squarely, file cut ends, ream to remove rough edges and thread in accordance with Massachusetts Electric Code. No running thread shall be permitted. Make all connections mechanically strong and tight, with connectors. Where conduit surface coating is damaged or removed in the cutting, threading or reaming process, restore the surface to its original condition.

3.07 - CONDUIT CLEANING

A. Clean conduits before and after installation, ream ends free of burrs, and free inside surfaces from all imperfections.

B. After installation of each new conduit run, snake the run with band to which is attached a tube cleaner with cylindrical mandrel of a diameter 85 percent of nominal diameter of conduit. Remove and replace all conduit through which mandrel will not pass.

C. Use a sponge with steel brush to clean steel conduit and use a sponge with nylon brush to clean PVC conduits.

D. After cleaning, protect ends of all conduit with standard caps to prevent entrance of water, concrete, debris, or other foreign substance.

3.08 - CONDUIT DRAINAGE

A. Pitch conduit to drain to outlet boxes or install so as to avoid trapping moisture. Where dips are unavoidable in exposed conduits, install fitting to match conduit system with drain hole at low point.

3.09 - INSTALLATION OF BOXES

A. Unless otherwise indicated, install NEMA 1 or NEMA 12 sheet metal boxes only in dry, accessible locations. Install NEMA 4 and 4X rated boxes in exterior concrete or masonry walls, in floor slabs, in basements, all other below grade locations and elsewhere as indicated. Unless otherwise indicated, cast metal boxes shall be used where vapor-tight fixtures are required, for all surface mounting of wall switches and receptacles and for all outdoor use.

B. Install boxes in conformance with all the requirements of Massachusetts Electric Code. Install boxes designed for type of construction involved. Support boxes in same manner as conduit. Size boxes to provide bending radius for wire or cable of eight times diameter or in accordance with Massachusetts Electric Code, whichever is larger.

C. Center all outlets in panels, or spaces and adjust to structural finish. Where specific locations are not indicated, locate outlets with respect to equipment served.

D. Place all outlet boxes, junction boxes and pull boxes, in accessible locations when they are installed above or behind plastered ceilings, furred spaces, or suspended ceilings. Install access panels. Mark all access panels for all boxes so panels can be readily located in future. Mark, using metal tabs or plastic buttons which cannot mark ceilings or walls, that can be used for type of construction being used.

E. Assemble cast-metal boxes with threaded conduit hubs in such manner that conduit connections and gasketed covers are watertight. Close all unused threaded openings with pipe plugs and compound.

F. Provide cast boxes with covers and device plates that can be used for the area classification. Install screws of Type 316 stainless steel or high brass for iron boxes.

3.10 - FLEXIBLE CONNECTIONS TO MOTORS AND EQUIPMENT

A. At all motors and electrically operated equipment to which conduit connections are made, install with a connection between end of conduit and terminal box of motor or other equipment.

B. Install the conduits in locations permitting direct connection to motors.

C. Make connections between rigid raceway and motor or equipment subject to vibration and adjustment using flexible conduit. Make each connection with one quarter bend so that no vibration can be transmitted beyond flexible connection.

D. Use maximum of 6 feet of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquid tight flexible conduit in wet or damp locations. Install liquid-tight flexible metal conduit in areas subject to wetting due to fire protection sprinklers or broken or ruptured water line. Locate conduit to reduce the possibility of damage to the exterior flexible conduit jacket. Use fittings that screw into flexible conduit and provide gaskets. Install separate ground conductor across flexible connections.

3.11 - HAZARDOUS AREAS

A. Install all conduits, fittings, equipment and devices within areas to comply with requirements of Massachusetts Electrical Code including Hazardous Locations, Class, Division, and Group as indicated on the Contract Drawings.

B. In such hazardous locations, seal conduits terminating at boxes enclosing circuit-opening equipment at entrance to enclosure with compound-filled, commercial, sealing fittings to prevent passage of explosive or combustible gases through conduits.

C. Seal all conduits leading from or entering such hazardous locations at points of exit or entrance with two-part epoxy sealant.

D. Install conduit connections with five threads tightly engaged and made up with thread compound.

E. Where drain/seal fittings are required, they shall be of malleable iron construction with an internal drainage path which provides a visual means to see that the compound chamber is filled. The installation shall enable the drain/breather fitting and filler plug to be installed right after the compound is poured.

F. Provide stainless steel braided flexible conduit rated for hazardous area locations when making connection between rigid raceway and motor or equipment subject to vibration and adjustment.

3.12 - PROTECTION

A. Provide protection and install in accordance with manufacturer printed instructions such that coatings, finishes, and enclosures are without damage or deterioration at completion of Project.

B. Repair damage to PVC with matching touch-up coating recommended by the manufacturer.

3.13 - CHECKOUT AND TESTING

A. Provide in accordance with Sections 16050 and 16998 and as specified herein.

B. Check overhead conduit system installation by using the following check list:

1. Conduits are supported on independent supports (i.e., not on process piping, pipe ways, or piping hangers).
2. Exposed conduits are run, parallel or perpendicular to structural members.
3. Conduits are routed far away from fire hazards and heat sources.
4. Conduits are supported at the specified intervals.
5. Pull boxes and fittings are installed so that covers are removable. Verify that covers are installed and tightly bolted with gaskets provided where needed.
6. Circular cross-sectional area is same at conduit bends. Single bends do not exceed 90 degrees.
7. Conduits are terminated in threaded hubs or bushings to prevent damage to wire.
8. Conduits joints are tight.
9. Seal fittings and/or sealing compound is installed at moisture barriers to prevent entry of moisture and gases into equipment and/or where indicated.
10. Drains and conduit seals are installed on vertical conduit runs entering devices, equipment, and enclosures to prevent entrance of moisture and gases.
11. Flexible conduit is installed at motors and other equipment as specified. Verify that cabling and conduit runs are identified at each end.

3.14 - CONDUIT SEALS

A. Furnish and install sealant to maintain fire ratings of walls and floors in annular space between conduit and building finish.

B. Apply sealant after cable installation and all testing.

C. Furnish and install moisture/fire proof sealant in conduit interior and cable interstitial space where conduits enter/leave electric rooms, in all control panels, terminal boxes, motor control centers, and switchboard.

3.15 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 16120

ELECTRIC WIRES AND CABLES

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 1
1.03 – DEFINITIONS 2
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING 3
1.06 - DESIGN CRITERIA 3
1.07 - REFERENCES 3
1.08 - QUALITY ASSURANCE 3
PART 2 - PRODUCTS 4
2.01 - ACCEPTABLE MANUFACTURERS 4
2.02 - MATERIALS AND COMPONENTS 4
PART 3 - EXECUTION 5
3.01 - GENERAL 5
3.02 - INSTALLATION OF WIRING 5
3.03 - CONDUCTOR IDENTIFICATION 5
3.04 - CONNECTORS, TERMINAL LUGS AND BOARDS 6
3.05 - FIELD CABLE TESTS 6
3.06 - CONTRACT CLOSEOUT 6

PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide wires, cables, termination and identification materials for complete electrical systems as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

C. Perform tests on installed wire and cables in accordance with SECTION 16998, FIELD INSPECTION AND ACCEPTANCE TESTS.

D. Provide fire stops for all electrical penetrations routed through fire rated walls and floors.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 – DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Submit the following in accordance with SECTION 01300, SUBMITTALS.

1. Submit shop drawings and manufacturer's product data for all cables, terminations, terminal blocks, lugs, connectors, fire proofing tape, identification tags, etc. in accordance with the requirements of SECTION 16050, GENERAL ELECTRICAL.

2. Submit the following data for fire stop material:

a. Manufacturer’s Listed Systems Designs.

b. Manufacturer’s Product Data Sheets.

c. Manufacturer’s Materials Safety Data Sheets.

d. Manufacturer’s printed instructions for installation on each proposed product. Identify where each material will be used at the Project site.

e. Manufacturer’s prefabricated devices providing descriptions for identification at the Project site.

3. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance.

a. Failure to include a copy of the marked-up specification sections will result in return of the entire submittal without further review and consideration until the marked-up specification are re-submitted with the entire package.

1.05 - PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

B. The design conditions and other pertinent requirements for the equipment are listed on the Contract Drawings.

1.07 - REFERENCES

A. American Society for Testing and Materials (ASTM):

1. B3: Soft or Annealed Copper Wire.
2. B8: Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
3. B33: Tinned Soft or Annealed Copper Wire for Electrical Purposes.

B. Massachusetts Electrical Code.

C. National Fire Protection Association (NFPA):

1. NFPA-70: National Electrical Code (NEC).

D. Underwriters Laboratories, Inc. (UL):

1. U.L. 44: Wires and Cables Rubber Insulated.
2. U.L. 83: Wires Thermoplastic-Insulated.
3. U.L. 854: Cables, Service Entrance.
4. U.L. 1479: Fire Tests of through Penetration Firestops.

E. National Electrical Manufacturer’s Association (NEMA):

1. WC 5: Thermoplastic Insulated Wire & Cable.
2. WC 8: Ethylene-Propylene-Rubber-Insulated Wire & Cable.

1.08 - QUALITY ASSURANCE

A. Firestop Materials and Smoke Seal materials shall have a flame spread rating of 25 or less, National Fire Protection Association (NFPA Class “A”).

PART 2 - PRODUCTS

2.01 - ACCEPTABLE MANUFACTURERS

A. 600V Cable:

1. Pirelli Cable Corporation.
2. Okonite.
3. The Rockbestos Company.
4. Or equal.

B. Metering and Instrumentation Wire, 600V:

1. The Rockbestos Company.
2. Okonite.
3. Pirelli Cable Corporation.
4. Or equal.

C. Cable Fireproofing Tape:

1. MAC Products, Inc.
2. 3M Company.
3. Thomas & Betts Company.
1. Or equal.

2.02 - MATERIALS AND COMPONENTS

A. Material and stranding of conductors to conform to ASTM B3, ASTM B33, and to ASTM B8.

B. Wires and Cables for Maximum 600-Volt power: Furnish copper conductors. For No. 8 and smaller, provide THWN/THHN type cable. Provide No. 6 and larger as XHHW/2. Provide No. 12 and No. 10 AWG as solid conductor. Provide No. 8 AWG and larger as stranded conductor. Provide wires and cable conforming to UL 83.

C. Wires and Cables for Maximum 600-Volt control, indicating, metering, or alarm circuits: Furnish copper conductors, type THWN/THHN stranded, rated 75C with thermoplastic insulation and nylon jacket. Provide wires and cable conforming to UL 83. Cables used in fire alarm circuits shall be listed per the requirements of Article 760 of NEC.

D. Shielded Cable for Instrumentation Wiring: Provide 19-strand tinned copper conductors, size No. 16 AWG. Insulate conductors individually with color coded polyethylene or polyvinylchloride. Twist pairs twisted with varying lay (if more than one pair) and cover with cable tape and copper or aluminum coated mylar shielding tape and tinned copper drain wire. Jacket shall be polyvinylchloride. Cables shall be rated 600 volts and 90 degrees C.

E. Category 6 (CAT6) Cable: Category 6 cable shall consist of 4 twisted pairs of different lay and ground wires, enclosed by an overall conductive mylar backed aluminum foil shield. This shall be enclosed by an overall thermoplastic jacket. The cable shall meet the applicable requirements of ANSI/TIA/IEA-568-B.

PART 3 - EXECUTION

3.01 - GENERAL

A. Provide all material, equipment, and labor to install the electric wire and cables as indicated and as specified.

B. Perform work in accordance with the Massachusetts Electrical Code.

C. Provide power cable identification as follows:

System Voltage	Neutral	Phase A	Phase B	Phase C
208/120V	White-Black	Red	Blue	
240/120V	White- Gray Stripe	Black- Blue Stripe	Red- Blue Stripe	None
480/277V	Gray	Brown	Orange	Yellow

D. Use green to identify insulated ground conductors.

NOTE: Colored insulation, tapes or sleeves may be used to provide color coding but they must be installed on all conductors at all pull and junction boxes. Insulated ground conductors must have green insulation.

E. Provide control, indicating, metering or alarm cable identification as follows:

1. AC Control Red
2. DC Control Blue

3.02 - INSTALLATION OF WIRING

A. Install wiring in accordance with applicable provisions of Massachusetts Electrical Code, and as indicated.

B. Provide wire and cable sizes as indicated. However, in no case use smaller cable sizes than required by the Massachusetts Electrical Code.

C. Unless otherwise indicated, use no conductor smaller than No. 12 AWG for power, No. 14 AWG for control, and No. 16 AWG for shielded applications.

D. Install conductors for branch lighting circuits so that voltage drop requirements of Massachusetts Electrical Code are met.

E. Install conductors continuous from outlet to outlet and make no splices except within outlet or junction boxes.

F. There shall be no splices between connection points.

G. Draw all conductors contained within a single conduit at the same time.

H. Apply wire pulling compound to conductors being drawn through conduits.

I. Use no cable bend with radius of less than eight times its diameter.

J. Support cables in riser conduits at intervals as required by Massachusetts Electrical Code.

K. Pull cables in underground conduit system without splices. Use lubricants recommended by the cable manufacturer. Do not exceed maximum pulling tension specified by the manufacturer. Use a gauge to measure pulling tension to ensure that the recommended limit is not exceeded.

L. Wrap cables in manholes on an individual cable basis with fireproof tape 2 inches wide. Extend fireproofing 1-inch into any duct. Install tape in accordance with manufacturer’s instructions.

3.03 - CONDUCTOR IDENTIFICATION

A. Label each wire at both termination points. Label each wire at each end using numbering system consisting of equipment tags, terminal numbers and circuit number where wire is coming from. Carry individual conductor or

circuit identification throughout. Random numbering labels similar to what is used for “Quick Pulls” type wiring shall not be acceptable.

B. Identify each wire in junction boxes, cabinets, and terminal boxes. Where no termination is made use a plastic-coated, wire marker and where termination is made use a, plastic, pre-printed sleeve wire marker.

C. In cases where terminal boards are provided for the control, indicating, and metering wires, identify all wires including motor leads and other power wires too large for connection to terminal boards, by sleeve wire markers as specified above.

D. In manholes and handholes, identify each power wire by laminated plastic tag with “to” and “from” destinations identified. Tags shall be located to be visible. Control wires to be bundled and marked with “to” and “from” destinations identified.

3.04 - CONNECTORS, TERMINAL LUGS AND BOARDS

A. For wiring of circuits consisting of No. 10 or No. 12 AWG solid wires, such as for lighting branch circuits, utilize self-insulated pressure type connectors for all splices or joints.

B. Terminate all wires and conductors means of ring and tongue, nylon self-insulated, tin-plated copper pressure terminals.

C. Fabricated terminal boards, installed where indicated, of type 600 volts, 30 amperes, screw terminals, with white marking strips for wire identification, of the 4-, 6-, 8-, or 12-pole type.

D. Mark terminal strips with ink or indelible pencil. Mark each wire consistently throughout entire system, using notation of wires given on manufacturer's wiring diagrams.

E. Wire connections for which terminals are not supplied, for example, at solenoids or motor terminal junction boxes:

1. 10 AWG and smaller: Use self-insulated pressure-type connectors.

2. 8 AWG and larger: Use insulated, mechanical type with set screw or follower bearing directly on the wire. Split bolt connectors are not acceptable.

3.05 - FIELD CABLE TESTS

A. Perform cable testing in accordance with SECTION 16998, FIELD INSPECTION AND ACCEPTANCE TESTS.

3.06 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 16160

PANELBOARDS

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 1
1.03 - DEFINITIONS 1
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING 2
1.06 - DESIGN CRITERIA 2
1.07 - REFERENCES 3
PART 2 - PRODUCTS 3
2.01 - ACCEPTABLE PANELBOARD MANUFACTURERS 3
2.02 - PANELBOARDS 3
2.03 - CIRCUIT BREAKERS 4
2.04 - CABINETS 4
PART 3 - EXECUTION 5
3.01 - INSTALLATION 5
3.05 - TESTS AND CHECKOUTS 5
3.03 - CONTRACT CLOSEOUT 5

PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide Panelboards as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Submit shop drawings and manufacturer's product data in accordance with requirements of SECTION 16050, ELECTRICAL – GENERAL.
2. Submit time current characteristic curves, short circuit rating and data for each circuit breaker type and rating.
3. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check marked to indicate specification compliance.
    a. Failure to include copy of the marked-up specification section will result in return of the entire submittal without further review and consideration until the mark-up specification are re-submitted with the entire package.

1.05 - PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed according to the written recommendations of the supplier and as to not to degrade quality, serviceability or appearance.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

C. Seismic Requirements

1. Conform to the requirements as indicated on the Structural Drawings and as specified in SECTION 01900, SEISMIC AND WIND REQUIREMENTS.

D. Quality Assurance

1. Review the manufacturer’s recommended installation with the manufacturer prior to installation.

E. Provide panelboards including circuit breakers, surge protection devices (SPD) and cabinets, as indicated and specified.

F. Surge Protection Devices (SPD) shall be integral to the panelboard cabinet. SPD shall be as specified in SECTION 16400, SURGE PROTECTION DEVICES (SPDs)

G. Panelboards shall be of the same manufacturer supplying the Low Voltage Switchboard under SECTION 16366, LOW VOLTAGE SWITCHBOARD

1.07 - REFERENCES

A. National Electrical Manufacturers Association (NEMA)

1. PB1- Panelboards
2. AB1- Molded Case Circuit Breakers

B. Federal Specifications (FS)

1. W-P-115A - Panel, Power Distribution.
2. W-C-375B - Automatic Circuit Breakers.
3. QQ-S-365B - Silver Plating, Electro deposited, General Requirements for

C. Massachusetts Electrical Code

D. Underwriter's Laboratories, Inc.

1. U.L. 67 – Panelboards
2. U.L. 489 – Molded Case Circuit Breakers

E. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - ACCEPTABLE PANELBOARD MANUFACTURERS

A. Eaton

B. Square D

C. GE

2.02 - PANELBOARDS

A. Provide factory assembled deadfront type panelboards.

B. Provide panelboards with branch circuit breakers and a main circuit breaker or main lugs only as indicated.

C. Furnish panelboards with full capacity separate ground bus, separate insulated neutral bus and furnish panelboards connected to a 3-phase, 4-wire service or single phase, 3-wire service as indicated. All buses to be tinned copper.

D. Provide panelboards with the voltage, frequency and current ratings as indicated conforming to NEMA Standard PB1, Federal Specification W-P-115A. U.L. 67, and the N.E.C.

E. Furnish the panelboard main and 100% neutral buses, with 98 percent conductivity rectangular copper bars provided with bolted type lugs.

F. Drill buses to fit either "A", "B" or "C" Phase connectors, and make sure that connectors are inter-changeable and installed in a distributed phase sequence.

G. Silver plate copper buses connections and terminals, to a thickness of 0.005-in., conforming to the requirements of Federal Spec. QQ-S-365B.

H. Prevent terminal lugs from turning per NEMA standard PBI and verify they can be used for the conductor material and size.

I. Provide main bus-bracing for each panel board for 10,000 amperes symmetrical short circuit at 240 volts or less and 65,000 amperes symmetrical short circuit at 480 volts unless otherwise indicated.

J. Provide typed panelboard directory cards with the following information:

1. Panelboard name designation.
2. Panelboard voltage rating.
3. Panelboard ampere rating.
4. Panelboard short circuit rating.
5. Panelboard pole/circuit numbers and branch circuit description as wired in the field.
6. Indicate 2 pole and 3 pole branch circuit breakers.
7. Label spare circuit breakers “spare”.

2.03 - CIRCUIT BREAKERS

A. Furnish bolt-on type branch and main circuit breakers. Furnish frame sizes, trip settings and number of poles as indicated. Clearly and visibly mark circuit breakers with ampere trip rating. Furnish breakers meeting the requirements of F.S. W-C-375B and NEMA AB1. Provide circuit breakers marked with ampere trip rating that can be read at a distance of two feet from the panel. Provide breakers meeting the requirements of Fed. Spec. W-C-375B and NEMA AB1.

B. Furnish all breakers with quick-make, quick-break, toggle mechanisms and thermal-magnetic, inverse time-limit overload and instantaneous short circuit protection on all poles, unless otherwise indicated. Automatic tripping indicated by the breaker handle assuming a clearly distinctive position from the manual ON and OFF position. Furnish breaker handle that is trip-free on overloads.

C. Provide circuit breakers rated 200A and larger shall have solid state adjustable trip units having long-time, short-time and instantaneous protective relaying.

D. Do not use single pole breakers with handle ties or bails in lieu of multipole breakers.

E. Furnish handle lock device on breakers to prevent the manual opening of the selected breakers.

F. Furnish padlocking device on all breakers to prevent the opening of circuit breakers.

G. Voltage and interrupting rating of all breakers in a panelboard shall not be less than voltage and short circuit rating of the panelboard main buses, as indicated. Series rated circuit breakers shall not be used. Furnish breakers to operate satisfactorily at the frequency indicated.

H. Furnish ground fault interrupter circuit breakers for circuits as indicated. The circuit breaker shall be UL listed, Class A, Group I device (5 milliamp sensitivity, 25 millisecond trip time or 30 ma for heat trace circuits).

I. Furnish single pole breakers with full module size. Do not install two pole breakers in a single module.

J. Furnish time-current characteristic curves and catalog information and data for each size of breaker furnished.

K. Provide transient surge protective devices in accordance with SECTION 16400, SURGE PROTECTION DEVICES (SPDs) as specified herein and as indicated.

2.04 - CABINETS

A. Provide cabinets without knockouts. Drill cabinets only for the exact conduit entrances and mounting bolts. NEMA rating of panels to match areas as denoted on the drawings.

B. Finish cabinet fronts, trims and surface-mounted boxes in ANSI No. 61 or 49, light-gray enamel over a rust-inhibitive primer. Front covers shall be hinged to cabinets and shall be double door (door in door) construction. Provide cabinets for surface or flush mounting as indicated.

C. Unless otherwise specified, construct panelboard cabinets of code-gauge galvanized, sheet steel and equip with gutters for the risers and outgoing circuits.

D. Provide all panelboard locks keyed alike.

E. Provide cabinets drilled only for the exact conduit entrances and mounting bolts.

2.05 – MINI POWER CENTERS

A. Provide mini power centers consisting of primary main circuit breaker, integral transformer and secondary distribution panelboard with main breaker.

B. Provide mini power centers with primary and secondary ratings as indicated on the contract drawings.

C. Integral transformer shall be dry-type with 180℃ insulation system and 115℃ rise.

D. Internal panelboard shall be provided in accordance with this Section.

PART 3 - EXECUTION

3.01 - INSTALLATION

A. Mount panelboards such that the height of the top operating handle does not exceed 6 ft. 6-in. from the floor.

B. Hang each door of the cabinet on semi- or fully-concealed hinges with a combination catch and lock.

C. On cabinets 48 in. high and over, install a 3 point catch assembly latching at top, bottom and middle.

3.05 - TESTS AND CHECKOUTS

A. Provide field and functional testing in accordance with SECTION 16050, ELECTRICAL - GENERAL and SECTION 16998, FIELD INSPECTION AND ACCEPTANCE TESTS and as specified herein.

3.03 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRAT CLOSEOUT.

END OF SECTION

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SECTION 16260

VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 2
1.03 - DEFINITIONS 2
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING 4
1.06 - DESIGN CRITERIA 4
1.07 - REFERENCES 4
PART 2 - PRODUCTS 5
2.01 - MANUFACTURERS 5
2.02 - HARMONIC ANALYSIS 5
2.03 - PROVISIONS 7
2.04 - SHOP TESTING 10
PART 3 – EXECUTION 10
3.01 - INSPECTION 10
3.02 - INSTALLATION 10
3.03 - FIELD TESTING 10
3.04 - CONTRACT CLOSEOUT 11

PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide Variable Frequency Drives as specified herein and/or as shown on the Contract Drawings.

B. Summary

1. Provide complete IGBT (Insulated Gate Bipolar Transistors) type variable frequency drive (VFD) units and appurtenances including drive reactors, transformer, DC chokes, harmonic filters, output filters, enclosures, control circuits and auxiliary items in a single line-up. Provide all drive components specified housed within one enclosure.

2. Floor mounted VFD units shall not have overall measurements larger than what is shown on the Contract Drawings.

3. Coordinate the VFD units with the driven equipment manufacturers.

4. VFD units shall be manufacturer's standard technology and in production for no less than 5 years.

5. Provide control system operation, input and control signals, status signals and devices as specified herein and as indicated on the Contract Drawings.

6. Provide UL listed and labeled drives.

7. Coordinate VFD input harmonic filter with results of final harmonics study specified herein.
8. VFD units shall be 6 pulse type with an integral 5% impedance line reactor.
9. For VFDs located more than a cable length of 100 feet from the motor load provide output filter at VFD.

C. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance.
    a. Failure to include a copy of the marked-up specification sections will result in return of the entire submittal without further review and consideration until the marked-up specification are resubmitted with the entire package.

2. Shop Drawings: Provide a complete list of equipment components, and materials, including manufacturer's descriptive and technical literature, and catalog cuts. Provide complete wiring, system interconnection and schematic diagrams for the equipment and controls furnished including external interlocked and controlled components, equipment layout, time versus current curves for protective devices and any other details required to demonstrate that the system and the required external controls have been coordinated and will function as specified and indicated.

    a. Provide data to verify that drives can be used for motor lead lengths up to 100 feet without output filters. Include information from the VFD manufacturer or output filter manufacturer stating that the motor terminal voltage limitations as defined by NEMA Standard MG-1 are met. For VFDs located more than a cable length of 100 feet from the motor load provide output filter at VFD.

    b. Provide enclosure drawings and details showing all dimensions and construction details.

3. Submit a written statement signed by the VFD manufacturer that the VFD manufacturer has received the required information from the pump and motor manufacturers for the driven equipment. Submit statement from each driven equipment manufacturer indicating that the VFD drive submitted is compatible with driven equipment and is rated for the specified application. Statement shall certify that that the VFDs, motors and associated process equipment have been review and coordinated with the equipment selections.

4. Harmonic Analyses Report:

    a. Submit harmonic analysis report including project specific load data for (2) scenarios as Specified in Section 2.02 – Harmonic Analysis.

    b. Submit a statement indicating that the harmonics limits specified are met.

    c. Harmonic loads to be used for analysis are as indicated in Attachment A, Attachment B and Attachment C of this Section.

5. Provide installation and anchoring details to meet earthquake requirements as specified and indicated on the structural drawings.

6. Submit manufacturer’s printed installation instructions.

7. Spare Parts Data: Submit a list of spare parts.

8. Operating and Maintenance Instruction Manuals:

    a. Operating instruction manuals outlining step-by-step procedures required for system startup and operation.

    b. Manufacturer's name, model number, service manual parts list.

    c. Brief description of equipment and basic operating features.

    d. Maintenance instruction manuals outlining maintenance procedures.

    e. Troubleshooting guide listing possible reasons for breakdown(s) and repair(s).

    f. Point-to-point connection wiring diagram for the system.

9. Performance Test Reports: Upon completion of installed system, submit in booklet form all shop and field tests performed to prove compliance with specified performance criteria.

10. Provide any specialty software and all required tools required for programming of the provided VFD units.

1.05 - PRODUCT HANDLING

A. Comply with the requirements of SECTION 01610, DELIVERY, STORAGE AND HANDLING.

B. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

C. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

B. The design conditions and other pertinent requirements for the equipment are listed on the Contract Drawings.

C. Quality Assurance

1. Provide quality assurance in accordance with SECTION 16050, ELECTRICAL WORK - GENERAL, SECTION 01400, QUALITY ASSURANCE and as specified herein.

2. Provide services of Service Technician, specifically trained on type of equipment specified.

a. Start-up and testing: 2 person-days

b. Vendor Training: 2 person-days

c. Person-day is defined as one 8-hour day, excluding travel time.

D. Seismic Requirements

1. Conform to the requirements specified in SECTION 01900, SEISMIC AND WIND REQUIREMENTS and as specified herein.

1.07 - REFERENCES

A. Institute of Electrical and Electronics Engineers (IEEE)

1. Massachusetts Electric Code

2. National Electrical Manufacturers Association (NEMA): MG 1

3. National Fire Protection Association (NFPA):

B. NFPA-70 National Electric Code.

C. Underwriter's Laboratories Inc. (UL):

1. UL-508 Electrical Industrial Control Equipment

D. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - MANUFACTURERS

A. Manufacturer shall have five years, all within the last 10 years, commercial experience in the manufacture, operation and servicing of equipment of type, size, quality, performance, and reliability equal to that specified.

B. Acceptable Variable Frequency Drive Units:

1. Eaton
2. Square D
3. GE

2.02 - HARMONIC ANALYSIS

A. The VFD manufacturer shall perform a detailed harmonic analysis for each of the three pump stations as described under this section based on the loads specified in Table 16260-1.

TABLE 16260-1
Equipment List

Equipment	Total Quantity	Quantity Operating	HP/AMPS/kVA/kW
Pump Station No. 1			
Non VFD Loads			
Mini Power Center MPC.01-1	1	1	7.5kVA
Odor Control Fan PS1.OC-1*	1	1	1HP
VFD Loads			
PS1.P-1/2/3**	3	3	40HP
Pump Station No. 2			
Non VFD Loads			
Mini Power Center MPC.02-1	1	1	7.5kVA
Odor Control Fan PS2.OC-1*	1	1	1HP
VFD Loads			
PS2.P-1/2**	2	2	40HP
Pump Station No. 3			
Non VFD Loads			
Mini Power Center MPC.03-1	1	1	7.5kVA
Odor Control Fan PS3.OC-1*	1	1	1HP
VFD Loads			
PS3.P-1/2**	2	2	30HP

* Motor is powered by full voltage motor starter.

** Motor is powered with 6-pulse variable frequency drive with 5% input line reactor.

B. The VFD manufacturer shall submit a statement that the harmonics limits specified are met.

C. The VFD system shall be provided such that there is less than 5% voltage total harmonic distortion at the point of common coupling (PCC). Current distortion at the terminals will be in accordance with Table 16260-2.

TABLE 16260-2
Maximum Harmonic Current Distortion in Percent ISC/IL Odd Harmonic

Ratio	5 to 9	11 to 15	17 to 21	23 to 33	35 +	TDD
Less than 20	4.0	2.0	1.15	0.6	0.3	5.0
20 to 50	7.0	3.5	2.5	1.0	0.5	8.0
50 to 100	10.0	4.5	4.0	1.5	0.7	12.0
100 to 1000	12.0	5.5	5.0	2.0	1.0	15.0
1000 +	15.0	7.0	6.0	2.5	1.4	20.0

Notes:

1. Even harmonics are limited to 25% of odd harmonics.
2. DC offset distortions not allowed.
3. Ratio = Isc/IL where

   Isc = Maximum short circuit current at PCC.

   IL = Maximum demand load current at PCC (fundamental frequency component)

   TDD: Total Demand Distortion
4. With phase shift transformers or converters with pulse number (q) higher than six (6) are used, the limits for the characteristic harmonic orders are increased by a factor equal to the square root of q divided by 6 provided that the amplitudes of the non-characteristic harmonic orders are less than 25% of the limits specified in the table above.

D. The harmonic analysis performed shall be based on the following:

1. Point of common coupling (PCC) shall be plant main switchboard SWBD.10-1, 480 VAC bus.
2. Harmonic analysis shall be performed for two cases.
   a. When the system is fed by the electrical utility.
   b. When the system is fed by the onsite standby generator.

E. The analysis shall include an explanation of all assumptions, sources of data, methodologies and formulas used in the study and a summary of the study results.

F. Based on the harmonic study results, supply the VFD units with any additional filtering equipment required to meet the harmonic requirements specified herein.

2.03 - PROVISIONS

A. Service conditions shall be as follows:

1. Ambient Temperature Range: 0 degrees C to 40 degrees C.
2. Operational Humidity: Up to 90 percent non-condensing.
3. Environment: As indicated on enclosure schedule.
4. Altitude: Below 3,300 ft. above sea level.
5. Input Power
    a. Nominal voltage - 460 volts (plus 10 percent or minus 10 percent), 3-phase, 3 wire
    b. Nominal Frequency - 60 Hertz (plus or minus 2 Hz.)

B. Drive Systems

1. General
    a. Furnish solid state variable frequency, microprocessor type with Pulse Width Modulated (PWM) output wave form converter. The VFD shall employ a full wave rectifier, a DC bus choke, DC bus capacitors and Insulated Gate Bipolar Transistors (IGBT) as the output switching device to convert nominal 480 volts, 3 phase, 60 Hertz, 3 wire input power into adjustable-frequency 3 wire system at 0 to 480 volts, 3 phase, 0 to 60 Hertz output power.
    b. Motor control circuits shall be wired in accordance with the requirements specified herein and as indicated.
    c. The Contractor shall be responsible for the successful compatibility and operation of the entire drive and control system serving the motor and driven equipment. This includes the responsibility for obtaining all loads, torque, speed and performance requirements from the pump and motor manufacturers and integrating these into a variable frequency drive system that fulfills the requirements of this Specification.
    d. Provide constant torque drives or variable torque drives based on the type of the driven equipment load.
    e. Provide VFD control so that there is accurate zero to full load torque control at low frequencies, including zero speed, with torque repeatability accuracy of 2% or better and torque response time less than 20 ms.
    f. Provide on drive thermal magnetic type, 480 volts circuit breaker to be used as main disconnecting device and fixed diode input rectifier for a constant power factor.
    g. RMS harmonic output of the drive not to provide more than 5 percent increase in motor heating over similar operation of the motor with zero harmonics in the current.
    h. The unit shall withstand drive output terminal line-to-line and line-to-ground short circuits without component failure during start-up and during operation. Drive to safely shutdown until short is cleared.
    i. Provide drives with NEMA-1 gasketed type cabinet.
    j. Provide drive output such that the motors have a base rating voltage less than or equal to 600 volts and that the peak instantaneous voltage shall be limited to 1600 volts or less, with a voltage rise time greater than or equal to 0.1 micro-seconds per NEMA Standard MG-1, Part 31.40.4.2.
    k. The drive unit shall be of modular design to provide for ease and speed of maintenance.

l. Control circuits shall be isolated from power circuits. Unit to accept a 4-20 mA DC speed control signal from an isolated, ungrounded transmitter with unit in remote mode and from local door-mounted manual speed potentiometer or micro-processor type keypad with unit in local mode. The input 4-20 mA signal to be optically isolated from the drive run control circuit. Furnish door-mounted switch on the enclosure for local/remote mode. Manual speed potentiometer or keypad controls to have adjustable minimum speed setting of 10 to 80% of full speed and maximum speed setting of 50 to 100% of full speed. The total speed setting to follow a linear time ramp, adjustable from 1-300 seconds for acceleration and deceleration control. Provide output 4-20mA signal for VFD speed statues.

m. Harmonic filters shall be provided with contactors and controlled by the VFD to remove them from the line when the drive is not operating. Contactors shall be provided with spare contacts for remote alarm and to energize status lamp at VFD enclosure.

n. VFD shall be capable of full rated output when powered by incoming voltage with Total Harmonic Distortion (THD) in excess of 10%.

o. Furnish series choke and capacitors on DC bus to reduce ripple in rectifier output and to reduce harmonic distortion reflected into incoming power feeders.

p. Size enclosure to dissipate heat generated by VFD within limits of specified service conditions. Provide integral fans or cooling systems. VFD enclosures to have keypad controls located on exterior of enclosure. Provide visual alarm indicator on cabinet door.

q. Provide oversized cable lugs for incoming and outgoing cables. Cable lugs size shall be per cables as indicated.

2. Performance characteristics

a. Continuous current rating (amps): Minimum of 110 percent of motor rated full load amps, continuous.

b. Acceleration time to top speed, 1-60 seconds, adjustable.

c. Deceleration time from top speed, 1-60 seconds, adjustable.

d. Frequency stability: +/- 0.5% (at 25 degrees C, +/- 10 degrees C) after reaching operating temperature.

e. Output voltage: Proportional to frequency with low speed boost.

f. Combined drive/and filtering efficiency, defined as VFD output KW divided by VFD input KW, shall meet the following requirements at the specified operating points:

(1) 96 percent minimum at 60 Hz VFD output and 100 percent load.

(2) 92 percent minimum at 50 Hz VFD output and 60 percent load.

g. VFD fundamental power factor shall be 0.95 or higher at all speeds and loads.

h. The VFD shall be capable of sustaining continued operation with a 30% dip in nominal line voltage.

i. Losses to be utilized in drive system efficiency calculation shall include the input isolation transformer, harmonic filter and power factor correction if applicable. Auxiliary controls such as internal VFD control boards and cooling fans shall be included in all loss calculations.

3. Drive Protection

a. General

(1) Fault detection and trip circuits shall protect VFD and connected motor against line voltage transients, single-phase, power line over-voltage and under-voltage, output over-voltage and over-current, and VFD over-temperature. The VFD shall employ three (3) current limit circuits to provide trip free operation. The slow current regulation limit circuit shall be adjustable to 125% of the VFD's variable torque current rating. The rapid current regulation limit shall be adjustable to 170% of the VFD's variable torque current rating. The current switch off limit shall be fixed at 225% of the VFD's full load current rating.

b. Internal Protection: Provide circuitry as follows:

(1) Current limiting, fast acting, semiconductor input fuses for protection of internal power semiconductors.

(2) Instantaneous output over-current trip max. - 200 percent.

(3) DC bus and control circuit transformer fusing.

(4) Grounded control chassis.

(5) Under and over voltage trip, 3 phases.

(6) Motor overload protection, with solid state relays.

(7) Main circuit breaker, with door interlocked handle. Provide means to allow entry into panel by authorized personnel. Circuit breaker to be rated 65,000 AIC.

(8) Fault reset push button.

(9) Line to ground faults.

(10) Input metal oxide varistor and input line reactor for transient protection.

(11) VFD over-temperature.

c. Troubleshooting: Provide diagnostic aids to indicate cause of fault; used to assist in troubleshooting circuit problems. Isolated Form C contacts for remote indication of alarms to include the following:

(1) Over/under voltage indication.

(2) Over-current trip indication.

(3) DC bus charged indication.

(4) Fault detection indication.

(5) Recycle start indication (to indicate that the unit tried to pick up load for three previous tries and failed).

d. Provide power loss ride through capability which will allow the logic to maintain control due to load inertia without faulting. The number of restarts on power loss condition shall be programmable.

C. Auxiliary Systems

1. Provide variable frequency drive unit with appropriate power circuitry and auxiliary contacts, etc. for energizing and controlling the variable frequency drive as indicated.

D. Control Features

1. Provide VFD control circuit as indicated on Contract Electrical Drawings.
2. Accept a grounded, isolated, 4-20 mA input remote speed control signal from an external device.
3. Provide a 4-20 mA output signal proportioned to VFD output frequency for remote speed indication.
4. Jog permissive input. When activated along with remote run contact, VFD will run at a pre-set speed.

E. Devices:

1. Provide operating, monitoring or alarm indicating devices, door mounted, as indicated on the Contract Drawings and as follows:
   a. Separate adjustable speed potentiometer switch to adjust VFD frequency when operated in manual mode.
   b. Speed indicating meter in Hz and rpm to indicate frequency and motor speed of the motor.
   c. Control relays as indicated.
   d. Provide LED cluster type alarm and status lights. Lights shall be Red for “OFF” position, Green for “ON” position and Amber for “Alarms”.

2.04 - SHOP TESTING

A. Provide a factory burn-in test and a control and alarm test on each drive unit by simulating each control signal and each alarm function to verify proper and correct drive unit action.

B. Provide prototype factory test data for a similar size and type VFD unit for short circuit testing. Data to verify that each drive can be started into a line-to-line fault and line-to-ground fault on the drive terminals. Each drive can be operating at full load and be subjected to a line-to-line fault and line-to-ground fault on the drive terminals. All phases (A, B & C) to be included in test data.

C. Provide certified documentation of all tests performed.

D. Provide above stated tests in addition to routine factory tests.

PART 3 – EXECUTION

3.01 - INSPECTION

A. Examine VFD location for preparation in accordance with manufacturers written instructions. Check conduits and raceway location for connection to units.

B. Visually inspect delivered unit(s) and accessories for conformance with specification and drawings.

C. Verify availability of appropriate pacing signal and program motor protection relay settings.

3.02 - INSTALLATION

A. The VFDs shall be installed as indicated and in accordance with the manufacturer’s installation instructions.

B. Factory-trained service technician, other than sales representatives, shall supervise field installation, inspect, make final adjustments and operational checks, make functional checks of spare parts, and prepare a final report for record purposes. Adjust control and instrument equipment until this equipment has been field tested.

C. The VFD units speed input and speed feedback shall be programmed in Hz.

3.03 - FIELD TESTING

A. Perform testing checkout, and start-up for variable frequency drive equipment under technical direction of manufacturer's service technician.

B. Coordinate all testing with electrical testing performed under SECTION 16998, FIELD INSPECTION AND ACCEPTANCE TESTS.

C. Field Tests:

1. Test each drive over the total speed range that it will be required to operate through for the load being driven for two hours. Determine for each drive, motor, and load combination the following at minimum speed, maximum speed, and at 1/3 and 2/3 points between the minimum and maximum speeds:

   a. Input power (kW), voltage, current and RMS power factor on the line side of the drive isolation device.

   b. Output to the driven load in kilowatts.

   c. For each drive, measure the harmonic voltage distortion and harmonic current distortion for each harmonic at the main distribution bus for maximum and minimum load conditions.

   d. Measure the total harmonic voltage distortion and total harmonic current distortion at each PCC, while all drive loads are running. The test results shall confirm the harmonic study results and should prove that harmonic distortion limits specified in Paragraph 2.02 have been met. If testing results are not within the specified limits, provide additional filtering equipment to meet the harmonic distortion limits specified.

2. Test each drive by using the actual control signal for remote and local operation.

3. Test each driver alarm functions.

4. Perform all tests in the presence of the Owner’s representative.

5. Perform the above test in addition to the manufacturer's normal field tests and driven equipment testing as specified in DIVISION 11, EQUIPMENT.

6. Submit final test report with summary comparing field test data with harmonic analysis design calculated values for each drive.

3.04 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF TEXT

See Attachments

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ATTACHMENT A
Pump Station No. 1
Equipment List

Equipment	Total Quantity	Quantity Operating	HP/AMPS/kVA/kW
Non VFD Loads			
P.S. NO. 1 ODOR CONTROL FAN	1	1	1 HP*
LP.01-1	1	1	15 KVA
VFD Loads			
RAW WASTEWATER PUMPS 1/2/3	3	3	40 HP**

* Motor is powered by full voltage motor starter.

** Motor is powered with 6-pulse variable frequency drive with 5% input line reactor.

ATTACHMENT B
Pump Station No. 2
Equipment List

Equipment	Total Quantity	Quantity Operating	HP/AMPS/kVA/kW
Non VFD Loads			
P.S. NO. 2 ODOR CONTROL FAN	1	1	1 HP*
LP.02-1	1	1	15 KVA
VFD Loads			
RAW WASTEWATER PUMPS 1/2	2	2	40 HP**

* Motor is powered by full voltage motor starter.

** Motor is powered with 6-pulse variable frequency drive with 5% input line reactor.

ATTACHMENT C
Pump Station No. 3
Equipment List

Equipment	Total Quantity	Quantity Operating	HP/AMPS/kVA/kW
Non VFD Loads			
P.S. NO. 3 ODOR CONTROL FAN	1	1	1HP*
LP.03-1	1	1	15 KVA
VFD Loads			
RAW WASTEWATER PUMPS 1/2	2	2	30 HP**

* Motor is powered by full voltage motor starter.

** Motor is powered with 6-pulse variable frequency drive with 5% input line reactor.

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SECTION 16320

GENERAL PURPOSE DRY-TYPE TRANSFORMERS

(Filed Sub-Bid Required)

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PART 1 - GENERAL

1.00 - SUBBID REQUIREMENTS

A. The Work of SECTION 16320, GENERAL PURPOSE DRY-TYPE TRANSFORMERS is a part of DIVISION 16, ELECTRICAL which requires a single filed sub-bid in accordance with M.G.L. c.149, s.44A through 44H, inclusive, as amended. See SECTION 16050, ELECTRICAL WORK - GENERAL.

B. The Work of SECTION 16320, GENERAL PURPOSE DRY-TYPE TRANSFORMERS requires the Subcontractor to perform all Work specified under this section.

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide General Purpose Dry-Type Transformers as specified herein and/or as shown on the Contract Drawings.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Submit shop drawings and manufacturer's product data of the transformer, enclosure, core and coil, insulation system and all specified accessories.
2. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance.
    a. Failure to include a copy of the mark-up specification sections will result in rejection of the entire submittal with no further review and construction.
3. Provide manufacturer’s printed installation instructions including anchoring details to meet earthquake requirements as specified and indicated.

1.05 - PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

B. The design conditions and other pertinent requirements for the equipment are listed on the Contract Drawings.

1.07 - DESCRIPTION

A. Provide copper-wound, dry-type transformers as indicated and specified.

B. Provide transformer windings and enclosures rated for the installation location and in accordance with the requirements herein.

1.08 - REFERENCES

A. Underwriters' Laboratories, Inc. (UL):

1. UL 506 - Transformers, Specialty.

B. National Electrical Manufacturers Association (NEMA):

1. ST 20 - Dry-Type Transformers for General Applications (ANSI C89.2).
2. TP-1 – Guide for Determining Energy Efficiency for Distribution Transformers.

C. American Society for Testing and Materials (ASTM):

1. D 635 - Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.

D. Massachusetts Electrical Code.

E. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.09 - SEISMIC REQUIREMENTS

A. Conform to the requirements as indicated on the structural drawings and as specified in SECTION 01900, SEISMIC AND WIND REQUIREMENTS.

1.10 - REQUIREMENTS OF REGULATORY AGENCIES

A. Furnish transformers in accordance with NEMA ST 20 and UL 506.

B. Furnish transformers with UL listing mark.

PART 2 - PRODUCTS

2.01 - ACCEPTABLE MANUFACTURERS

A. Eaton Corporation

B. Siemens

C. Schneider Electric

D. Or equal.

2.02 - TRANSFORMERS

A. Provide copper-wound, dry type transformers.

B. In NEMA 1 and NEMA 12 designated areas, furnish general purpose, ventilated, dry-type transformers in indoor-style enclosure. On single-phase transformers and three-phase transformers above 9 KVA, provide two windings per phase.

C. Auto transformers shall not be used in place of general purpose dry-type transformers.

D. Furnish two 2-1/2 percent full capacity taps above and below nominal in high voltage winding for transformers rated above 15 kVA. Provide two five percent taps below rated voltage for transformers rated 15 kVA and below.

E. Furnish transformers, single-phase or three-phase, as indicated. Furnish transformers with kVA ratings as indicated.

F. Furnish three-phase transformers, Delta-Wye, Delta-Delta or Wye-Wye connected as indicated and conforming with latest NEMA standards. Scott Tee connected transformers above 9 kVA shall not be used.

G. Furnish transformers with primary and secondary voltages and frequency, wye connected, as indicated for secondary windings, with neutral brought out for cable termination.

H. Furnish transformers that have continuous operation at rated kVA with normal life expectancy as defined in NEMA ST 20.

I. For transformers rated 30 kVA or less, furnish 180 deg. C insulation. Performance shall be obtained without exceeding 115 deg. C average temperature rise by resistance or 145 deg. C hot spot temperature rise in 40 deg. C maximum ambient and 30 deg. C average ambient. Maximum coil hot spot temperature shall not exceed 185 deg. C.

J. Transformers rated greater than 30 kVA shall be provided with 220 deg. C insulation materials with proven reliability and low-loss 80 deg. C full load operating temperature rise rating.

K. Furnish transformers made of flame retardant materials that will not support combustion as defined in ASTM D 635.

L. Furnish core mounting frames and enclosures of welded and bolted construction with mechanical rigidity and strength to withstand shipping, erection and short circuit stresses.

M. Transformers located in sprinkled areas shall be provided with NEMA 2 rated enclosure to protect transformer from water falling at an angle of 75 degrees from the vertical.

N. Furnish transformers that meet UL thermal overload test of 200 percent of rated current for one half hour.

O. Furnish transformers not to exceed the 65 deg. C rise established by UL as safe limit for maximum surface enclosure temperature.

P. Furnish transformers with sound level not exceeding:

Trans. kVA	Average Sound Level in dB NEMA ST 20
0 - 09	40
10 - 50	45
51 - 150	50

Q. Install transformers with sound levels greater than 50 dB on resilient vibration isolating mounts to prevent amplification of sound. Transformers rated 15 kVA and larger to be provided with rubber washer anti-vibration pads and molded neoprene assemblies to isolate noise from the transformer to the mounting surface.

R. Provide a grounded copper electrostatic shield between the primary and secondary windings. The design of the shield shall be to shunt noise and transients to the ground path.

S. Furnish transformers sized and configured for 100 percent neutrals for the secondary full load current.

T. Furnish transformers with copper windings.

U. Furnish transformers that meet efficiency guidelines of NEMA Standards in accordance with the Department of Energy (DOE) requirements.

2.03 - SHOP TESTING

A. Furnish results of audible-sound-levels tests in accordance with NEMA ST 20 of similar size transformer.

PART 3 - EXECUTION

3.01 - INSTALLATION

A. Install and guard transformers as specified by latest Massachusetts and ANSI standards, and in accordance with manufacturer's printed instructions.

B. Install transformers so that there is space around transformer to dispose of transformer full load losses by ventilation without ambient temperature reaching 40 deg. C. maximum as specified in Paragraph 2.02.

C. Unless otherwise indicated, wall mount with supports, transformers rated 15 kVA and below. Floor mount transformers rated above 15 kVA.

D. Provide lifting lugs and jacking plates on transformer enclosure.

E. Provide concrete pad for all floor mounted transformers.

3.02 - CHECKOUT AND TESTING

A. Provide in accordance with SECTIONS 16050, ELECTRICAL WORK - GENERAL and 16998, FIELD INSPECTION AND ACCEPTANCE TESTS.

3.03 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 16400

SURGE PROTECTION DEVICES (SPDs)

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PART 1 - GENERAL

1.01 - SCOPE

A. Provide Surge Protection Devices (SPD) integral to the electrical distribution system equipment as indicated. The distribution system 480V distribution panels.

B. The components shall provide protection for electrical and electronic devices against the damaging effects of surges, transients and electrical line noise.

C. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance.
    a. Failure to include a copy of the marked-up specification sections will result in rejection of the entire submittal with no further review and construction.
2. Shop drawings, manufacturer's product data, and component ratings in accordance with this section and the requirements of SECTION 16050, ELECTRICAL – GENERAL.
3. Provide verification that the SPD complies with the required ANSI/UL 1449 listing by UL.
4. Submit SPD type, model number, system voltage, phases, modes of protection, voltage protection rating (VPR) and nominal discharge current (In).
5. Provide outline drawings and internal wiring diagrams.
6. Submit factory test data.
7. Operating and Maintenance Instruction Manuals:
    a. Operating instruction manuals outlining step-by-step procedures for system startup and operation.
    b. Manufacturer’s name, model number, service manual parts list.
    c. Brief description of equipment and basic operating features.
    d. Maintenance instruction manuals outlining maintenance procedures.
    e. Troubleshooting guide listing possible breakdown and repairs.
    f. Simplified connection wiring diagrams for each circuit.

1.05 - PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed according to the written recommendations of the supplier and as to not to degrade quality, serviceability or appearance.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. Quality Assurance

1. SPD units and all components shall be designed manufactured and tested in accordance with the latest applicable UL Standard (ANSI/UL 1449 3rd Edition).

2. SPD units shall be UL approved for use with Lightning Protection Systems.

1.07 - REFERENCES

A. Underwriters Laboratory (UL)

B. Massachusetts Electric Code.

C. American National Standard Institute (ANSI)/Institute of Electrical and Electronic Engineers (IEEE):

1. ANSI/IEEE C62.41 - IEEE Guide for Surge Voltages in Low-Voltage AC Power Circuits

2. ANSI/IEEE C62.45 - IEEE Guide for Surge Suppressor Testing

3. National Electrical Manufacturers Association (NEMA):

4. NEMA 250 - Enclosures for Electrical Equipment (1000 volts maximum)

5. NEMA LS 1 - Low Voltage Surge Protection Devices

D. Military Standard: 220A - Radio Frequency Interference and Electromagnetic Interference.

E. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - ACCEPTABLE MANUFACTURERS

A. Transient voltage surge suppression components.

1. Eaton-Cutler Hammer

2. Schneider Electric

3. Siemens

4. Or equal.

2.02 - GENERAL

A. Electrical Requirements:

1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.

2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 125% of the nominal system operating voltage.

3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

4. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

	Protection Modes			
Configuration	L-N	L-G	L-L	N-G
Wye	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

5. Nominal Discharge Current (In) – All SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20kA shall be rejected.

6. ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

Modes	208Y/120	480Y/277
L-N; L-G; N-G	400V	800V
L-L	800V	1800V

7. ANSI/IEEE C High Let-Through Voltage – The let through voltage based on an ANSI/IEEE C62.41 Category C High waveform (10kV, 10kA) shall not exceed the following:

Mode	208Y/120	480Y/277
L-N	560V	960V

8. ANSI/IEEE Cat. B Ringwave Let Through Voltage – The let-through voltage based on an ANSI/IEEE C62.41 Category B ringwave (6 kV, 500 amps) shall not exceed the following:

Mode	208Y/120	480Y/277
L-N	160V	165V

B. SPD Design:

1. Maintenance Free Design – The SPD shall be maintenance free and shall not require any intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

2. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.

3. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.

4. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.

5. Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:

    a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.

        (1) For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.

        (2) For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.

        (3) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

    b. Remote Status Monitor – The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.

    c. Surge Counter

        (1) The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location.

        (2) The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 ± 20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.

        (3) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.

6. Overcurrent Protection

   a. The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

7. Fully Integrated Component Design – All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

8. Safety Requirements

   a. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

2.03 - SYSTEM APPLICATION

A. The SPD applications covered under this section include distribution and branch panel locations, motor control centers (MCC), and switchboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

B. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum Surge Current Capacity Based on ANSI / IEEE C62.41 Location Category

Category	Application	Per Phase	Per Mode
B	480 VAC Distribution Panelboards	160 kA	80 kA

C. SPD Type – all SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

2.04 – LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.

1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
3. The panelboard shall be capable of re-energizing upon removal of the SPD.
4. The SPD shall be interfaced to the panelboard via a direct bus bar connection. Alternately, an SPD connected to a 30A circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the 30A circuit breaker.
5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
6. The SPD shall be of the same manufacturer as the panelboard.
7. The complete panelboard including the SPD shall be UL67 listed.

2.05 - SHOP TESTING

A. Provide a factory performance test for each unit. The tests shall be in accordance with the latest version of NEMA and UL Standards:

PART 3 - EXECUTION

3.01 - INSPECTION

A. Visually inspect delivered unit(s) and accessories for conformance with the Contract Drawings and specifications.

3.02 - INSTALLATION

A. Install unit in compliance with the manufacturer's printed instructions. All electrical installation Work shall be in accordance with UL Listing Requirements and applicable Massachusetts Electrical Codes.

3.03 - CHECKOUT AND TESTING

A. Provide field and functional testing in accordance with SECTION 16050, ELECTRICAL - GENERAL and SECTION 16998, FIELD INSPECTION AND ACCEPTANCE TESTS and as specified herein.

3.04 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 16402

UNDERGROUND DISTRIBUTION SYSTEM

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PART 1 - GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide Underground Distribution System as specified herein and/or as shown on the Contract Drawings.

B. Conform to lines, grades, elevations, and dimensions. Resolve interferences with other underground conduit, piping or equipment, either new or existing with the Authority. Match components for installation.

C. Provide Schedule 40 polyvinylchloride (PVC) conduits for power and control circuits. Provide rigid galvanized steel conduits for instrumentation and communication.

D. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings: Submit the following in accordance with SECTION 01300, SUBMITTALS and as specified herein.

1. Submit shop drawings and manufacturers' product data for all components and materials used in the construction of underground distribution systems in accordance with requirements of SECTION 16050, ELECTRICAL - GENERAL.

2. Provide "As-Built" drawings of underground ductbank system in accordance with SECTION 01050, FIELD ENGINEERING and SECTION 01300, SUBMITTALS.

1.05 - PRODUCT HANDLING

A. Provide delivery, storage, and handling of equipment and materials in accordance with SECTION 01610, DELIVERY, STORAGE AND HANDLING.

1.06 - DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

B. The design conditions and other pertinent requirements for the equipment are listed on the Contract Drawings.

1.07 - QUALITY ASSURANCE:

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE.

1.08 - REFERENCES

A. Massachusetts Electrical Code.

B. National Electric Safety Code.

1.09 - SEISMIC REQUIREMENTS

A. Conform to the requirements as indicated on the Structural Drawing S-1 and as specified in SECTION 01900, SEISMIC AND WIND REQUIREMENTS.

PART 2 - PRODUCTS

2.01 - ACCEPTABLE MANUFACTURERS

A. Polyvinylchloride (PVC) Conduit:

1. Specified in SECTION 16110, ELECTRICAL RACEWAY SYSTEMS Paragraph 2.01.B.

B. Rigid Steel Conduit, Galvanized:

1. Specified in SECTION 16110, ELECTRICAL RACEWAY SYSTEMS Paragraph 2.01.A.

2.02 - MATERIALS AND COMPONENTS

A. Conduit Spacers: Furnish conduit spacers made of plastic to maintain spacing between conduits.

B. Cable Supports in Handholes shall be provided as follows:

1. Cable racks, stainless steel.

2. Cable supports, stainless steel.

3. Insulators, high grade dry-process porcelain.

PART 3 - EXECUTION

3.01 - GENERAL

A. Perform Work in accordance with the Massachusetts Electrical Code and as indicated and as specified.

3.02 - INSTALLATION OF CONDUITS

A. Lay conduits indicated to be direct buried in the ground.

B. Provide separation of power and control conduits of 3 inches both vertically and horizontally. Build ductbank layer by layer. Coordinate with General Contractor to backfill and compact each layer to provide support for next layer.

C. Separate power and control ducts from instrument telephone, fire alarm and signal ducts by 12 inches.

D. Provide yellow ductbank marker tapes, reading "Caution - Electrical Lines Below", over entire length of ductline. Locate tapes 12 inches below grade. Provide a tape for every 12 inches of width of ductline.

E. Install conduit, with spacers as specified. Rigid galvanized steel conduits to be painted with bituminous paint by others under SECTION 09940, SHOP PAINTING and SECTION 09941, FIELD PAINTING.

F. Install conduit runs following routing on drawing and running in straight lines. Provide end bells where ducts enter handholes of the same material as the duct system. Terminate steel conduit entering hand holes in grounding bushing. Where deviation from a straight line becomes necessary, install bends of radius which allow for rodding and installation of cable.

G. Accomplish changes in direction of runs exceeding total of 10 degrees, either vertical or horizontal, by long sweep bends having radius of curvature of 25 ft. Manufactured bends can be used at ends of short runs of 100-ft. or less, and then only at or close to the end of run. Provide long sweep bends made up of one or more curved or straight sections and/or combinations thereof. Install manufactured bends with radius of 36-in. where larger radius cannot be used.

H. Lay ductlines to slope of 4 inches per 100-ft. and slope to handholes from a high point between the handholes. Ductlines are to slope away from buildings.

I. Install spacers at intervals of 4 ft. and stagger between tiers of ducts to provide 12-in. of longitudinal separation. Install base spacers to provide 3-in. between bottom of trench and underside of bottom conduits. Coordinate with General Contractor to fill space with concrete under SECTION 03300, CAST-IN-PLACE CONCRETE. Firmly wire conduits and spacers together before concrete is placed.

J. Prior to placing of concrete under SECTION 03300, CAST-IN-PLACE CONCRETE, General Contractor to remove all dirt, sand, and any other debris from between conduits and from trench bottoms under SECTION 02210, EARTH EXCAVATION, BACKFILL, FILL AND GRADING. Hold conduits in place to prevent floating or accidental movement.

K. Stagger joints in conduits 6-in. Do not allow couplings to rest on bottom of trench. Install couplings for plastic conduit in accordance with manufacturer's recommendations.

L. General Contractor to install concrete encasements under SECTION 03300, CAST-IN-PLACE CONCRETE so clearance of 12-in. from concrete to parallel pipes, lines, and structures, is maintained. Where ducts cross, clearance of 6 inches is required.

M. At a point close to the handhole wall, drive a ground rod into earth. Extend ground rod 6-in. above finished handhole floor. After completion of handhole by General Contractor under SECTION 03300, CAST-IN-PLACE CONCRETE, connect 6-foot length of No. 4 bar copper ground wire to ground rod. Connect grounding bushings, cable racks, covers, other metallic parts, splices, and ground wire installed with each feeder to ground loop.

N. Keep conduits clean of concrete, dirt, and other substances during the course of construction. After the ductlines have been completed, pull a standard flexible mandrel not less than 12-in. long, having a diameter 1/4-in. less than the inside diameter of the conduit, through each conduit, after which pull a brush with stiff bristles through each conduit to make certain that no particles of earth, sand, or gravel have been left in the line. Replace conduit runs that do not allow the passage of the mandrel at no additional cost to the Authority. Pneumatic rodding may be used to draw in the lead wire. Install in spare conduits a pull wire or rope and plug and seal spare conduits after cleaning.

3.03 - AS-BUILT DRAWINGS OF UNDERGROUND WORK

A. Provide one set of marked copies of contract drawings, showing exact routing and depths of all underground conduit and duct handholes. Provide scaled plot plans, showing principal outline of buildings and structures. Reference conduits, ducts, and all bends deviating from straight line, dimensionally from fixed objects or structures.

3.04 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 16450

GROUNDING

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PART 1 – GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide a single, integrated grounding system, including conductors, raceways, and connections, indicated and specified, and in accordance with the Massachusetts Electrical Code Article 250 and the National Electrical Safety Code, as specified herein and/or as shown on the Contract Drawings

B. Include grounding of electrical equipment enclosures, generators, transformers, ground grid systems with ground rod and structural steel.

C. Include grounding conductors completely interconnecting ground grid and other distribution equipment, and other groundable equipment.

D. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance.

a. Failure to include a copy of the marked-up specification sections will result in rejection of the entire submittal with no further review and construction.

2. Submit shop drawings and manufacturers' product data in accordance with requirements of SECTION 16050, ELECTRICAL - GENERAL.

1.05 - PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

C. Seismic Requirements

1. Conform to the requirements as indicated on Structural Drawing 00-S-001 and as specified in SECTION 01900, SEISMIC AND WIND REQUIREMENTS.

1.07 - REFERENCES

A. American National Standards Institute (ANSI)

1. ANSI C2: National Electrical Safety Code

B. National Fire Protection Association (NFPA):

1. NFPA 70: National Electric Code
2. NFPA 780: Lightning Protection Code

C. Massachusetts Electrical Code

D. American Society for Testing and Materials (ASTM)

1. B3: Soft or Annealed Copper Wire.
2. B8: Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
3. B33: Tinned Soft or Annealed Copper Wire for Electrical Purposes.

E. Underwriters Laboratories, Inc. (UL)

1. U.L. 44: Wires and Cables Rubber Insulated.
2. U.L. 83: Wires Thermoplastic-Insulated.

F. National Electrical Mfg's Association (NEMA)

1. WC 3: Rubber Insulated Wire & Cable.
2. WC 5: Thermoplastic Insulated Wire & Cable.
3. WC 7: Cross-Linked-Thermosetting Polyethylene-Insulated Wire & Cable.
4. WC 8: Ethylene-Propylene-Rubber-Insulated Wire & Cable.

G. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - ACCEPTABLE MANUFACTURERS

A. Ground Rods

1. Erico Products Inc.
2. Galvan Electrical Products.
3. Nehring Electrical Works.
4. Or equal.

B. Exothermic Welding

1. Erico Products, Inc.
2. American Brass Mfg. Co.
3. Orgo-Thermit, Inc.
4. Or equal.

C. Connecting Hardware

1. American Brass Mfg. Co.
2. Thomas and Betts
3. Anderson Electric Corp.
4. Or equal.

2.02 - MATERIALS AND COMPONENTS

A. Conductors

1. Provide tinned copper grounding conductors, sized as indicated. Provide protection of conductors if physical damage would result from direct exposure.
2. Provide uninsulated conductors where conductors are buried in the earth or where they are embedded in the concrete.
3. In buildings, provide insulated grounding conductors with green insulation. Provide insulated grounding conductors with insulation rated at 600 volts.

B. Ground Bus

1. Provide a 2-in. by 1/4-in. tinned copper bar with bolted type connectors as indicated.

C. Ground Rods

1. Provide copper-clad steel or galvanized steel ground rods; type, diameter and length as indicated on drawings. Make cable to ground rod connection without passing over end of ground rod.

D. Connections

1. Provide silicon bronze ground clamps for use on copper or brass pipes which are UL listed.
2. Provide ground clamps, for use on iron pipes, of galvanized or malleable iron, or of standard noncorrosive material.
3. Furnish ground clamps, for use on pipes, with rigid metal base providing solid contact by seating on the pipe. Do not use strap type clamps.

PART 3 - EXECUTION

3.01 - INSTALLATION OF GROUNDING CONDUCTORS

A. Install grounding conductors so that they will not be exposed to physical damage. Install connections firm and tight. Arrange conductors and connectors so no strain on connections.

B. Run grounding conductors associated with direct burial cables in common trenches above or if indicated beside cables.

C. Bury equipment grounding conductors 30 inches deep. Bring loops or taps up for connection to equipment or other items to be grounded.

D. Where raceways are used to contain and protect grounding conductors, install in accordance with SECTION 16110, ELECTRICAL RACEWAY SYSTEMS and SECTION 16402, UNDERGROUND DISTRIBUTION SYSTEMS.

E. Where bare grounding conductors are contained within metallic raceways, bond ends of raceways to conductors.

F. Install loop type, low impedance, grounding system interconnecting all components so two grounding connections are provided for each item of electrical equipment. Ensure that severing of any single grounding conductor in this system does not remove grounding protection on any major item.

G. Connect structural steel at locations indicated to the grounding loop and connect to each vertical column by loop or tap. Provide exothermic weld connections. Connect two opposite points on external loop to two different points on grounding system.

H. Buried and concealed ground connections are to use exothermic welding.

I. Make accessible connections to structural members by exothermic welding process. Connections to equipment or ground bus shall be by bolted connectors.

3.02 - INSTALLATION OF GROUND RODS

A. Install ground rods in manholes and handholes in accordance with requirements specified under SECTION 16402, UNDERGROUND DISTRIBUTION SYSTEMS. Connect each grounding conductor entering a manhole or handhole to ground rod by exothermic weld.

B. Install ground rods where indicated. Install the top of the rod 12-in. below the ground surface.

C. Make connection to overall grounding system as indicated.

D. Ensure that final resistance of interconnected ground system is 3 ohms, or less. Measure ground resistance in normally dry conditions, and not less than 48 hours after rainfall.

3.03 - EQUIPMENT GROUNDING

A. Ground each piece of electrical equipment by means of a grounding conductor installed in raceway feeding that piece of equipment with copper wire sized in accordance with Massachusetts Electric Code. Grounding conductors installed in conduit with insulated conductors to be furnished with green, 600-volt insulation. Ground conductors are in addition to and not to be considered as the neutral wire of the system.

B. Connect power transformer cases and neutrals to grounding system. Connect neutral ground connection at transformer terminal. Provide two separate, independent, diagonally opposite, connections for power transformers so removal of one connection will not impair continuity of other.

C. Connect two separate ground connections from ground grid to ground bus of electrical enclosures and outdoor generator. Confirm that each connection for item of equipment is from different section of ground grid.

D. Connect a grounding conductor between panelboard and grounding system. Where a grounding bar is furnished with panelboard, connect grounding conductor to bar.

E. Where conduits are not effectively grounded by firm contact with a grounded enclosure, apply grounding bushings on one end of conduit run.

F. Connect grounding conductors from equipment in area where ground bus is required to ground bus. Connect ground bus to grounding system. Mount ground bus on 600V pedestal insulators.

G. Connect lightning arresters to ground system by suitable conductors. Where lightning arresters are furnished with electrical equipment and grounding connections are not inherently provided, confirm that separate grounding conductor connects lightning arresters with system ground.

H. Connect generator neutral to grounding system by a grounding conductor of size required by NEC, unless a larger size is indicated. Connect grounding conductor to generator disconnect enclosure and generator neutral on generator side of disconnect. Ground generator frame with two separate independent connections, so removal of one connection will not impair continuity of other.

I. Ground transformers, lightning arresters, insulators and other appurtenances, installed on poles, poles and timber structures, or metal structure. Run grounding conductors between poles or structure and ground rods. Protect grounding conductor by molding applied for 8 ft. above ground, with both molding and conductor stapled. Install ground rod where indicated and driven until top of rod is 1 ft. below ground.

J. Interconnect the water piping systems with the grounding system per the Massachusetts Electrical Code.

K. Ground wire fences when used to enclose electrical equipment or when overhead electrical lines cross fence. Unless otherwise indicated, provide grounding by buried outside peripheral ground loop; connections to each corner fence post and nearby ground rod; flexible connections to each gate; and at least two connections to grounding system from approximately opposite positions on fence.

L. Connect the ground rods to the grounding conductor run with the direct burial cable.

3.04 - SIGNAL GROUNDING

A. Ground signal surge protection and shields of twisted, shielded cable using a signal bonding conductor. The signal bonding conductor shall be a continuous path from the instrument surge protection or shield to the grounding electrode conductor. The signal bonding conductor shall be isolated from the equipment grounding conductor for its entire path.

B. Where convenient several signal bonding conductors may be conbined, providing that all the following conditions are met:

1. The combined signal bonding conductor shall have the equivalent cross section of the conductors that it was combined from or three times the cross section of the largest conductor that it was combined from, whichever is less.

2. The combined signal bonding conductor shall be isolated from the equipment grounding conductor.

3. Where two signal bonding conductors are combined use a three port insulated splice.

4. Where three or more signal bonding conductors are combined, use a copper bus mounted on 600V insulators. Attach each conductors to the bus using an insulated ring tongue lug and screw terminal.

3.05 - TESTS AND CHECKOUTS

A. Provide field and functional testing in accordance with SECTION 16050, ELETRCIAL - GENERAL and SECTION 16998, FIELD INSPECTION AND ACCEPTANCE TESTS and as specified herein.

3.06 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 16900

ELECTRICAL CONTROLS AND MISCELLANEOUS ELECTRICAL EQUIPMENT

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PART 1 – GENERAL

1.01 - SCOPE

A. Provide and connect the electrical control equipment and miscellaneous electrical equipment, including such instruments and devices indicated and specified. Device enclosures for electrical equipment shall comply with the requirements of Massachusetts Electric Code including Hazardous Locations, Class, Division, and Group as indicated.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.
2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.
3. "Provide" shall mean furnish and install.
4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Submit shop drawings and manufacturer's product data, brochures including wiring diagrams in accordance with SECTION 16050, ELECTRICAL WORK – GENERAL.
2. Wiring diagrams to show control interface points provided with other equipment.
3. Shop drawings to include:
    a. Outline drawings with elevations.
    b. Equipment arrangement drawings.
    c. Anchor bolt location drawings.
    d. Electrical schematics and wiring diagrams.
    e. Electrical fuse/circuit breaker characteristic.
    f. Equipment performance curves and technical data.
    g. Bill of installation/assembly materials.
    h. Equipment weights.
    i. Completed manufacturer’s data sheets.
    j. Assembly sizes and weights.

1.05 - PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed according to the written recommendations of the supplier and as to not to degrade quality, serviceability or appearance.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

C. Seismic Requirements

1. Conform to the requirements as indicated on Structural Drawing 00-S-001 and as specified in SECTION 01900, SEISMIC AND WIND REQUIREMENTS.

1.07 - REFERENCES

A. Underwriter's Laboratories, Inc. (U.L.)

1. UL-467: UL Standard for Safety, Grounding and Bonding Equipment.
2. UL-4898 UL Standard for Safety, Molded-Case Circuit Breakers and Circuit Breaker Enclosures.
3. UL-823: Electrical Heaters for Use in Hazardous (Classified) Locations.

B. National Electrical Manufacturers Association (NEMA)

1. 250: Enclosures for Electrical Equipment (1000 volts maximum).
2. ICS 1: General Standards for Industrial Control and Systems.
3. ICS 2: Industrial Control Devices, Controllers and Assemblies.
4. ICS 4: Terminal Blocks for Industrial Use.

C. American Society for Testing and Materials (ASTM) Publications

1. D 178: Specification for Rubber Insulating Matting.

D. National Fire Protection Association (NFPA)

1. NFPA-70 National Electric Code (NEC).

E. Massachusetts Electric Code.

F. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 - A8CEPTABLE ELECTRICAL DISTRIBUTION MANUFACTURERS

A. Allen-Bradley.

B. General Electric Company.

C. Cutler-Hammer.

D. Square D Company.

E. Appleton Electric Company.

F. Crouse-Hinds Company.

G. O-Z/Gedney.

H. Or equal.

2.02 - ACCEPTABLE STAINLESS STEEL/GALVANIZED STEEL CHANNEL MANUFACTURERS

A. Unistrut Corp.

B. Power-Strut.

C. B-Line Systems, Inc.

D. Or equal.

2.03 - ACCEPTABLE FIBERGLASS CHANNEL MANUFACTURER

A. Omnistrut, Champion Fiberglass.

B. Durostrut, Enduro Composite Systems.

C. Struttech, Entrum Industries.

D. Or equal.

2.04 - SAFETY DISCONNECT SWITCHES

A. Provide heavy duty type, safety switches, with external operating handles, 3 PST, rated 600 volt, 60 Hertz with ampere rating as indicated, and having provisions for padlocking.

B. Provide rejection type fuses, 600 volts, 200,000 A.I.C., dual element, time delay, Class RK-5.

C. Heavy duty safety switches to be UL listed, and meet or exceed NEMA Standard KS1.

2.05 – PUSH BUTTON AND SELECTOR SWITCH STATIONS

A. Provide RUN-OFF-REMOTE (ROR) switches, start-stop, push buttons, tumbler switches and other accessory devices as necessary for the control of motors and other electrical equipment or devices as indicated where shown on the wiring schematics and/or plan drawings.

B. Provide pushbutton and selector switch stations made for heavy-duty service and with momentary or maintaining contacts as indicated or as necessary for starting and stopping of equipment with 10 amp contact ratings.

C. Acceptable manufacturers of heavy-duty switches and pushbuttons are Square D, Cutler-Hammer, Allen Bradley or equal. Indicating lights to be led cluster type.

D. At stations provide nameplates with white letters on black background.

E. Provide explosion proof stations approved for use in Massachusetts Electric Code, Class I, Division 1, Group C & D areas. Stations shall also meet NEMA 4X area requirements.

F. Provide galvanized cast-iron enclosures for NEMA Type 4 watertight stations.

G. Provide fiberglass reinforced polyester NEMA Type 4X enclosures for stations located in highly corrosive areas. Provide gaskets and Type 316 stainless steel screws, to prevent entry of chemicals.

2.06 - MANUAL MOTOR STARTERS

A. Provide manual motor starters where indicated and for 120-volt, 60-Hertz fractional horsepower motors.

B. Provide each manual motor starter with overload heater or heaters of suitable capacity for motor-running over-current protection for motor it controls. Provide manual starters as single or 2 pole, as necessary, and with toggle mechanisms indicating OFF and ON positions. Provide manual starters with built-in HAND-OFF-AUTO switches. Provide enclosures as indicated.

C. Manual starters to be located within sight of motors, as defined by Massachusetts Electric Code.

2.07 - WALL-MOUNTED COMBINATION STARTERS

A. Unless otherwise indicated, provide each combination starter with motor circuit protector and full-voltage magnetic starter. Provide starters in enclosures rated in accordance with the Area Classification Schedule on Contract drawings.

B. Indicating lights shall be LED cluster type, heavy-duty, oil-tight units. Lights shall be Red for “OFF” position, Green for “ON” position and Amber for “Alarms”.

2.08 - RUBBER MATS

A. Provide insulating rubber mats conforming to ASTM D-178 Type I, Class I: Mats shall be 3 ft. wide and have a length equal to the equipment before which they are to be placed. Provide two spare mats, each 12-feet long as spares.

B. Provide mats for transformers, switchboard, panelboards, motor control centers, control panels, SCADA racks, Fire Alarm Panels and variable frequency drives.

2.09 - CONTACTORS AND RELAYS

A. Provide mechanically held, heavy duty industrial type contactors (relays) for lighting control, rated 30 amps, 600 volts, with number of poles as indicated.

B. Provide contactor in the required NEMA enclosure suitable for wall mounting. Provide circuit breaker or fuse protection on each ungrounded pole. Provide mechanically held contactor from the following acceptable manufacturers: Automatic Switch Company 917 series, Cutler-Hammer, Square D or equal.

C. Provide control power transformer with primary and secondary fuse protection. Control power to be 120 volts, single phase.

D. Provide solid-state, industrial grade timing relays from the following acceptable manufacturers: Allen Bradley Series 700, Cutler-Hammer, Siemens or equal.

E. Provide industrial grade relays, NEMA rated, from the following acceptable manufacturers: Square D Class 8501, Cutler-Hammer, Allen Bradley or equal.

2.10 - NAMEPLATES

A. Provide nameplates for equipment (including pushbutton and selector switch stations) listed in this Section to designate the equipment controlled and their function.

B. Nameplates shall be laminated black bakelite with one-quarter inch (1/4-in.) high, white, recessed letters. Securely attach to the equipment with Type 316 stainless steel screws, or rivets. Adhesives, glue or cements will not be permitted.

C. Provide all junction boxes, pull boxes, disconnect switches and control panels with a nameplate to designate the system wiring contained within.

D. Install nameplates in a location near or on the equipment or devices.

2.11 - TERMINAL BLOCKS

A. Provide terminal blocks in all terminal boxes panels, control and instrumentation cabinets/panels requiring terminations as indicated on drawings or by wiring diagrams for equipment actually purchased. All terminals shall be rated 600V, 20 amp. All terminals shall be screw type with provisions for white wire markers.

2.12 - CHANNELS

A. Provide Type 316 stainless steel channel or fiberglass channel with corresponding accessories as specified in SECTION 16110, ELECTRICAL RACEWAY SYSTEMS. and herein.

B. Provide hot-dipped galvanized after fabrication for steel channel and accessories.

C. Provide channel of the proper material to match equipment classifications as specified in SECTION 16110, ELECTRICAL RACEWAY SYSTEMS.

2.13 – AUTOMATIC TRANSFER SWITCH

A. Provide UL listed, 480VAC, 3-phase, 3-wire, automatic transfer switches (ATS) to automatically transfer between normal utility power source and standby generator power source.

B. Provide open-transition, electrically operated automatic transfer switch of the current, voltage, and short circuit ratings indicated on the Contract drawings capable of switching all classes of load and fully rated.

C. Provide service entrance rated ATS.

D. Provide ASCO 7000 Series or approved equal.

E. Provide ATS with dry-type contacts to PLC for remote indication of transfer switch position and status:

1. Utility Power Position
2. Standby Generator Power Position
3. General Fault Alarm

PART 3 - EXECUTION

3.01 - CHANNELS

A. Install Type 316 stainless steel for mounting of electrical equipment in outdoor areas, NEMA 4 or 4X areas, and on below grade, outside building and structure walls.

B. Install galvanized steel channels for interior building mounting of electrical equipment except for those locations specified herein.

C. Install fiberglass channel in chemical areas with NEMA 4X enclosures.

3.02 - PHYSICAL CHECKOUT AND TESTING

A. Provide field and functional testing in accordance with SECTION 16050, ELETRCIAL - GENERAL and SECTION 16998, FIELD INSPECTION AND ACCEPTANCE TESTS and as specified herein.

3.03 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 16998

FIELD INSPECTION AND ACCEPTANCE TESTS

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PART 1 – GENERAL

1.01 - SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required to provide Field Inspections and Acceptance Testing as specified herein and/or as shown on the Contract Drawings.

B. After electrical installation is complete, (a) adjust and set all protective devices (in accordance) with results of electrical studies, (b) perform tests to demonstrate that the entire system is in working order and in accordance with applicable codes, manufacturer's instructions, drawings and specifications. Test shall be performed per International Electrical Testing Association (NETA): Acceptance Testing Specification for Electrical Power Distribution System and Equipment (STD). Tests are in addition to, and not a substitution for, tests of individual items at the manufacturer's facilities. Perform insulation and ground resistance tests before operating tests. Determine proper rotation of motors before permanent connections are made.

C. Tests are also intended to accomplish the following:

1. Provide initial acceptance tests and recorded data.
2. Ensure a successful start-up with a minimum of last minute interruptions and problems.
3. Determine the suitability of the equipment and systems for energizing and placing into operating service.
4. Ensure that each system component is installed satisfactorily, will perform and will continue to reliably perform its function.

D. Provide all necessary supervision, labor, materials, tools, test instruments or other equipment or services and expenses required to test, adjust, set, calibrate, functionally and operationally check all work and components of the various electrical systems and circuitry throughout the installation.

E. Engage the services of a nationally recognized Independent Electrical Tester to perform the required field inspections, test, and adjustments specified. The Independent Electrical Tester shall meet the following qualifications:

1. The testing firm is not to be a subsidiary, division, or department of the Contractor performing the work of Division 16.

2. The testing firm is not to be subsidiary, division, or department of the manufacturer of the equipment, materials or systems being inspected or tested.

3. The testing firm shall perform all testing in accordance with International Electrical Testing Association, Inc. (NETA), standards and procedures. All testing results shall be submitted on NETA forms and the testing data shall be certified by a Registered Professional Electrical Engineer. Test results shall indicate recommended action for sub-par test results. Results shall list recommended test values that should be obtained for a new installation.

4. Testing and checkout work shall be performed with personnel skilled and trained in the particular tests being conducted.

5. Evidence of the proposed testing firm's qualifications, accreditation, and experience shall be submitted for evaluation. Testing firm shall be member of NETA with minimum of five years of testing industrial electrical systems to NETA requirements and procedures.

F. The Independent Electrical Testing Contractor shall provide supervision, labor, materials, tools, test instruments, or other equipment, and services, required to adjust, set, calibrate, and test operate the components of the various electrical systems and circuits throughout the installation, the construction package, and as specified herein.

G. Perform these tests after the electrical installation is complete. These tests shall demonstrate that the entire electrical system is in proper working order and in accordance with: applicable codes; and the supplier's instructions, drawings, and specifications.

H. Testing by the Independent Electrical Tester in no way changes the requirements to perform the specified tests, checkouts, and inspections required under the equipment specification sections.

I. The listings and descriptions of the tests, and checks described herein is not to be considered as complete and all inclusive.

J. Retests required by defects and failures of equipment to meet specifications shall be conducted at no additional cost.

1. Replace wiring and equipment found to be defective, or failing to meet specified requirements, at no additional cost.

2. Supply electric current necessary for tests.

K. Where specified in other DIVISION 16, ELECTRICAL sections, perform work under the supervision of factory trained technicians, representing the equipment being tested or inspected.

L. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Submit inspection and testing forms for all electrical distribution equipment to be inspected and tested under this section.

2. Submit data sheets for the insulation resistance testing of conductors and motors prior to performing operating testing. List all cables and motors to be tested.

3. Provide space on data sheet forms to enter the results of testing, instruments used with serial numbers, and name of personnel performing testing. This data to be filled out during testing.

4. After completion of the testing, submit all test results with observed notes and recommendations.

1.05 - PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed according to the written recommendations of the supplier and as to not to degrade quality, serviceability or appearance.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 - DESIGN CRITERIA

A. The materials specified are intended to be standard materials of demonstrated successful performance, as manufactured by reputable concerns. Materials shall be designed and manufactured in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

1.07 - REFERENCES

A. National Electrical Manufacturer's Association – NEMA

B. American Society for Testing and Materials – ASTM

C. Institute of Electrical and Electronics Engineers – IEEE

D. International Electrical Testing Association – NETA – Acceptance Testing Specification for Electric Power Distribution Equipment and Systems (STD).

E. American National Standards Institute – ANSI

1. ANSI C2: National Electrical Safety Code

2. ANSI Z244-1: American National Standard for Personnel Protection

F. State and Local Codes and Ordinances

G. Insulated Cable Engineers Association – ICEA

H. Association of Edison Illuminating Companies – AEIC

I. Occupational Safety and Health Administration

1. OSHA Part 1910; Subpart S, 1910.308

2. OSHA Part 1926; Subpart V, 1926.950 through 1926.960

J. National Fire Protection Association – NFPA

1. ANSI/NFPA 70B: Electrical Equipment Maintenance

2. NFPA 70E: Electrical Safety Requirements for Employer Workplaces

3. ANSI/NFPA 70: National Electrical Code

4. ANSI/NFPA 780: Lightning Protection Code

5. ANSI/NFPA 101: Life Safety Code

K. All inspections and tests shall utilize the following references:

1. Project Design Specifications

2. Project Design Drawings

3. Manufacturer's instruction manuals applicable to each particular apparatus

L. Where reference is made to one of the above standards, the version in effect at the time of bid opening shall apply.

1.08 - SCHEDULING

A. The Contractor is responsible for the preparation of proposed procedures, testing and inspection forms, and schedules for all inspections, tests, settings and calibrations specified or otherwise required prior to or during the check out for start-up and acceptance of all the electrical components, equipment and systems. This work to be coordinated and to be compatible with the work of other crafts and the project schedule. The above must be organized and submitted with all proposed testing and NETA approved check out forms for the review. The procedures must provide specific instructions for the checking and testing of each component in addition to the system functional checks.

B. Prior to check out and testing for start-up, verify that all equipment and wiring is permanently identified with nameplates and tags. Check and tighten all terminals and connection points, remove all shipping blocks and hardware, thoroughly clean all equipment, repair all damaged or scratched finishes, inspect for broken and missing parts and review and collect manufacturer's drawings and instructions. Make routine checks and tests as the job progresses to verify that all wiring and equipment are properly installed.

C. Safety practices shall include, but are not limited to, the following requirements:

1. Occupational Safety and Health Act
2. Accident Prevention Manual for Industrial Operations, National Safety Council
3. Applicable state and local safety operating procedures
4. Owner's safety practices
5. National Fire Protection Association
6. American National Standards for Personnel Protection

D. All tests shall be performed with apparatus de-energized. Exceptions must be thoroughly reviewed to identify safety hazards and devise adequate safeguards.

E. The testing firm shall have a designated safety representative on the project to supervise the testing operations with respect to safety.

F. Ensure that all testing and checkout work is conducted in a safe manner. Special safety precautions such as the following to be utilized where appropriate:

1. Locking and tagging procedures
2. Barricades
3. De-energization and/or isolation of equipment prior to testing
4. Review of procedures with site personnel
5. Erection of warning signs
6. Stationing of guards and watchmen
7. Maintenance of voice communications
8. Personnel orientation

G. Report all inspections, tests, and calibration in writing on NETA approved report forms. The recorded data from shall have the signatures of the persons conducting the tests and authorized witnesses. The forms shall serve as the test and inspection checklist for inspection requirements. Submit all test and check out data in accordance with SECTION 01300, SUBMITTALS prior to adjustments, repairs, drying out, or similar work prior to final testing and acceptance. "As-found" and "as-left" test data to be recorded and reported in writing.

H. Sequence tests and checks such that the equipment can be energized immediately after the completion of the applicable tests.

PART 2 - PRODUCTS

2.01 - TESTING EQUIPMENT

A. Calibration:

1. All calibration and setting checks by the Independent Electrical Test shall be performed with the laboratory's calibrated test instruments. This test equipment to have calibrations traceable to the National Bureau of Standards. The Independent Electrical Tester dated calibration labels shall be visible on all test equipment. Calibrations over 6 months old will not be acceptable on field test instruments. All testing instruments shall be checked to verify satisfactory operation prior to proceeding with the tests. Serial and model numbers of the instruments used shall be recorded on the test forms.
2. Make necessary openings in circuits for testing instruments and place and connect all instruments, equipment, and devices, necessary for the tests. Upon completion of tests, remove instruments and instrument connections and restore all circuits to permanent condition.

2.02 - TESTING

A. Coordination

1. Coordinate activities, and cooperate with others on project, to ensure that systems are ensure that systems are energized when required, loads applied, and other requirements are carried out on timely, coordinated basis.

2. Conduct tests in presence of the Owner's representative. Provide ten calendar days or more advance notification of when any test is to be performed.

3. Conduct testing such that warranties or guarantees are not voided. Coordinate all testing with manufacturer's factory trained technicians, where applicable. Where specified tests are not compatible with the manufacturer's recommendations, obtain the manufacturer's review prior to testing. Permit witnessing by the manufacturer's representative if so requested.

B. Preparation

1. Make up no low voltage connections at service entrance, transformers, motors, switchboard and motor control centers, permanently until correct phase rotation of all equipment is determined. Install and insulate these connections temporarily, if necessary, while determining proper rotation. Make permanent connections after proper rotation has been established and subsequent to completion of insulation resistance and dielectric tests.

PART 3 – EXECUTION

3.01 - INSULATION TESTS OF EQUIPMENT, CABLE, AND CIRCUITS

A. Independent Electrical Testing:

1. The Independent Electrical Tester shall perform all inspections and testing as specified herein.

B. List each circuit and measured resistance as test data.

C. Maintain records of all insulation resistance values. Identify conductor, or equipment, date that value was taken, and resistance value. Submit the information in neat tabular forms.

3.02 - SPECIFIC TESTS AND INSPECTIONS

A. General:

1. The following specific items or work shall be performed by the Independent Electrical Tester. The equipment and cable shall be de-energized and isolated as necessary to perform the tests.

2. Perform tests and inspections as specified throughout DIVISION 16, ELECTRICAL. Tests and inspections required by these sections are not necessarily repeated under this section.

3. Provide assistance as requested by the Independent Electrical Tester in performing its work.

B. Equipment Test and Inspection During Construction and Prior to Acceptance Testing:

1. Motors:

a. Visually inspect the motor for any physical damage.

b. Before energizing any machine, visually inspect for serviceability. Verify that proper alignment has been performed. Check nameplate for electrical power requirements.

c. Test run all motors before placing into regular service. A check on the motor for rotation, speed, current and temperature rise shall be made and results recorded. Maintain the proper color codes for phase identifications. A motor phase rotation meter should be used prior to connection at motor to prevent later swaps of phase wires.

2. Grounding Systems:

   a. All loops and major equipment grounds to be tested to remote earth or directly referenced to an extremely low resistance (3 ohm) reference ground bench mark. Visual inspection of all systems, raceway and equipment grounds to be made to determine the adequacy and integrity of the grounding. All ground testing results to be properly recorded, witnessed, and submitted.

   b. Ground tests shall be performed in accordance with NETA using a J. G. Biddle Company low resistance, Null balance type, ground testing ohmmeter, and test lead resistance compensated for. The test instrument to be the type, which compensates for potential and current rod resistances.

   c. Test entire grounding system for continuity of connections and for resistance. Ensure that ground resistance of conduits, equipment cases, and supporting frames does not vary appreciably from that of system as whole and does not exceed 3 Ohms.

3. Outdoor Pad Mounted Transformer:

   a. At the time of equipment receipt, visually check the exterior for any damage or defects.

4. Circuit Breakers – Low Voltage:

   a. At the time of equipment receipt, visually check the exterior for any damage or defects.

   b. Perform complete inspection and electrical test in accordance with NETA.

5. Dry-Type Transformers:

   a. All 480 volt primary, air-cooled, transformers shall be given an insulation test, by means of a megger, after connections with the primary cables are complete. The supply cable shall be meggered with the primary winding and to the open air circuit breaker. Secondary leads may be meggered with the secondary windings to the open load breakers.

   b. Check continuity and correctness of connections of all windings and ratings.

   c. Perform inspection checks, and electrical tests in accordance with NETA.

6. 600 VAC Wire and Cable:

   a. Before energizing, the continuity and insulation resistance of all wiring shall be measured with a megger from each wire to all others and to ground.

   b. All cables and wires to be checked for proper identification numbering and/or color coding.

   c. Perform inspection checks and electrical tests in accordance with NETA.

7. Overhead Conduit Systems:

   a. The overhead conduit system to be checked for proper installation by using the following check list: (This list not to be considered all inclusive but as a guide for inspection).

      (1) Conduits are supported on appropriate independent supports (i.e., not on process piping, pipe ways, or piping hangers).

      (2) Exposed conduits are run in a neat workmanlike manner, parallel or perpendicular to structural members.

      (3) Conduits are routed as far away from possible fire hazards and heat sources as practical.

      (4) Conduits are supported at the required intervals.

      (5) Pull boxes and fittings are installed so that covers are easily removable. Verify that all covers are installed and tightly bolted with gaskets provided where needed.

      (6) Number of bends in the conduit does not exceed NEC requirements without a pull box installed.

(7) Circular cross-sectional area is uniform at conduit bends. Single bends do not exceed 90 degrees.

(8) Conduits are terminated in threaded hubs or bushings to prevent damage to wire.

(9) Conduits joints have joint compound of the type specified and are tight and conduit ends are properly reamed and threaded not to engage less than 5 threads.

(10) Pull fittings are of adequate size such that cable can be installed and replaced at a later date without bending the cable less than code or manufacturer's requirements.

(11) Seal fittings and/or sealing compound is installed at moisture barriers to prevent entry of moisture into equipment and/or where shown on plans.

(12) Drains and conduit seals are installed on vertical conduit runs entering devices, equipment, and enclosures to prevent entrance of moisture.

(13) Flexible conduit is installed at motors and other equipment as specified or required. Verify that all cabling and conduit runs are properly identified at each end.

8. Panelboard electrical checks to be as included in the Wire and Cable section of this specification. Panelboards to be checked for proper circuit identification on the door schedule.

9. Sealing of Openings: Inspect the entire job to ensure that all openings and holes provided or utilized are properly sealed as specified.

10. Where referenced NETA Standards indicate optional testing, perform these tests as described.

3.03 - CONTRACT CLOSEOUT

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

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SECTION 99999

ATTACHMENTS

ATTACHMENT A

Downtown Area Sewer Expansion, Main Street at Route 6A and Route 28, Orleans, MA Record Drawings, by AECOM Technical Services, Inc., July 8, 2019

ATTACHMENT B

Town of Orleans, MA, Locust Road and Brewster Cross Road Stormwater Improvement by GHD, Inc., September 2019

ATTACHMENT C

The Stop & Shop Supermarket Company, Cranberry Cove Plaza, Store No. 026, Orleans, MA Septic System Upgrade Bioclere System Addition, by Woodard & Curran, Inc., September 1995

ATTACHMENT D

Preliminary Pumping Station No. 2 Site Planting Plan

ATTACHMENT E

Miscellaneous Testing and Soil Data: Geotechnical Data Report

ATTACHMENT F

Downtown Area Collection System Layout

ATTACHMENT G

Library Parking- Option 2

ATTACHMENT H

Pre-Bid Conference

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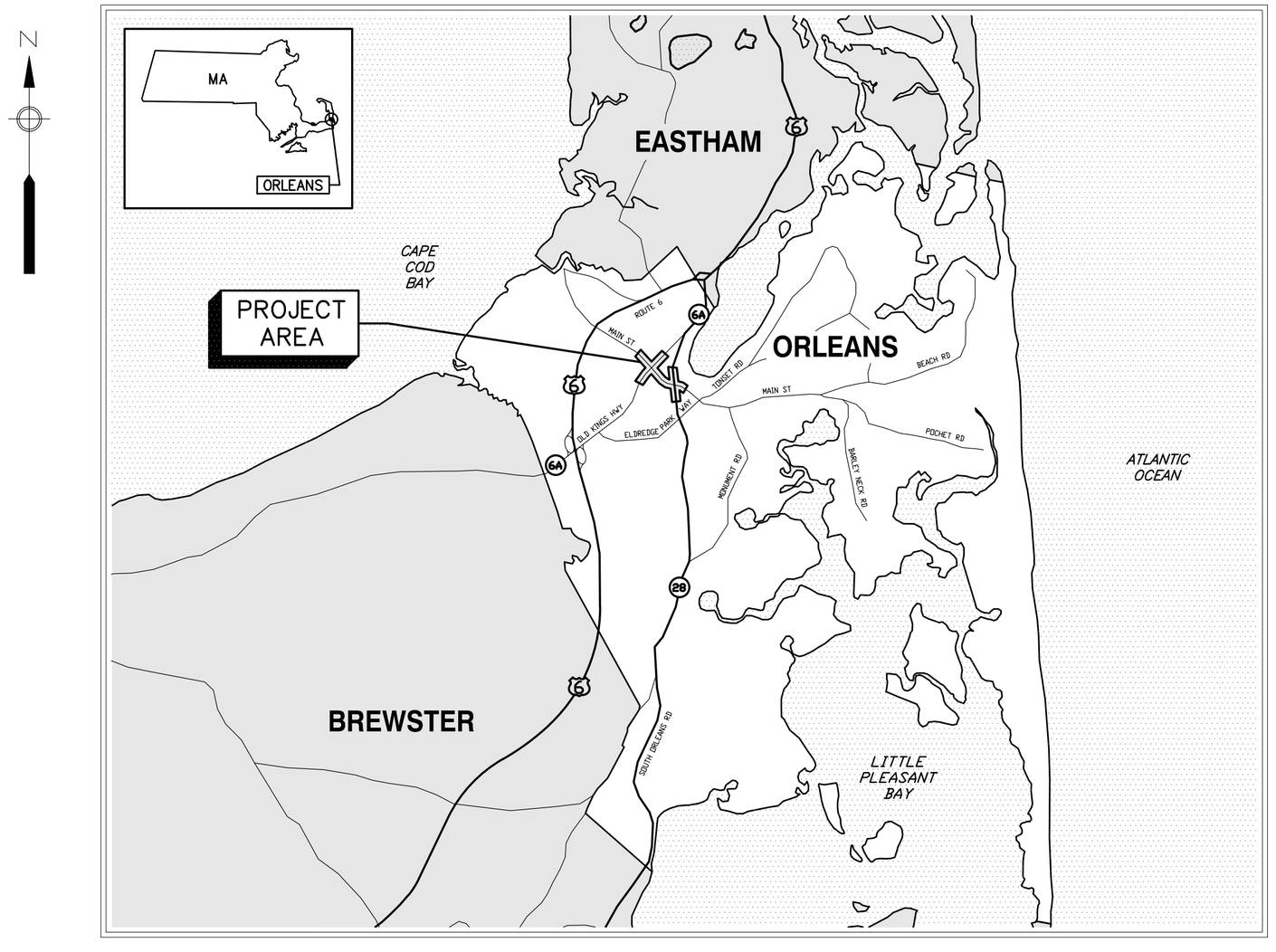
ATTACHMENT A

Downtown Area Sewer Expansion, Main Street at Route 6A and Route 28, Orleans, MA
Record Drawings, by AECOM Technical Services, Inc., July 8, 2019

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DOWNTOWN AREA SEWER EXPANSION
MAIN STREET AT
ROUTE 6A AND ROUTE 28

ORLEANS, MA
JULY 2019



LOCATION PLAN

APPROXIMATE SCALE: 1" = 5000'

0 5000 10,000 20,000

SCALE: 1"=5000'

ATTACHMENT G
Library Parking- Option 2

INDEX OF DRAWINGS

SHEET NO.	TITLE
G-001	COVER SHEET AND INDEX OF DRAWINGS
G-002	SHEET KEY PLAN
C-001	GENERAL NOTES, LEGENDS AND ABBREVIATIONS
C-101	PLAN AND PROFILE SEWER - CRANBERRY HIGHWAY (ROUTE 6A)
C-102	PLAN AND PROFILE SEWER - MAIN STREET
C-103	PLAN AND PROFILE SEWER - MAIN STREET
C-104	PLAN AND PROFILE SEWER - SOUTH ORLEANS RD (ROUTE 28) TO ACADEMY PLACE AND OLD COLONY WAY
C-501	SEWER DETAILS I
C-502	SEWER DETAILS II
T-101	TRAFFIC MANAGEMENT PLAN I
T-102	TRAFFIC MANAGEMENT PLAN II
T-103	TRAFFIC MANAGEMENT PLAN III

RECORD DRAWING

NOTE: This Record Drawing has been prepared based on information provided by others. AECOM has not verified the accuracy and/or completeness of this information and shall not be responsible for errors or omissions which may be incorporated as a result.

AECOM

PROJECT

Downtown Area
Sewer Expansion

Main Street at
Route 6A and Route 28

CLIENT

Town of Orleans, MA
19 SCHOOL ROAD
ORLEANS, MA 02653
(508) 240-3700

CONSULTANT

AECOM TECHNICAL SERVICES, INC.
9 JONATHAN BOURNE DRIVE
POCASSET, MA 02559
PHONE: (508) 833-6950
www.aecom.com

CONSULTANTS

REGISTRATION

COMMONWEALTH OF MASSACHUSETTS
THOMAS E. PARECE
CIVIL
No. 34463
REGISTERED PROFESSIONAL ENGINEER

ISSUE/REVISION

I/R	DATE	DESCRIPTION
	2019-07-08	RECORD DRAWING
	2018-01-31	MASSDOT PERMIT SET
	2017-12-06	ISSUED FOR BID

PROJECT NUMBER

60476644

Designed By:	**M. CURRAN**
Drawn By:	**M. CURRAN**
Dept Check:	**T. PARECE**
Proj Check:	**M. DONOGHUE**
Date:	**JULY 2019**
Scale:	**AS NOTED**

DISCIPLINE

GENERAL

SHEET TITLE

COVER SHEET AND INDEX OF DRAWINGS

SHEET NUMBER

G-001

Project Management Initials: Designer:____ Checked:____ Approved:____

Last saved by: CURRANM(2019-07-08) Last Plotted: 2019-07-08
Filename: L:\WORK\60476644 - ORLEANS DOWNTOWN SEWER\SHEETS - MAIN ST 6A\GIG-001.DWG

Project Management Initials: Designer:____ Checked:____ Approved:____

Last saved by: CURRANM(2019-07-08) Last Plotted: 2019-07-08
Filename: L:\WORK\60476644 - ORLEANS DOWNTOWN SEWER\SHEETS - MAIN ST 6A\G\G-002.DWG

MID-CAPE HIGHWAY – ROUTE 6
ROCK HARBOR ROAD
LOCUST ROAD
NAMSKAKET ROAD
MAIN STREET
CAPE COD RAIL TRAIL
ROUTE 6A
CRANBERRY HIGHWAY
SOUTH ORLEANS ROAD
POND
TOWN COVE
C-102
C-104
C-101
C-103
COVE ROAD
ROUTE 28
CUMMINGS ROAD
ACADEMY PLACE
OLD COLONY WAY
BREWSTER CROSSROAD
BOLAND POND
OLD TOTE ROAD
WEST ROAD

N

RECORD DRAWING

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1" = 200' SCALE 0 200 400 600 FEET

AECOM

PROJECT

Downtown Area
Sewer Expansion

Main Street at
Route 6A and Route 28

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Drawn By:	M. CURRAN
Dept Check:	T. PARECE
Proj Check:	M. DONOGHUE
Date:	JULY 2019
Scale:	AS NOTED

DISCIPLINE

GENERAL

SHEET TITLE

SHEET KEY PLAN

SHEET NUMBER

G-002

GENERAL NOTES

1. HORIZONTAL DATUM IN U.S. SURVEY FEET IS REFERENCED TO THE MASSACHUSETTS STATE PLANE, MAINLAND COORDINATE SYSTEM (NAD83).
2. VERTICAL DATUM IN U.S. SURVEY FEET IS REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. THE INFORMATION SHOWN HEREON IS BASED ON THE REFERENCED DATA ACCUMULATION PLANS. THESE PLANS DO NOT REPRESENT A PROPERTY OR BOUNDARY SURVEY, AND THE PROPERTY LINES SHOWN DO NOT REPRESENT A LAND SURVEYOR'S PROPERTY BOUNDARY OPINION. THE BOUNDARY INFORMATION SHOWN ON THESE PLANS WAS COMPILED FROM OTHER MAPS, RECORD RESEARCH, AND OTHER SOURCES OF INFORMATION. THE BOUNDARIES SHOWN HEREON SHALL NOT BE CONSTRUED AS HAVING BEEN OBTAINED AS THE RESULT OF AN ACCURATE ON THE GROUND SURVEY, AND ARE SUBJECT TO CHANGE AS AN ACCURATE FIELD SURVEY MAY DISCLOSE.
4. SIDELINES OF RIGHTS OF WAY AND PROPERTY LINES ARE AS SHOWN ON PLANS PREPARED BY SMC SURVEYING AND MAPPING CONSULTANTS, ENTITLED: "EXISTING CONDITIONS SURVEY ORLEANS, MA, FOR TOWN OF ORLEANS, REVISED: NOVEMBER 28, 2016. WHERE SUPPLEMENTAL RIGHT OF WAY AND PROPERTY LINE INFORMATION WAS REQUIRED, TOWN OF ORLEANS AND/OR MASS GIS DATA WAS USED.
5. BUILDING LOCATIONS SHOWN HEREON ARE AS SHOWN ON PLANS PREPARED BY SMC SURVEYING AND MAPPING CONSULTANTS, ENTITLED: "EXISTING CONDITIONS SURVEY ORLEANS, MA, FOR TOWN OF ORLEANS, REVISED: NOVEMBER 28, 2016. UPDATED AND SUPPLEMENTAL BUILDING LOCATIONS ARE BASED ON PLANIMETRICS FROM JW SEWALL AERIAL SURVEY OF FEBRUARY 27, 2017.
6. SUPPLEMENTAL TOPOGRAPHIC SURVEY BY COASTAL ENGINEERING COMPANY, INC (CEC) SHOWN ON SHEETS 22 THROUGH 30 IS BASED ON AERIAL SURVEY PERFORMED BY JW SEWALL AND SUPPLEMENTAL FIELD SURVEY BY CEC. CONTOUR DATA IS BASED UPON THE AERIAL SURVEY BY JW SEWALL, EXCEPT FOR ROADWAY AREAS WITHIN THE LIMITS OF THE SMC PLAN, AND THE ROUNDABOUT SHOWN ON SHEET 23. ELEVATIONS AND SITE FEATURES FOR ALL MAIN INTERIOR ROADWAYS WITHIN COVERAGE AREA ARE BASED ON PLANS BY SMC SURVEYING AND MAPPING CONSULTANTS, ENTITLED: "EXISTING CONDITIONS SURVEY ORLEANS, MA, FOR TOWN OF ORLEANS, REVISED: NOVEMBER 28, 2016.
7. LOCATION OF WATER, SEWER, TELEPHONE, ELECTRIC, AND GAS LINES ARE APPROXIMATE, BASED UPON RECORD LOCATION INFORMATION PROVIDED TO COASTAL ENGINEERING COMPANY, INC. AND FOR REFERENCE ONLY.
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AT NO ADDITIONAL COST TO THE OWNER.
9. ALL CONSTRUCTION OPERATIONS SHALL BE ACCOMPLISHED IN ACCORDANCE WITH APPLICABLE STATE STATUES AND U.S. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION REGULATIONS (O.S.H.A). COPIES OF O.S.H.A.'S STANDARDS MAY BE PURCHASED FROM THE U.S GOVERNMENT PRINTING OFFICE. THE CONTRACTOR ALONE WILL BE RESPONSIBLE FOR THE EXECUTION OF THE WORK IN ACCORDANCE WITH ALL APPLICABLE HEALTH AND SAFETY REQUIREMENTS.
10. THE CONTRACTOR SHALL HAVE A HEALTH AND SAFETY PLAN AND SHALL PROVIDE COPIES OF SAME TO THE ENGINEER.
11. THE CONTRACTOR SHALL TAKE ALL NECESSARY MEASURES AND SHALL PROVIDE ALL NECESSARY CONTINUOUS BARRIERS OF SUFFICIENT TYPE, SIZE AND STRENGTH TO PREVENT ACCESS TO ALL OPEN EXCAVATIONS AT THE COMPLETION OF EACH DAY'S WORK.
12. CONTRACTOR SHALL FOLLOW ALL REQUIREMENTS OF THE LOCAL MUNICIPALITY AND THE STATE WHEN WORKING IN THEIR RIGHTS OF WAY.
13. NO WORK, STORAGE, OR TRESPASS SHALL BE PERMITTED BEYOND THE BOUNDARIES OF ANY EASEMENTS WITHOUT WRITTEN PERMISSION OF THE PROPERTY OWNER.
14. ALL CONSTRUCTION ACTIVITY SHALL BE CONFINED TO THE AREA WITHIN THE LIMIT OF WORK AS SHOWN ON THE PLANS. LIMIT OF WORK SHALL BE DEFINED AS THE SERVICE RECIPIENTS PROPERTY LINE AND THE ADJACENT RIGHT-OF-WAY. RIGHTS OF ENTRY AND/OR EASEMENTS HAVE BEEN OBTAINED FOR ALL PROPERTIES INCLUDED IN THIS PROJECT.
15. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SECURING A SITE FOR DISPOSAL OF ALL EXCAVATED UNACCEPTABLE MATERIAL THAT IS UNSUITABLE FOR USE AS BACKFILL AND ALL OTHER EXCESS EXCAVATED MATERIALS. THE CONTRACTOR SHALL PROVIDE THE ENGINEER WITH THE LOCATION OF THE DISPOSAL SITE AND WRITTEN PERMISSION FOR USE OF THE SITE FROM THE PROPERTY OWNER. THE COST FOR SECURING AND MAINTAINING THE DISPOSAL SITE SHALL BE THE CONTRACTOR'S RESPONSIBILITY.
16. IF AT ANY TIME THE CONSTRUCTION EXCAVATION REVEALS ANY ARTICLE OF HISTORIC OR ARCHEOLOGICAL SIGNIFICANCE, WORK AT THE LOCATION WILL CEASE AND THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER.
17. THE CONTRACTOR SHALL COORDINATE ALL WORK AS NECESSARY WITH MASSDOT AND THE TOWN OF ORLEANS AND/OR ITS REPRESENTATIVES.
18. WORKING HOURS WITHIN THE TOWN ARE 7:00 A.M. TO 5:00 P.M., MONDAY THROUGH SATURDAY OR AS SPECIFIED IN THE MASSDOT PERMIT AND SPECIFICATIONS. PERMISSION IS REQUIRED FROM THE TOWN VIA THE ENGINEER TO WORK ON SUNDAY, LEGAL HOLIDAYS, OR ANY WEEKDAY NIGHT PAST THE HOURS SPECIFIED. THIS PERMISSION MUST BE REQUESTED 72 HOURS IN ADVANCE. SUNDAY WORK WILL ONLY BE ALLOWED IN CASE OF EMERGENCY.
19. EXISTING VALVES OR HYDRANTS SHALL BE OPERATED BY THE MUNICIPAL OWNER. THE CONTRACTOR SHALL COORDINATE WITH THE MUNICIPAL OWNER OF THE WATER SYSTEM.
20. THE CONTRACTOR IS RESPONSIBLE FOR PERFORMING ALL WORK AS INDICATED ON THE DRAWINGS, IN THE SPECIFICATIONS AND AS DIRECTED BY THE ENGINEER IN CONFORMANCE WITH ALL APPLICABLE CODES AND IN A PROPER AND WORKMANLIKE MANNER.
21. CONTRACTOR TO SUBMIT WORK SCHEDULE INCLUDING NECESSARY UTILITY RELOCATIONS BASED ON RESULTS OF TEST PITS. NO PIPE INSTALLATION SHALL OCCUR PRIOR TO APPROVAL OF THE SCHEDULE AND COMPLETION OF TEST PITS.
22. THE CONTRACTOR IS RESPONSIBLE FOR SEQUENCING OF ALL WORK TO AVOID CONFLICTS BETWEEN ALL PROPOSED WORK.
23. THE CONTRACTOR SHALL PREPARE AND SUBMIT A TRAFFIC MANAGEMENT PLAN FOR ALL WORK PRIOR TO THE START OF CONSTRUCTION TO SHOW HOW TRAFFIC FLOW WILL BE MAINTAINED DURING CONSTRUCTION. THE CONTRACTOR SHALL FURNISH ALL PROTECTIVE AND/OR WARNING DEVICES AS REQUIRED TO CONTROL TRAFFIC AND PROTECT THE PUBLIC IN ALL WORK AREAS.
24. ALL SIGNAGE AND PAVEMENT MARKINGS SHALL BE IN ACCORDANCE WITH LOCAL AND STATE GUIDELINES.
25. THE CONTRACTOR SHALL MAINTAIN EMERGENCY ACCESS TO ALL AREAS AFFECTED BY THE WORK AT ALL TIMES. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING AN EMERGENCY RESPONSE PLAN. THIS PLAN SHALL BE COORDINATED WITH THE ENGINEER, THE TOWN AND ALL EMERGENCY DEPARTMENTS.
26. PRIOR TO CLOSING ANY ROADWAY (PARTIALLY OR COMPLETELY), MUNICIPAL POLICE, THE TOWN AND LOCAL FIRE OFFICIALS SHALL BE NOTIFIED. THE CONTRACTOR SHALL COMPLY WITH ANY CONDITIONS SET BY THE PUBLIC SAFETY OFFICIALS, IN CONJUNCTION WITH THE OWNER AND ENGINEER.
27. CONTRACTOR TO PROVIDE AND MAINTAIN SEDIMENTATION AND EROSION CONTROL MEASURES TO PROTECT ALL CATCH BASINS, DRAINAGE INLETS AND SWALES IN THE CONSTRUCTION ZONE.
28. ALL EROSION CONTROL MEASURES FOR THE WORK ZONE SHALL BE IN PLACE PRIOR TO THE START OF CONSTRUCTION.
29. THE CONTRACTOR IS RESPONSIBLE FOR THE PROTECTION OF THE EXISTING FEATURES AND STRUCTURES WITHIN AND ADJACENT TO THE WORK. CONTRACTOR SHALL BOX ALL TREES, SHRUBS, FLOWER BOXES, AND HEDGES BEFORE PLACING EARTH AGAINST OR NEAR THEM. IN THE EVENT OF DAMAGE, REPAIRS OR REPLACEMENT SHALL BE COMPLETED AT THE CONTRACTOR'S EXPENSE AS APPROVED BY THE ENGINEER.
30. EXCAVATION OF ANY TYPE SHALL BE ACCOMPLISHED IN SUCH A MANNER THAT UNDERGROUND UTILITIES OR STRUCTURES ARE NOT DAMAGED. ALL ROADWAYS, PARKING AREAS, SIDEWALKS AND OTHER STRUCTURES DISTURBED BY CONSTRUCTION IN OR OUTSIDE THE PROJECT AREA SHALL BE RETURNED TO THEIR ORIGINAL CONDITION OR BETTER. ALL COSTS RELATED TO THE REPAIR OF DAMAGED UTILITIES OR STRUCTURES SHALL BE BORNE BY THE CONTRACTOR.
31. CONTRACTOR SHALL SAW-CUT ALL PAVEMENT, ROADS, AND DRIVEWAYS TO BE DISTURBED DURING CONSTRUCTION.
32. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING PROPER AND ADEQUATE TRENCH SHORING AND BRACING AT ALL TIMES IN ACCORDANCE WITH REQUIRED SAFETY STANDARDS.
33. THE CONTRACTOR SHALL FIELD VERIFY THE LOCATION OF EXISTING SEWER SERVICE CONNECTIONS PRIOR TO CONSTRUCTING REPLACEMENT SERVICE CONNECTIONS WHEN REQUIRED.
34. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO VERIFY ALL EXISTING CONDITIONS AT EACH SITE RECEIVING SEWER SERVICE, INCLUDING BUT NOT LIMITED TO, INVERT ELEVATIONS AT EACH MANHOLE, DEPTH AND LOCATION OF EXISTING PIPING TO ON-SITE WASTE DISPOSAL SYSTEMS (OWDS) AND THE LOCATION OF EXISTING OWDS.
35. ALL PROPOSED GRAVITY SEWER SERVICES SHALL BE 6" DIAMETER PVC UNLESS OTHERWISE NOTED.
36. ALL PROPOSED PRECAST SEWER MANHOLE INVERTS ARE TO BE CONSTRUCTED IN ACCORDANCE WITH DETAILS.

GENERAL NOTES - (CONT.)

37. ALL UNEXCAVATED ROCK WITHIN 3'-0" HORIZONTALLY OF THE ENDS OF BUILDING CONNECTIONS, BRANCHES AND STUBS, AND DOWN TO A HORIZONTAL PLANE 6-INCHES BELOW THE BOTTOMS OF SUCH CONNECTIONS, BRANCHES AND STUBS, SHALL BE REMOVED.
38. ROCK REMOVAL BY THE MECHANICAL METHOD SHALL CONSIST OF CUTTING AWAY ROCK AT TRENCH BOTTOM TO FORM A LEVEL BEARING SURFACE 6" BELOW INVERT ELEVATION OF PIPE.
39. NO TREES OR TREE LIMBS ALONG THE ENTIRE ROUTE OF CONSTRUCTION ON PUBLIC WAYS SHALL BE CUT UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
40. THE CONTRACTOR SHALL EXERCISE CARE TO PREVENT DAMAGE TO ROOT SYSTEMS OF EXISTING TREES OR SHRUBS IN LOCATIONS OF PROPOSED SEWER LINES.
41. THE LOCATIONS OF UTILITIES SHOWN ON THESE PLANS ARE APPROXIMATE. THE CONTRACTOR SHALL COORDINATE WITH THE TOWN AND UTILITY COMPANIES INVOLVED TO VERIFY IN THE FIELD THE EXACT LOCATION, SIZE, AND MATERIAL OF CONSTRUCTION OF MAINS AND SERVICES TO PREVENT DAMAGE, LOSS OF SERVICE DURING CONSTRUCTION AND FOR REPLACEMENT OF SERVICES. THE CONTRACTOR SHALL NOTIFY "DIG SAFE" 72-HOURS PRIOR TO ANY EXCAVATION.
42. THE CONTRACTOR IS RESPONSIBLE TO VERIFY THE DEPTH OF EXISTING UTILITY CROSSINGS EITHER BELOW OR ABOVE THE NEW SANITARY PIPING. METHODS FOR DETERMINING DEPTHS TO UTILITIES WILL BE BY TEST PITS OR BY VACUUM EXCAVATION, WHICHEVER IS DEEMED ACCEPTABLE AT THE SPECIFIC LOCATION.
43. EXISTING UTILITIES TO REMAIN IN SERVICE DURING CONSTRUCTION. ANY INTERRUPTION OF SERVICE SHALL BE COORDINATED WITH THE ENGINEER AND APPROVED BY THE TOWN.
44. EXISTING UTILITIES INTERFERING WITH THE WORK SHALL BE RELOCATED AS DIRECTED BY THE ENGINEER.
45. THE CONTRACTOR IS RESPONSIBLE FOR MAKING ALL ARRANGEMENTS FOR ANCHORING, SUPPORTING AND/OR RELOCATING AND PROTECTING ALL UTILITIES DURING CONSTRUCTION. ALL COSTS SHALL BE INCLUDED IN THE UNIT PRICES BID. IN THE EVENT OF DAMAGE, THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COST OF ALL REPAIRS.
46. THE CONTRACTOR SHALL MAINTAIN ACCESS TO ALL EXISTING FIRE HYDRANTS AT ALL TIMES. SHOULD AN EXISTING HYDRANT NEED TO BE TAKEN OUT OF SERVICE, THE CONTRACTOR SHALL NOTIFY THE LOCAL FIRE DEPARTMENT 24 HOURS PRIOR TO TAKING IT OUT OF SERVICE.
47. IF WATER MAINS NEED TO BE RE-LAYED AS A RESULT OF NEW PIPELINE CONSTRUCTION, THE WATER MAINS SHALL BE LAID A MINIMUM OF 10-FEET HORIZONTALLY FROM AN EXISTING SEWER OR STORM SEWER, UNLESS OTHERWISE DIRECTED BY THE ENGINEER. WHEN WATER MAINS MUST CROSS ABOVE A SEWER, THE WATER MAIN SHALL BE LAID AT SUCH AN ELEVATION THAT THE TOP OF THE SEWER IS AT LEAST 18-INCHES BELOW THE BOTTOM OF THE WATER MAIN. WHERE RE-LAYED WATER MAINS ARE SHOWN TO CROSS SEWERS, THE RE-LAYED WATER MAIN SHALL BE INSTALLED SO THAT A FULL LENGTH OF WATER MAIN CROSSES THE SEWER MIDWAY BETWEEN THE JOINTS OF THE WATER MAIN.
48. CONTRACTOR SHALL MAKE HIS OWN ARRANGEMENTS TO OBTAIN WATER FOR FLUSHING, CHLORINATION, AND TESTING. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING, FURNISHING, INSTALLING, AND REMOVING ALL NECESSARY MATERIAL (TAPS, CORPORATIONS, AND SERVICE PIPE) REQUIRED FOR PROPER TESTING AND CHLORINATION OF WATER MAINS.
49. CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING, FURNISHING, INSTALLING, AND REMOVING ALL NECESSARY MATERIAL (TAPS, CORPORATIONS, AND SERVICE PIPE) REQUIRED FOR PROPER TESTING AND CHLORINATION OF WATER MAINS.
50. AFTER TESTING, ALL CORPORATIONS INSTALLED FOR TESTING AND CHLORINATION SHALL BE REMOVED AND REPLACED WITH BRASS PLUGS. WATER TIGHTNESS OF BRASS PLUGS SHALL BE OBSERVED VISUALLY UNDER PRESSURE.
51. ALL ROAD CUTS SHALL BE RESTORED WITH SUB-BASE MATERIAL AT THE END OF EACH WORK DAY. CONTRACTOR SHALL MAINTAIN ROAD CUTS UNTIL THE TEMPORARY/PERMANENT PAVEMENT IS INSTALLED.
52. TEMPORARY TRENCH PAVEMENT SHALL BE INSTALLED AT THE END OF EACH WORK DAY UNLESS OTHERWISE DIRECTED BY THE OWNER.
53. THE CONTRACTOR SHALL RESTORE ALL DISTURBED AREAS TO PRE-CONSTRUCTION GRADES UPON COMPLETION OF SEWER CONSTRUCTION, EXCEPT WHERE PERMANENT GRADE CHANGES ARE SPECIFICALLY NOTED OR ORDERED.
54. ALL ROADS AND DRIVEWAYS SHALL BE REPLACED TO COMPLY WITH THE MASSDOT AND TOWN OF ORLEANS SPECIFICATIONS AS APPLICABLE.
55. ALL PAVED GUTTERS (ASPHALT WING), ALL STONE CURBS, AND ALL CONCRETE CURB ALONG ROADWAYS DISTURBED BY CONSTRUCTION SHALL BE REPLACED IN KIND AT NO ADDITIONAL COST TO THE OWNER.
56. ALL EXISTING FRAMES, COVERS, BOXES, ETC. SHALL BE RAISED TO FINISH GRADES PRIOR TO PLACEMENT OF PAVEMENT WEARING COURSE.
57. THE CONTRACTOR SHALL REMOVE AND DISPOSE OF ALL WASTE BUILDING MATERIAL, CONCRETE, MASONRY, TREES, SHRUBS, DEBRIS AND OTHER MATERIALS NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK AND AS REQUIRED BY THE OWNER. CONSTRUCTION DEBRIS SHALL BE DISPOSED OF IN STRICT ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE AND FEDERAL LAWS.
58. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTINUOUS CLEANING OF MUD, DIRT AND DEBRIS OFF STREETS, WHEN SUCH MUD, DIRT OR DEBRIS IS DEPOSITED THERE AS A RESULT OF HIS CONSTRUCTION ACTIVITY. ANY DEBRIS, MUD, OR DELETERIOUS MATERIAL FROM THE PROJECT WILL BE REMOVED FROM THE STREET AND SURROUNDING STREETS BY CONTRACTOR AT THE END OF EACH WORKING DAY, OR BEFORE, IF DIRECTED BY THE OWNER OR ENGINEER.
59. USE WATER SPRINKLING, TEMPORARY ENCLOSURES AND OTHER SUITABLE METHODS TO LIMIT DUST AND DIRT RISING AND SCATTERING IN THE AIR.
60. CONTRACTOR IS RESPONSIBLE FOR REPLACING ALL EXISTING PAVEMENT MARKINGS INCLUDING CENTER LINES, EDGE LINES, STOP LINES, CROSSLANES AND LETTERING FOLLOWING RESTORATION OF PAVEMENT OR AS DIRECTED BY THE ENGINEER.

ABBREVIATIONS

B.B.	BITUMINOUS BERM
BIT. CURB	BITUMINOUS CURB
BIT. CONC.	BITUMINOUS CONCRETE
BM	BENCH MARK
CB	CATCH BASIN
CI	CAST IRON
CICL	CEMENT LINED CAST IRON
CMP	CORRUGATED METAL PIPE
CONC.	CONCRETE
CONN.	CONNECT
CS	CARBON STEEL
DI	DUCTILE IRON
DICL	DUCTILE IRON CEMENT LINED
DMH	DRAINAGE MANHOLE
DOE	DEPTH OF EXPLORATION
DYL	DOUBLE YELLOW LINE
ELEC	ELECTRICAL
EL	ELEVATION
EOP	EDGE OF PAVEMENT
EP	EXISTING PAVEMENT
EXIST.	EXISTING
FT	FEET
FM	FORCE MAIN
G	GAS
GAR	GARAGE
GC	GRANITE CURB
HDPE	HIGH DENSITY POLYETHYLENE
INV	INVERT
LP	LOW PRESSURE
LSA	LANDSCAPED AREA
MB	MAIL BOX
MIN	MINIMUM
NTS	NOT TO SCALE
PL	PLASTIC
PVC	POLYVINYL CHLORIDE
PVMT	PAVEMENT
PWW	PAVED WATERWAY
R	RIM
RCP	REINFORCED CONCRETE PIPE
S	SLOPE
SMH	SEWER MANHOLE
SWL	SINGLE WHITE LINE
SYL	SINGLE YELLOW LINE
STA	STATION
TBM	TEMPORARY BENCHMARK
TMH	TELEPHONE MANHOLE
T.O.P.	TOP OF PIPE
TRANS	TRANSFORMER
TYP	TYPICAL
UE	UNDERGROUND ELECTRIC
UP	UTILITY POLE
VCP	VITRIFIED CLAY PIPE
WTFC	WATERTIGHT FRAME AND COVER
W/	WITH
WF	WETLAND FLAG

LEGEND

EXISTING		PROPOSED	
CBDH	CONCRETE BOUND WITH DRILL HOLE	S	SEWER MANHOLE
CB	CONCRETE BOUND		CATCH BASIN SEDIMENTATION CONTROL
MHB	MASS HIGHWAY BOUND		TEST PIT
IRF	IRON ROD FOUND	2+00	STATIONING
	ROUND CATCH BASIN		GRAVITY SEWER
	CATCH BASIN		SEWER SERVICE LINE
	DOUBLE CATCH BASIN		PROJECT PAVEMENT RESTORATION LIMITS
	CULVERT		BUILDING
	DRAIN MANHOLE		
	DRAINAGE HEADWALL		
S	SEWER MANHOLE		
DS	DISPOSAL SYSTEM COVER		
	CESSPOOL		
	ELECTRIC BOX		
E	ELECTRIC MANHOLE		
	GAS VALVE		
	TELEPHONE BOX		
T	TELEPHONE MANHOLE		
	WATER GATE		
	IRRIGATION CONTROL VALVE		
	FIRE HYDRANT		
	UTILITY POLE WITH RISER		
	UTILITY POLE		
	UTILITY POLE WITH LIGHT		
	UTILITY POLE WITH LIGHT AND RISER		
	UTILITY POLE WITH TRANSFORMER		
	GUY		
	DECIDUOUS TREE		
	CONIFER TREE		
	SHRUB		
	SIGN (SINGLE POSTED)		
	SIGN (DOUBLE POSTED)		
TS	TRAFFIC SIGNAL		
	POST		
MW	MONITORING WELL		
	LIGHT POLE		
	FLAG POLE		
FDC	FIRE DEPARTMENT CONNECTION		
	VENT		
108.6+ WF-X	SPOT ELEVATION		
	WETLAND FLAG		
	WETLAND 100' BUFFER		
	PROPERTY LINE		
	FENCE		
S	SEWER LINE		
FM	SEWER FORCEMAIN		
D	DRAIN LINE		
W	WATER LINE		
G	GAS LINE		
UGE	UNDERGROUND ELECTRIC		
UGC	UNDERGROUND CABLE		
T	TELEPHONE LINE		
OWH	OVERHEAD WIRES		
52	INTERMEDIATE CONTOURS		
50	INDEX CONTOURS		
	EXISTING TREELINE		

REFERENCES

MASSDOT PLAN AND PROFILE OF MAIN STREET AT CRANBERRY HIGHWAY (ROUTE 6A) AND AT SOUTH ORLEANS ROAD (ROUTE 28) IN THE CITY/TOWN OF ORLEANS, BARNSTABLE COUNTY, 5/16/16.
MASSDOT CONTRACT DOCUMENT AND SPECIAL PROVISIONS.
PROPOSAL NO. 606461-97233 AND ADDENDUMS 9/23/16.
MASSACHUSETTS HIGHWAY DEPARTMENT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES DATED 1988 AS AMENDED, THE SUPPLEMENTAL SPECIFICATION DATED JULY 1, 2015 AND THE 2014 CONSTRUCTION STANDARD DETAILS.

RECORD DRAWING

NOTE: This Record Drawing has been prepared based on information provided by others. AECOM has not verified the accuracy and/or completeness of this information and shall not be responsible for errors or omissions which may be incorporated as a result.

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Checked: ____
Designer: ____
Project Management Initials: ____

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Filename: L:\WORK\60476644 - ORLEANS DOWNTOWN SEWER\SHEETS - MAIN ST 6A\CIC-001.DWG

AECOM

PROJECT

Downtown Area
Sewer Expansion

Main Street at
Route 6A and Route 28

CLIENT

Town of Orleans, MA
19 SCHOOL ROAD
ORLEANS, MA 02653
(508) 240-3700

CONSULTANT

AECOM TECHNICAL SERVICES, INC.
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CONSULTANTS

REGISTRATION

COMMONWEALTH OF MASSACHUSETTS
THOMAS E. PARECE
CIVIL
No. 34463
REGISTERED PROFESSIONAL ENGINEER

ISSUE/REVISION

I/R	DATE	DESCRIPTION
	2019-07-08	RECORD DRAWING
	2018-01-31	MASSDOT PERMIT SET
	2017-12-06	ISSUED FOR BID

PROJECT NUMBER

60476644

Designed By:	M. CURRAN
Drawn By:	M. CURRAN
Dept Check:	T. PARECE
Proj Check:	M. DONOGHUE
Date:	JULY 2019
Scale:	AS NOTED

DISCIPLINE

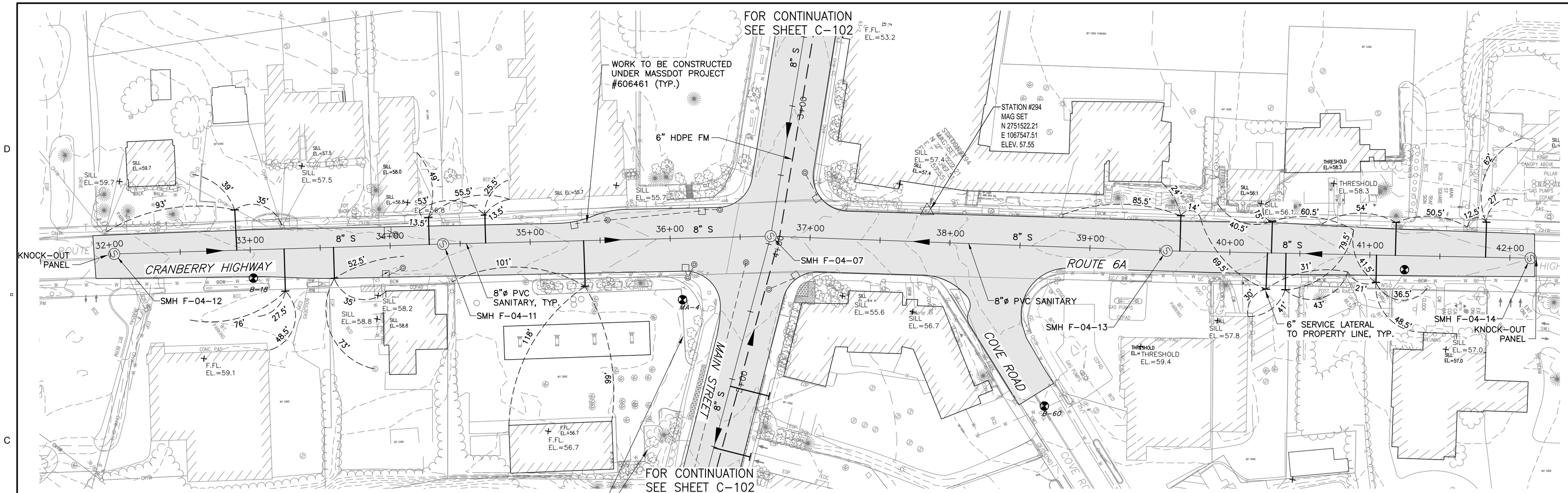
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SHEET TITLE

GENERAL NOTES, LEGENDS AND ABBREVIATIONS

SHEET NUMBER

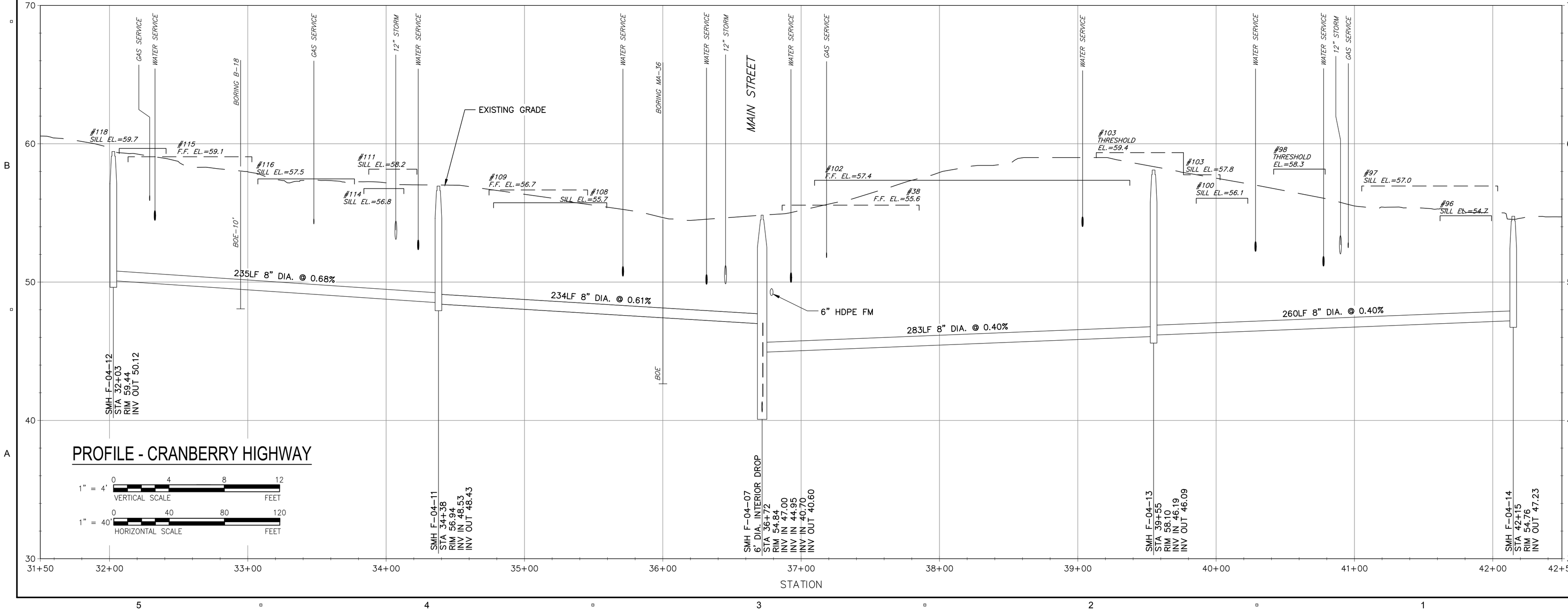
C-001



NOTE:
NO WORK IS TO BE DONE WITHIN 20 FEET OF THE TWO AMERICAN GUM TREES UNLESS THE WORK IS APPROVED BY AND PERFORMED IN THE PRESENCE OF THE ORLEANS DIRECTOR OF PUBLIC WORKS AND NATURAL RESOURCES OR HIS DESIGNEE.

PLAN - CRANBERRY HIGHWAY

SCALE: 1"=40'



PROFILE - CRANBERRY HIGHWAY

1" = 4' VERTICAL SCALE 0 4 8 12 FEET

1" = 40' HORIZONTAL SCALE 0 40 80 120 FEET

Approved: ____ Checked: ____ Designer: ____ Project Management Initials: ____

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	2018-01-31	MASSDOT PERMIT SET
	2017-12-06	ISSUED FOR BID

PROJECT NUMBER

60476644

Designed By:	M. CURRAN
Drawn By:	M. CURRAN
Dept Check:	T. PARECE
Proj Check:	M. DONOGHUE
Date:	JULY 2019
Scale:	AS NOTED

DISCIPLINE

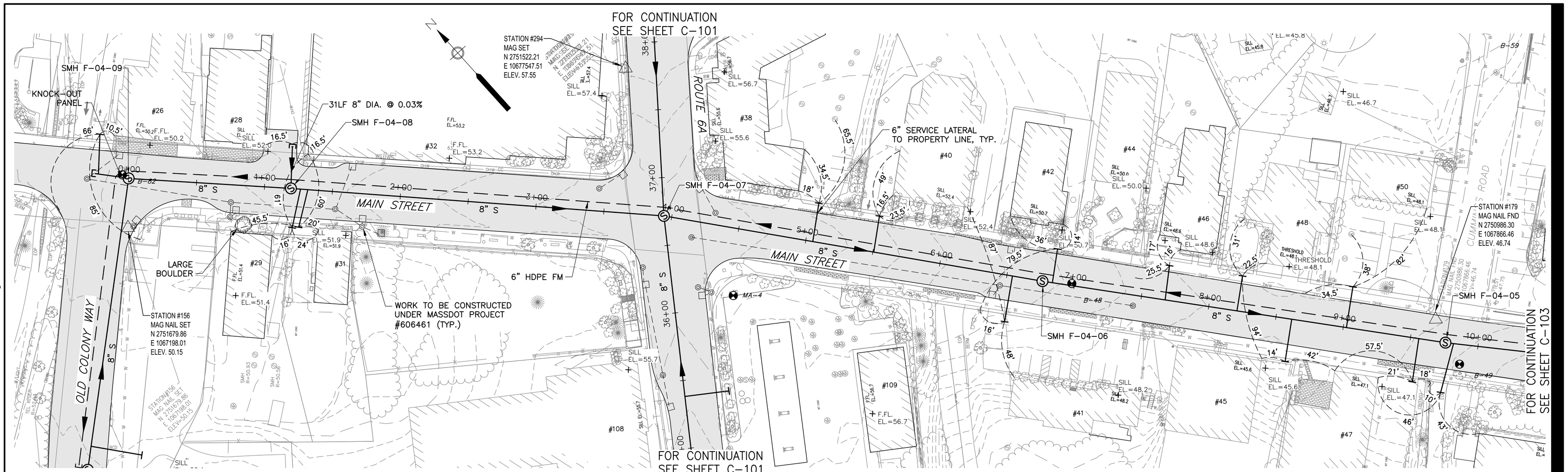
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SHEET TITLE

PLAN AND PROFILE SEWER
CRANBERRY HIGHWAY
(ROUTE 6A)

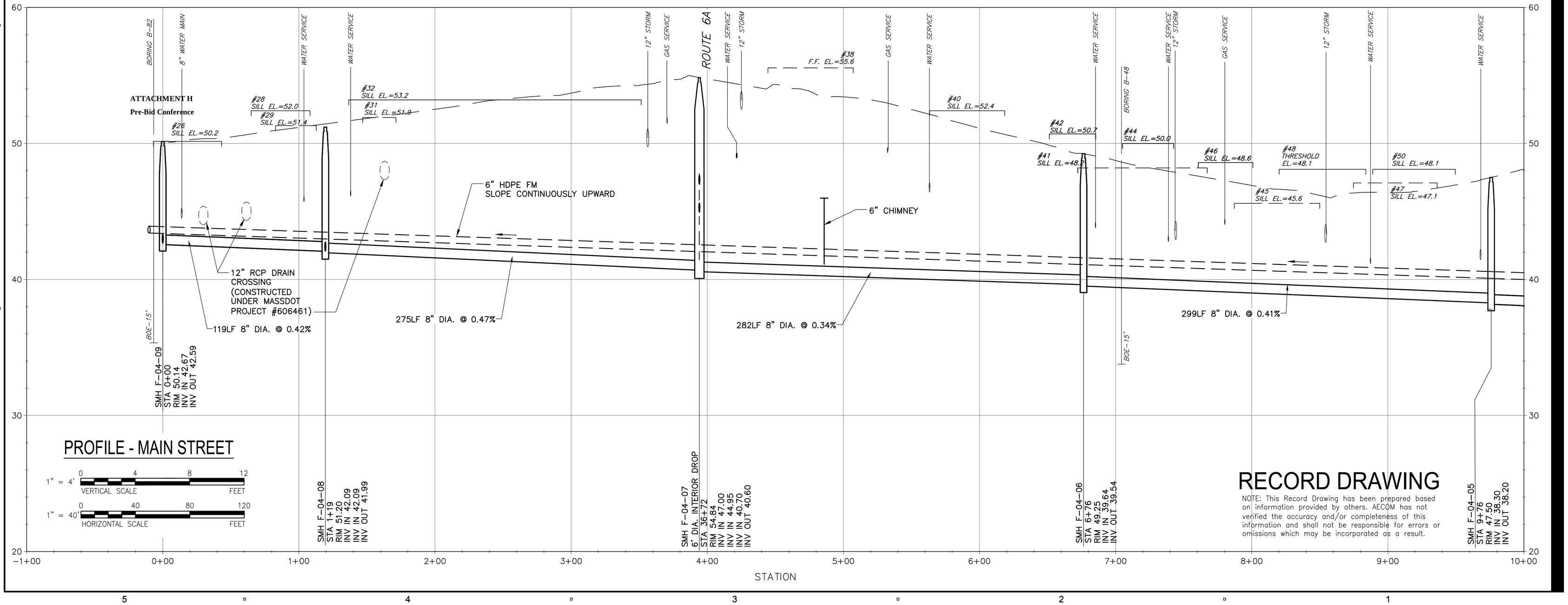
SHEET NUMBER

C-101



PLAN - MAIN STREET

SCALE: 1"=40'



PROFILE - MAIN STREET

1" = 4' VERTICAL SCALE (0, 4, 8, 12 FEET)

1" = 40' HORIZONTAL SCALE (0, 40, 80, 120 FEET)

RECORD DRAWING

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AECOM

PROJECT

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CLIENT

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07/08/19
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No. 34463
REGISTERED PROFESSIONAL ENGINEER

ISSUE/REVISION

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	2018-01-31	MASSDOT PERMIT SET
	2017-12-06	ISSUED FOR BID
I/R	DATE	DESCRIPTION

PROJECT NUMBER

60476644

Designed By:	M. CURRAN
Drawn By:	M. CURRAN
Dept Check:	T. PARECE
Proj Check:	M. DONOGHUE
Date:	JULY 2019
Scale:	AS NOTED

DISCIPLINE

CIVIL

SHEET TITLE

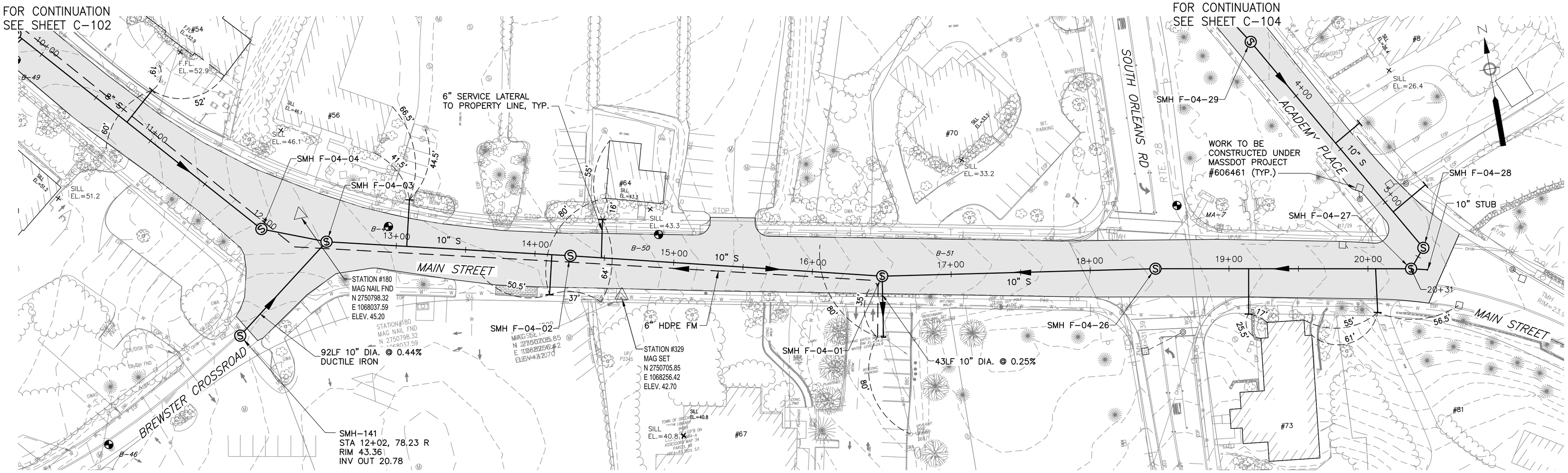
PLAN AND PROFILE SEWER MAIN STREET

SHEET NUMBER

C-102

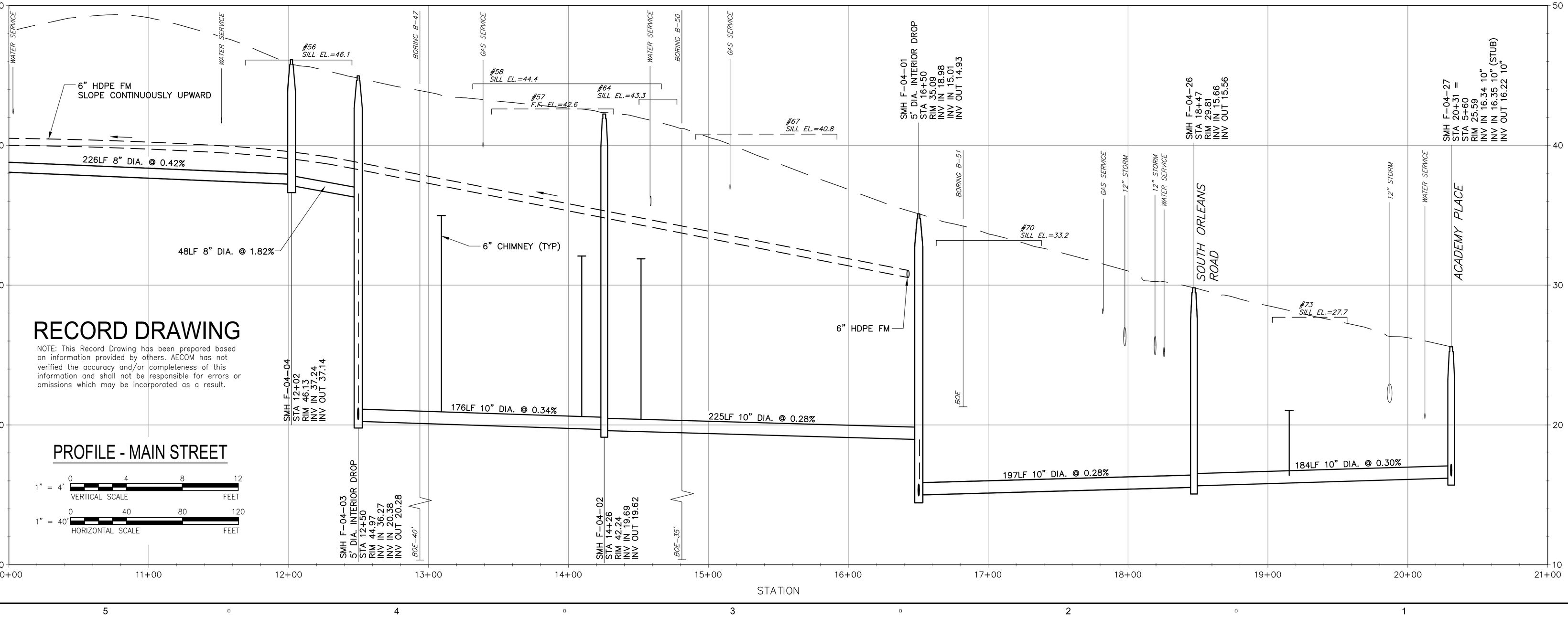
FOR CONTINUATION SEE SHEET C-102

FOR CONTINUATION SEE SHEET C-104



PLAN - MAIN STREET

SCALE: 1"=40'



RECORD DRAWING

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PROFILE - MAIN STREET

1" = 4' VERTICAL SCALE (0, 4, 8, 12 FEET)

1" = 40' HORIZONTAL SCALE (0, 40, 80, 120 FEET)

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AECOM

PROJECT

Downtown Area Sewer Expansion

Main Street at Route 6A and Route 28

CLIENT

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19 SCHOOL ROAD
ORLEANS, MA 02653
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Dept Check:	T. PARECE
Proj Check:	M. DONOGHUE
Date:	JULY 2019
Scale:	AS NOTED

DISCIPLINE

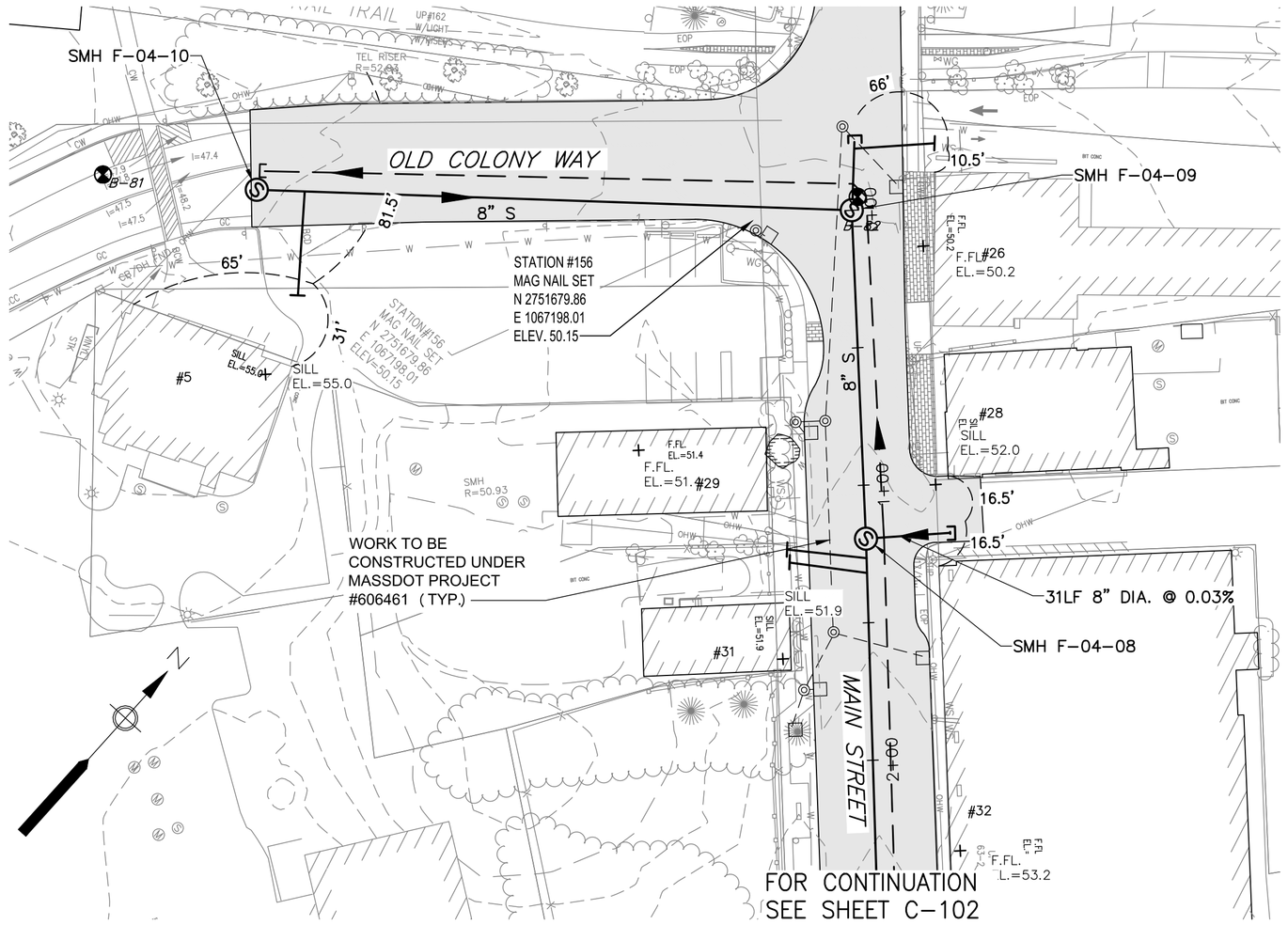
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PLAN AND PROFILE SEWER MAIN STREET

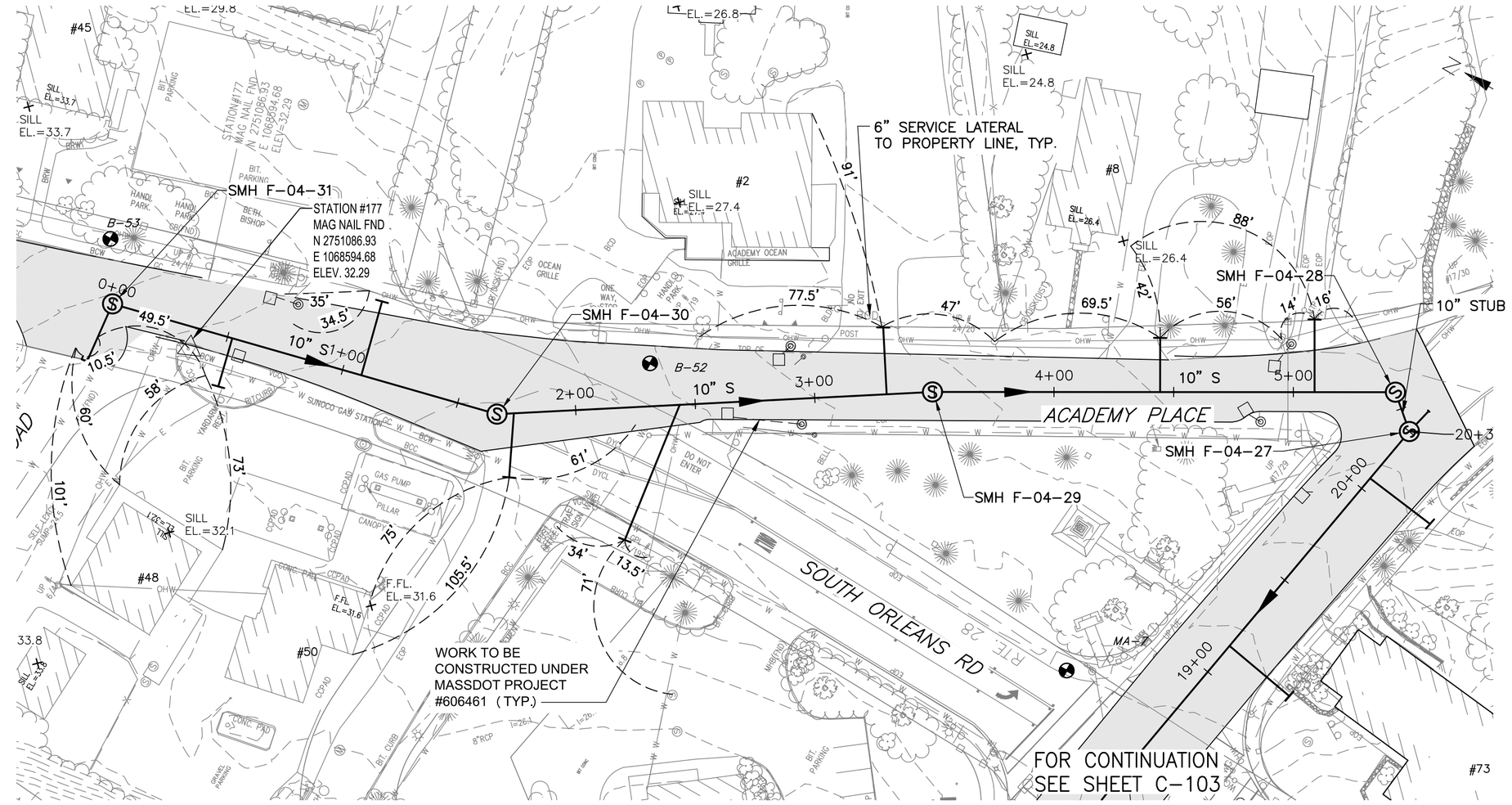
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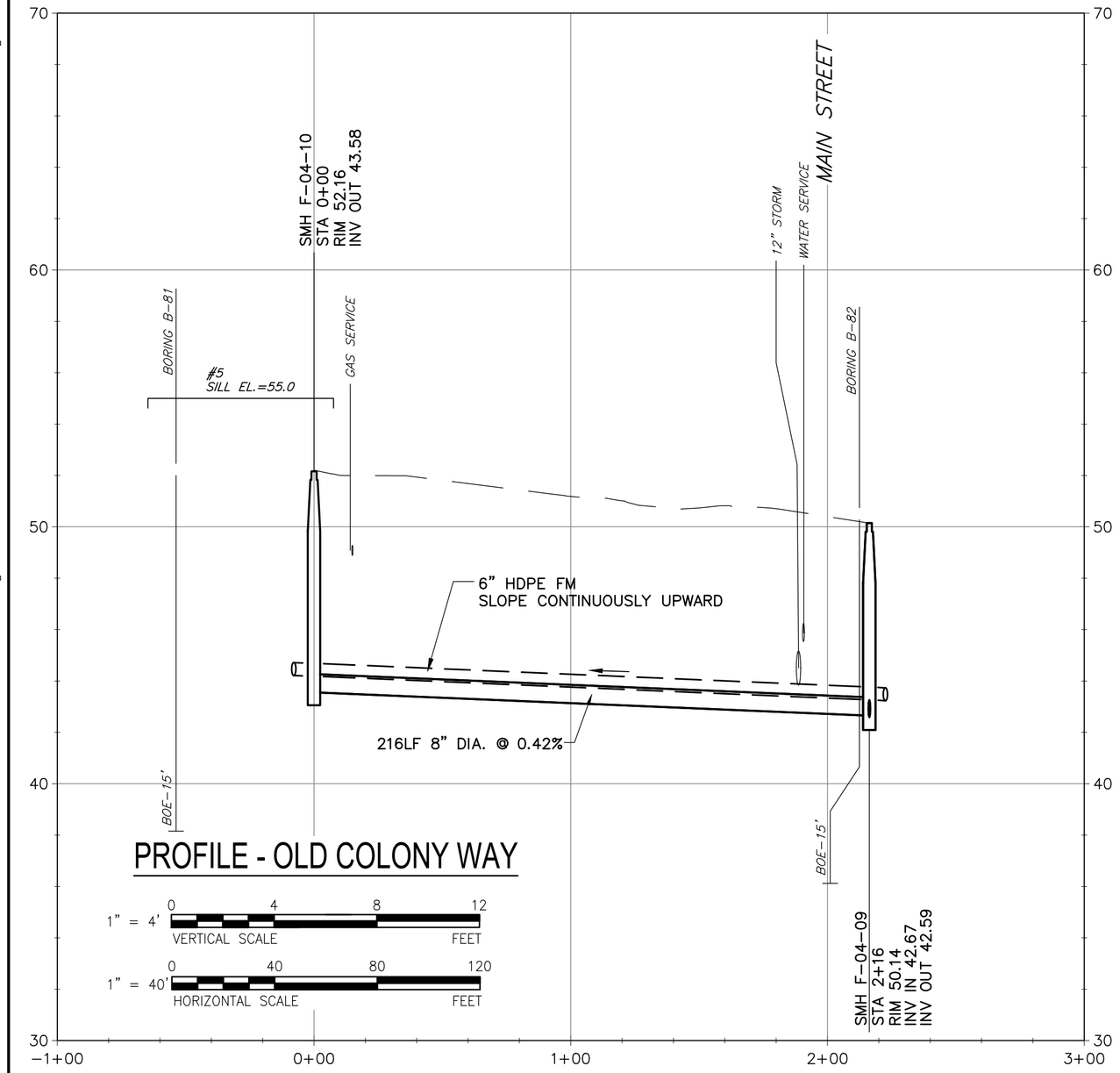
PLAN - OLD COLONY WAY

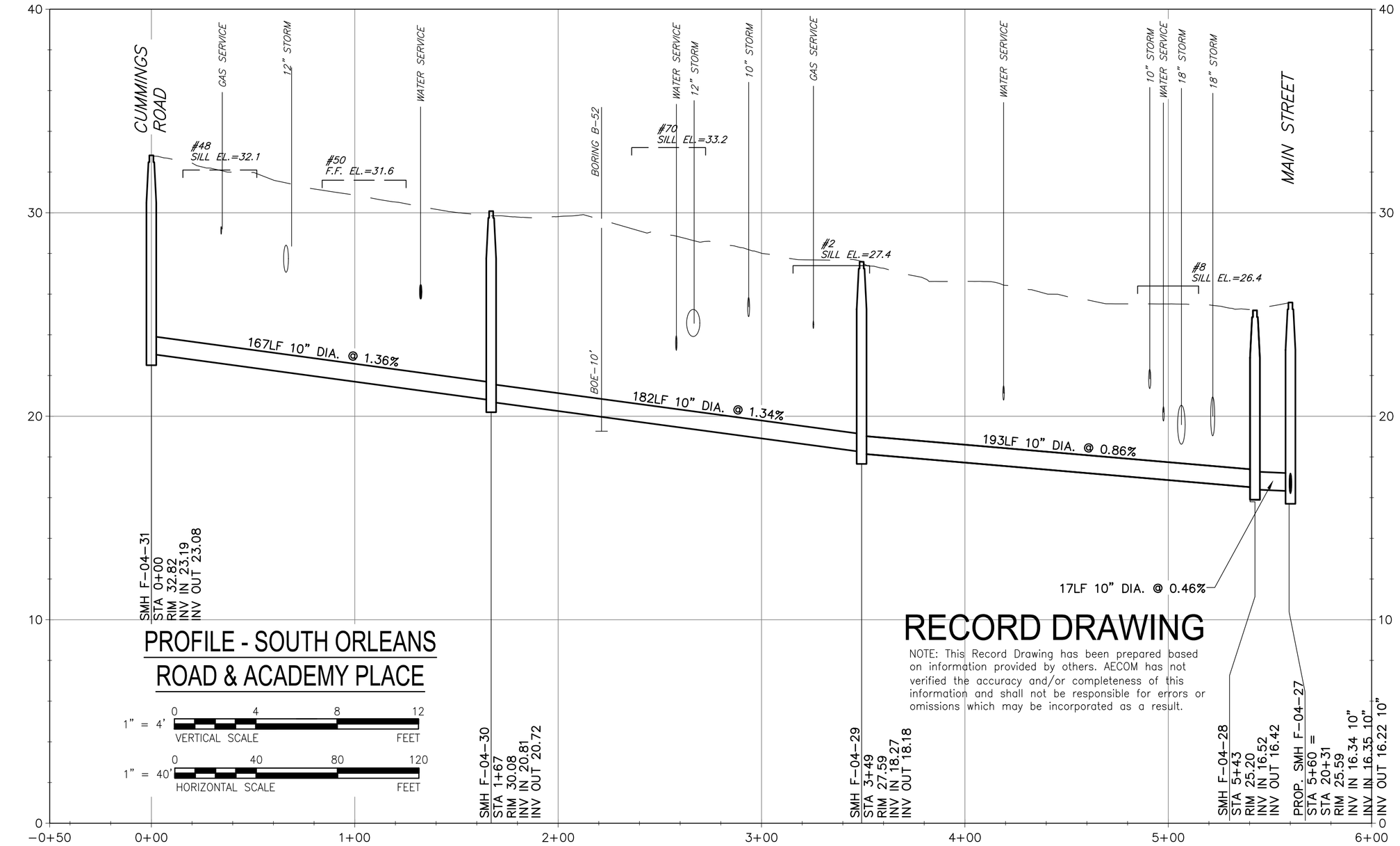
SCALE: 1"=40'



PLAN - SOUTH ORLESANS ROAD & ACADEMY PLACE

SCALE: 1"=40'





RECORD DRAWING

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AECOM

PROJECT

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Sewer Expansion

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Route 6A and Route 28

CLIENT

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60476644

Designed By:	M. CURRAN
Drawn By:	M. CURRAN
Dept Check:	T. PARECE
Proj Check:	M. DONOGHUE
Date:	JULY 2019
Scale:	AS NOTED

DISCIPLINE

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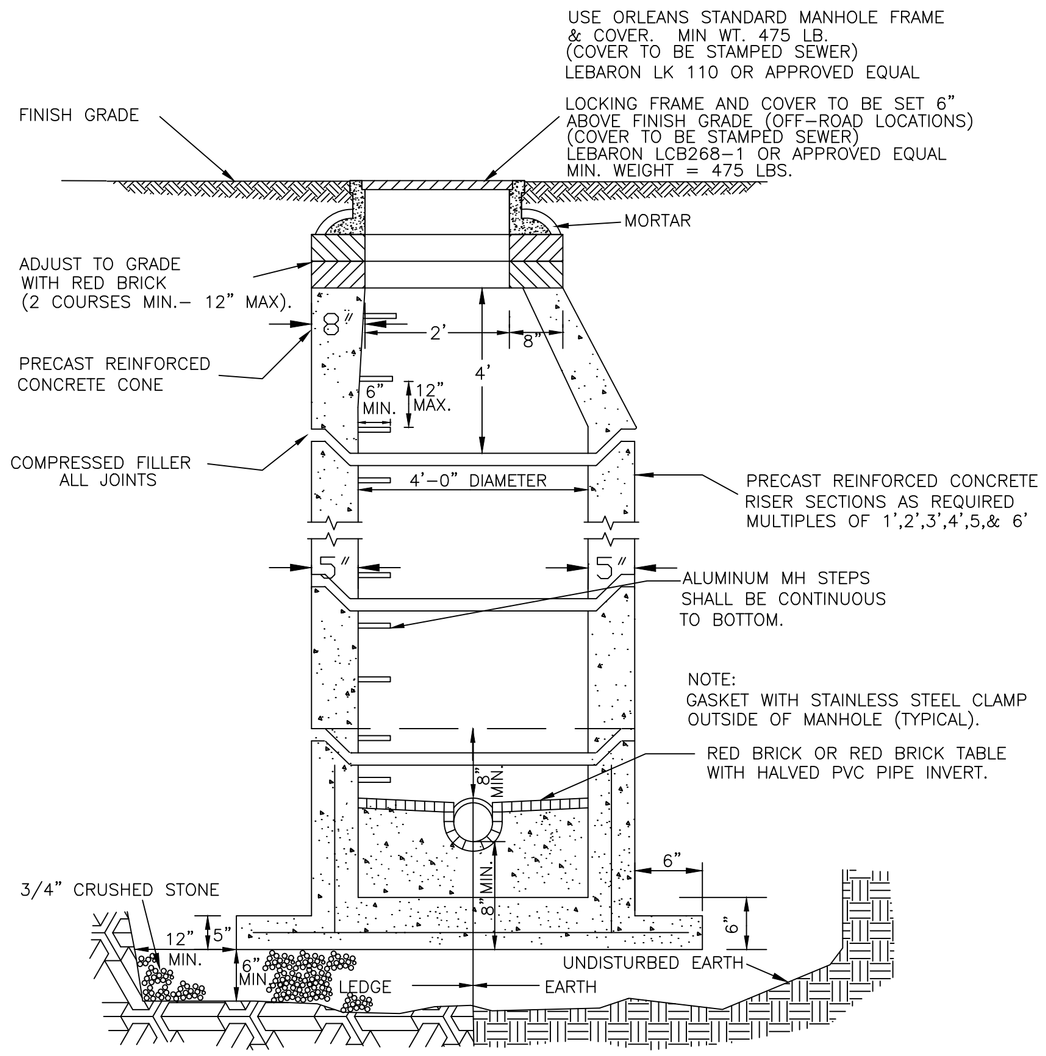
PLAN AND PROFILE SEWER SOUTH ORLESANS TO ACADEMY PL, OLD COLONY

SHEET NUMBER

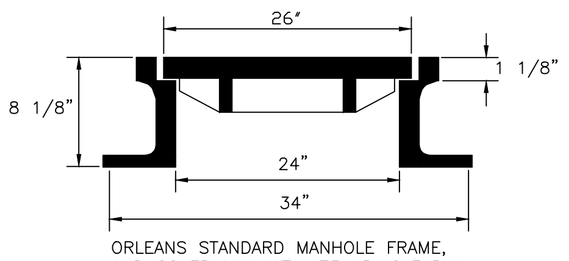
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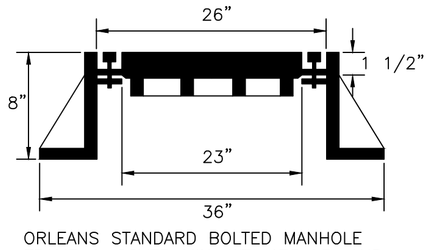
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TYPICAL PRECAST CONCRETE SEWER MANHOLE
(NOT TO SCALE)

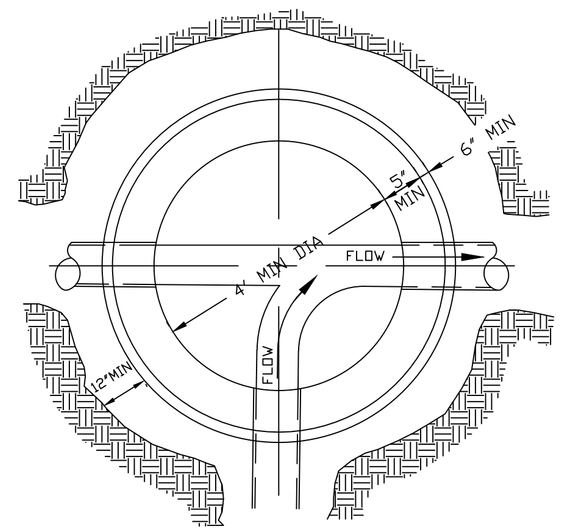


ORLEANS STANDARD MANHOLE FRAME, AND COVER MIN. WT. 475 LB. CLEARLY MARKED (SEWER) ON COVER. LEBARON LK 110 OR APPROVED EQUAL



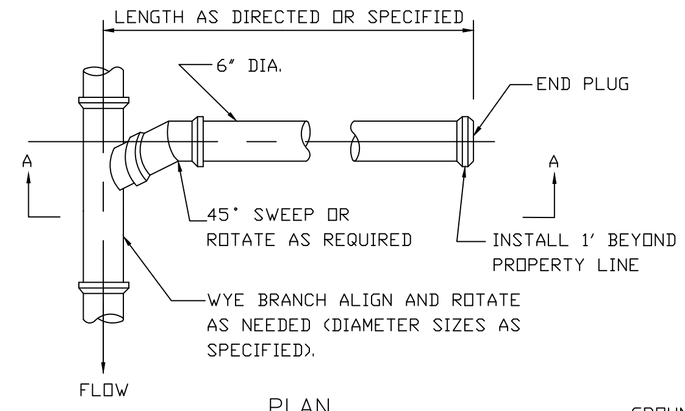
ORLEANS STANDARD BOLTED MANHOLE FRAME & COVER MIN. WT. 475 LB. AND CLEARLY MARKED (SEWER) ON COVER. (USE ON ALL OFF-ROAD INSTALLATIONS) LEBARON LCB 268-1 OR APPROVED EQUAL.

STANDARD SEWER MANHOLE FRAMES & COVERS
(NOT TO SCALE)

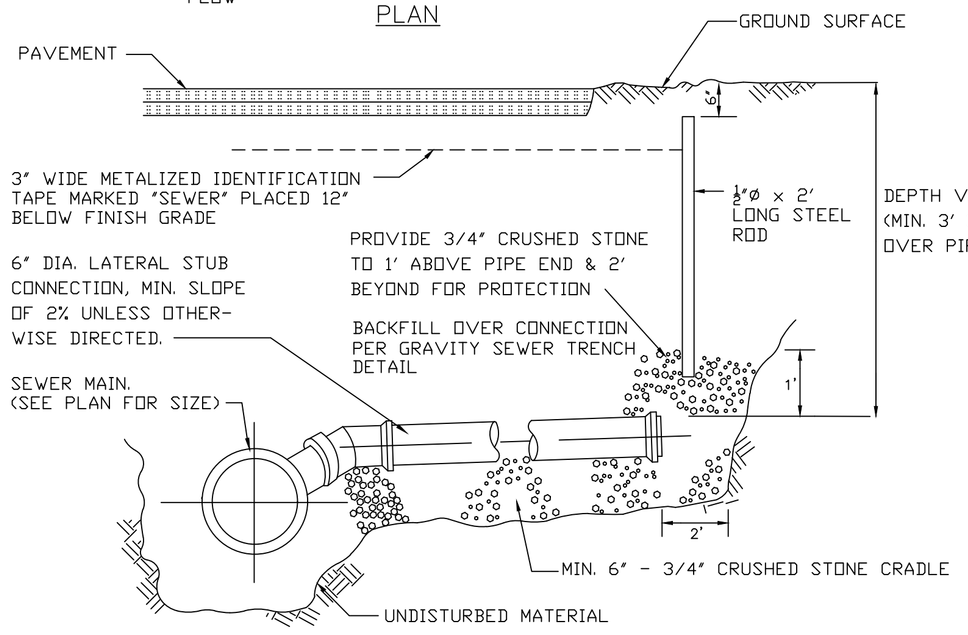


TOP VIEW

INVERT TABLE PLAN
(NOT TO SCALE)



PLAN

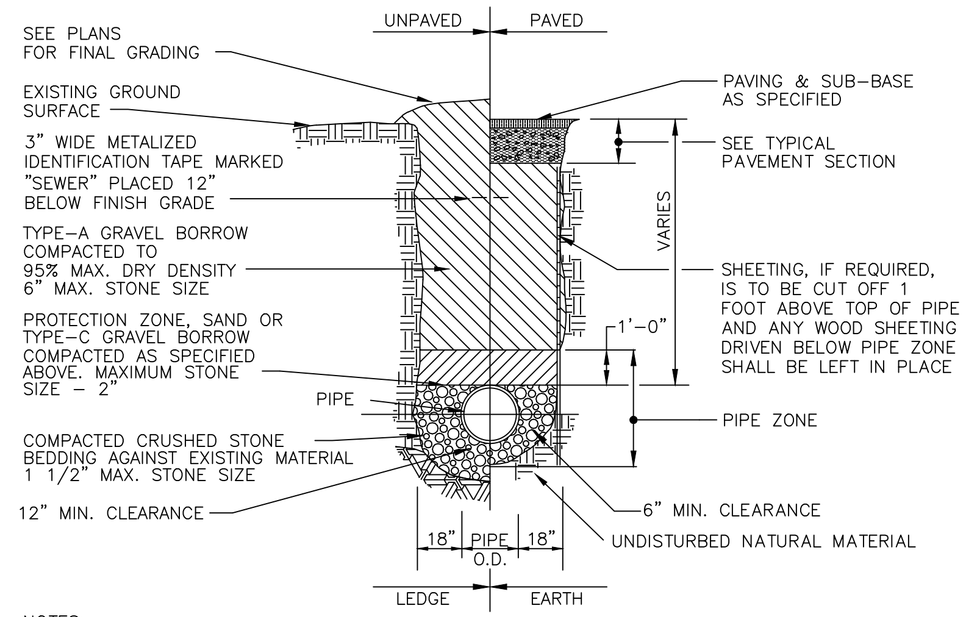


SECTION A-A

LATERAL CONNECTION MANHOLE

WHERE REQUIRED, A MANHOLE TO BE CONSTRUCTED ON A LATERAL CONNECTION. THIS MANHOLE SHALL CONFORM TO THE SAME STANDARDS AS THE MAIN SEWER MANHOLES. (SEE SEWER MANHOLE DETAILS.)

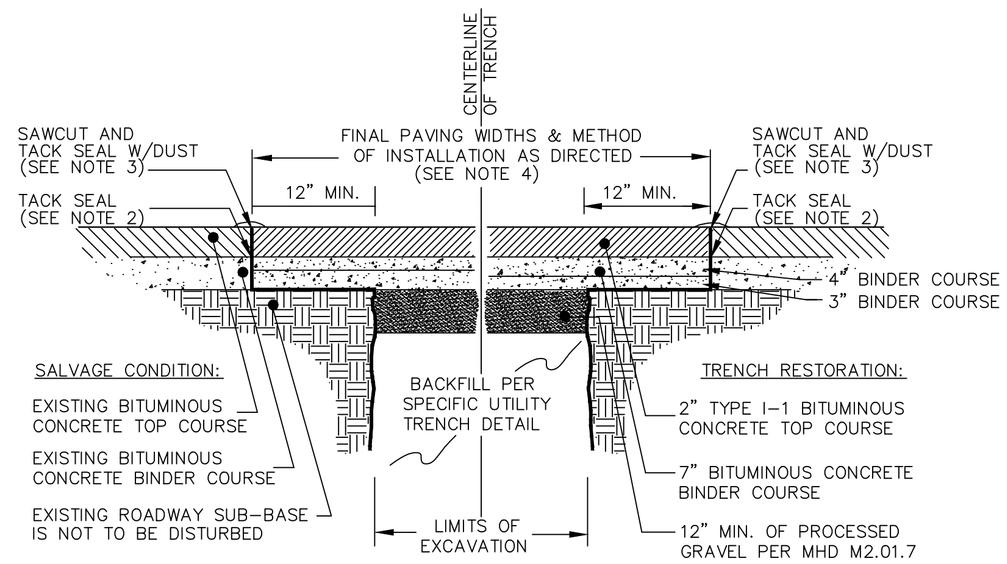
TYPICAL LATERAL STUB CONNECTION
(NOT TO SCALE)



NOTES:

1. GRAVEL BORROW SHALL CONFORM TO MASS HIGHWAY SPECIFICATION M1.03.0
2. CRUSHED STONE BEDDING SHALL CONFORM TO MASS HIGHWAY SPECIFICATION M2.01.1

GRAVITY SEWER/FORCE MAIN TRENCH DETAIL
NOT TO SCALE



1. ALL INSTALLATION AND MATERIAL SPECIFICATIONS PER MASS. HIGHWAY DEPARTMENT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES, 1988 AS AMENDED.
2. ALL EXPOSED BITUMINOUS CONCRETE IS TO BE TACKED PER MHD PRIOR TO NEW BITUMINOUS CONCRETE INSTALLATION.
3. ALL EXPOSED JOINTS ARE TO BE SEALED WITH TACK AND STONE DUST.
4. ANY TOP COURSE APPLIED AT A WIDTH OF 6' WIDE OR GREATER IS TO BE PLACED BY MACHINE/BOX SPREADER WHEN & AS DIRECTED BY THE TOWN OF ORLEANS.

TYPICAL TRENCH REPAIR & PAVEMENT SECTION DETAIL
NOT TO SCALE

RECORD DRAWING

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AECOM

PROJECT

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Main Street at Route 6A and Route 28

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19 SCHOOL ROAD
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CONSULTANTS

REGISTRATION

COMMONWEALTH OF MASSACHUSETTS
THOMAS E. PARECE
CIVIL
No. 34463
REGISTERED PROFESSIONAL ENGINEER

ISSUE/REVISION

I/R	DATE	DESCRIPTION
	2019-07-08	RECORD DRAWING
	2018-01-31	MASSDOT PERMIT SET
	2017-12-06	ISSUED FOR BID

PROJECT NUMBER

60476644

Designed By:	M. CURRAN
Drawn By:	M. CURRAN
Dept Check:	T. PARECE
Proj Check:	M. DONOGHUE
Date:	JULY 2019
Scale:	AS NOTED

DISCIPLINE

CIVIL

SHEET TITLE

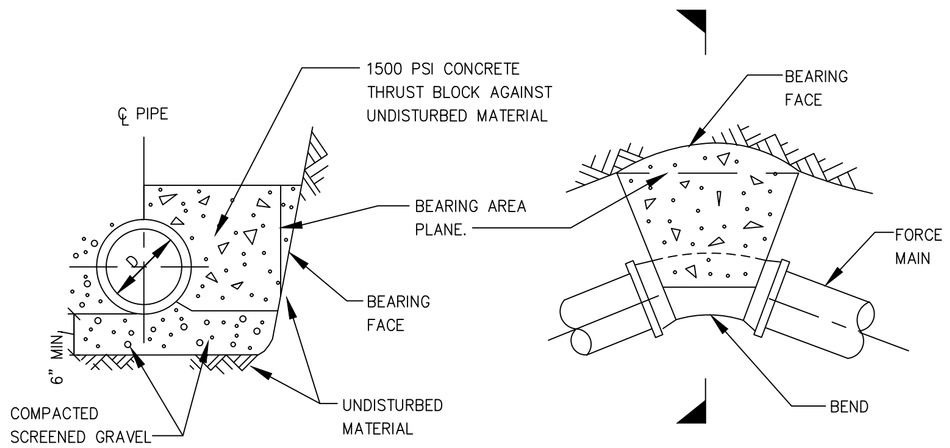
SEWER DETAILS I

SHEET NUMBER

C-501

Approved: ____ Checked: ____ Designer: ____ Project Management Initials: ____

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SECTION PLAN

NOTES:
1. WHERE SO INDICATED ON PLANS, THE FORCE MAIN BENDS SHALL BE BACKED UP WITH A CONCRETE THRUST BLOCK BETWEEN THE PIPE AND UNDISTURBED MATERIAL.
2. REQUIRED BEARING AREA TO BE CALCULATED ON VERTICAL PLANE 90 DEG. TO RADIAL PLANE PASSING THROUGH MIDPOINT OF BEND.
3. MINIMUM BEARING AREA: 2.0 SQ.FT.
4. SEE PLANS FOR REQUIRED BEARING AREAS GREATER THAN MINIMUM.

FORCE MAIN THRUST BLOCK
NOT TO SCALE

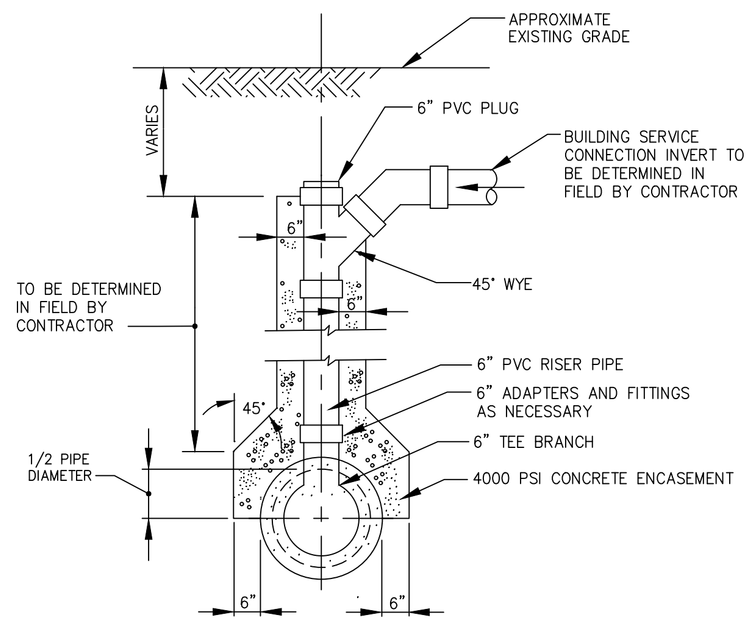
TABLE OF MINIMUM BEARING AREAS IN SQ. FT. AGAINST UNDISTURBED MATERIAL FOR WATER MAIN FITTINGS

PIPE SIZE	BEND	PRESSURE 150 PSI TYPE OF SOIL CONDITION A	B	C	D	E	F	G
6"	TEES & PLUGS	8.5	4.5	3	2.5	1.5	1.5	1
	90	12	6	4	3	2	1.5	1.5
	45	6.5	3.5	2.5	2	1.5	1	1
	22 1/2	3.5	2	1.5	1	1	0.5	0.5
8"	TEES & PLUGS	15.5	8	5.5	4	3	2	1.5
	90	21.5	11	7.5	5.5	4	3	2.5
	45	12	6	4	3	2	1.5	1.5
	22 1/2	6	3	2	1.5	1	1	1
12"	TEES & PLUGS	34	17	11.5	8.5	6	4.5	3.5
	90	48	24	16	12	8	6	5
	45	26	13	9	6.5	4.5	3.5	3
	22 1/2	13.5	7	4.5	3.5	2.5	2	1.5
16"	TEES & PLUGS	60.5	30.5	20.5	15.5	10.5	8	6.5
	90	85.5	43	28.5	21.5	14.5	11	9
	45	46.5	23.5	15.5	12	8	6	5
	22 1/2	23.5	12	8	6	4	3	2.5

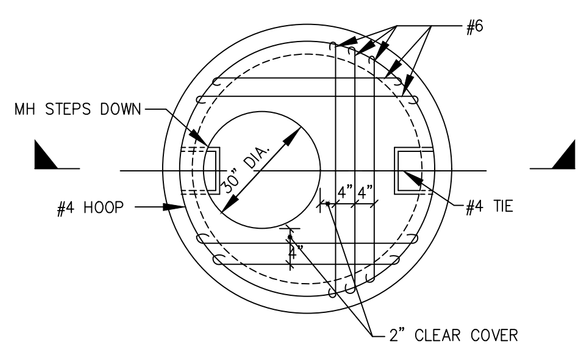
TYPE OF SOIL CONDITION	LATERAL BEARING PRESSURE (LBS PER SQ. FT.)
A - SOFT CLAY; FINE LOOSE SAND	500
B - SAND & CLAY; MIXED OR IN LAYERS; FINE CONFINED SAND	1000
C - HARD DRY CLAY	1500
D - COARSE SAND	2000
E - GRAVEL	3000
F - SOFT ROCK	4000
G - HARD PAN	5000

NOTES:
1. FOR FITTINGS WITH LESS THAN 22 1/2 DEFLECTION USE BEARING AREAS FOR 22 1/2 BEND.
2. JOINTS SHALL NOT BE ENCASED IN CONCRETE. BEARING AREAS MAY BE DISREGARDED FOR TRENCHES IN ROCK WHERE THE TOP OF THE ROCK FACE IS AT OR ABOVE THE CROWN OF THE PIPE. HOWEVER, CONCRETE BACKING SHALL BE PLACED BETWEEN THE PIPE AND ROCK FACE.
3. THE CONTRACTOR SHALL SUBMIT, 2-WEEKS IN ADVANCE OF PLACEMENT, WORKING DRAWINGS FOR EACH THRUST BLOCK, TO THE ENGINEER, FOR APPROVAL PRIOR TO INSTALLATION.
4. BEARING AREAS FOR THRUST BLOCKS FOR PIPE LARGER THAN 24 IN. SHALL BE DESIGNED BASED ON SOIL BORING DATA.
5. ACTUAL FIELD CONDITIONS SHALL BE VERIFIED DURING INSTALLATION.

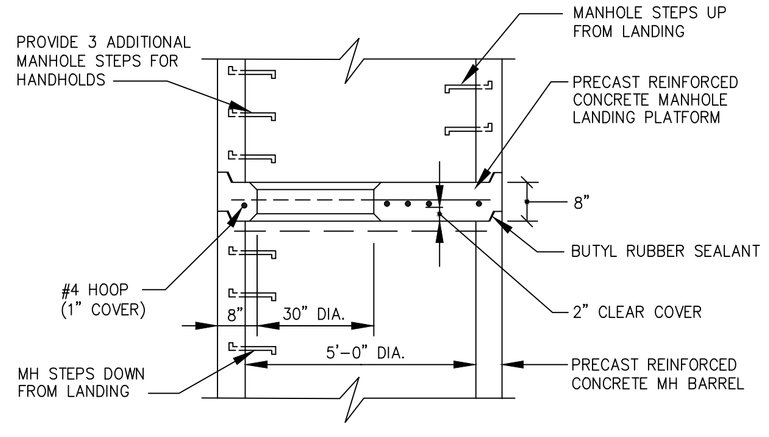
CONCRETE THRUST BLOCK BEARING AREAS FOR WATER MAIN
NOT TO SCALE



TYPICAL CHIMNEY DETAIL FOR SEWER CONNECTION
NOT TO SCALE



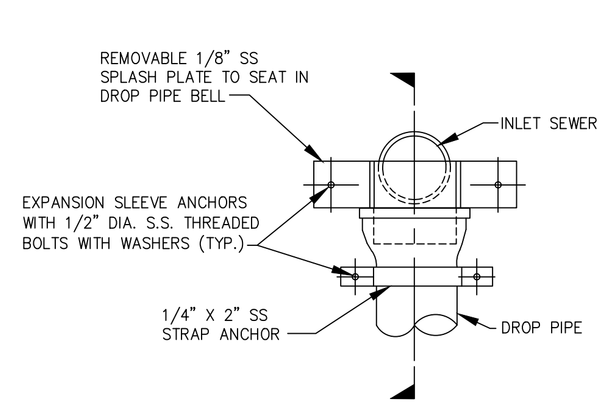
PLAN OF PRECAST SLAB



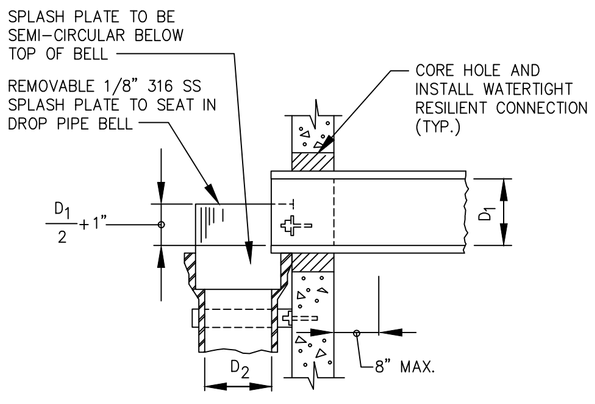
SECTION

NOTE:
LANDING PLATFORMS ARE TO BE INSTALLED AT THE MIDPOINT OF MANHOLES EXCEEDING 20' IN DEPTH.

PRECAST MANHOLE LANDING PLATFORM
NOT TO SCALE

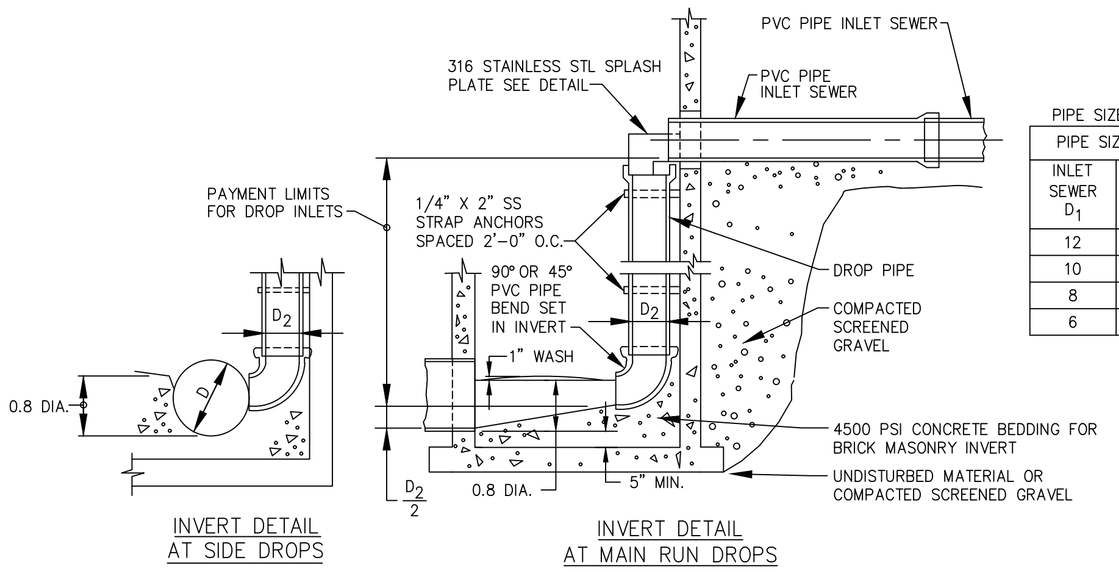


ELEVATION



SECTION

316 SS SPLASH PLATE DETAIL

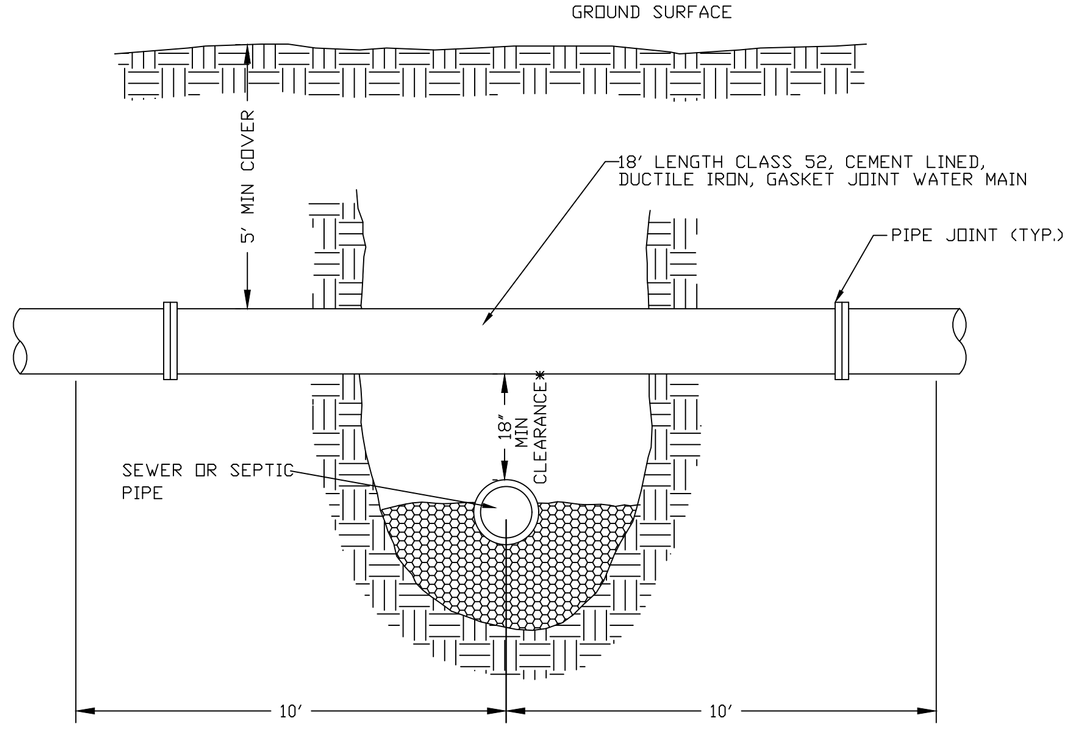


PIPE SIZE TABLE	
PIPE SIZES (IN)	
INLET SEWER D_1	DROP PIPE D_2
12	10
10	8
8	8
6	6

INVERT DETAIL AT SIDE DROPS

INVERT DETAIL AT MAIN RUN DROPS

INSIDE DROP INLETS FOR PVC PIPE SEWERS 12 INCH DIAMETER AND SMALLER
NOT TO SCALE



* WHEN THE CROSSING AS SHOWN IS LESS THAN 18' VERTICAL CLEARANCE THE UTILITY BEING INSTALLED MUST BE SLEEVED 10' ON BOTH SIDES OF THE CROSSING WITH SDR35 PVC PIPE. IF THE SEWER MAIN OR SERVICE CROSSES ABOVE THE WATERMAIN OR SERVICE, AGAIN THE UTILITY BEING INSTALLED MUST BE SLEEVED 10' ON BOTH SIDES OF THE CROSSING WITH SDR35 PVC PIPE. SEAL ENDS OF SER35 PVC WITH CONCRETE

TYPICAL WATER CROSSING
NOT TO SCALE

RECORD DRAWING

NOTE: This Record Drawing has been prepared based on information provided by others. AECOM has not verified the accuracy and/or completeness of this information and shall not be responsible for errors or omissions which may be incorporated as a result.

AECOM

PROJECT

Downtown Area Sewer Expansion

Main Street at Route 6A and Route 28

CLIENT

Town of Orleans, MA
19 SCHOOL ROAD
ORLEANS, MA 02653
(508) 240-3700

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CONSULTANTS

REGISTRATION

07/08/19
COMMONWEALTH OF MASSACHUSETTS
THOMAS E. PARECE
CIVIL
No. 34463
REGISTERED PROFESSIONAL ENGINEER

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I/R	DATE	DESCRIPTION
	2019-07-08	RECORD DRAWING
1	2018-02-19	ADDED DETAIL
	2018-01-31	MASSDOT PERMIT SET
	2017-12-06	ISSUED FOR BID

PROJECT NUMBER

60476644

Designed By:	M. CURRAN
Drawn By:	M. CURRAN
Dept Check:	T. PARECE
Proj Check:	M. DONOGHUE
Date:	JULY 2019
Scale:	AS NOTED

DISCIPLINE

CIVIL

SHEET TITLE

SEWER DETAILS II

SHEET NUMBER

C-502

Approved: ____ Checked: ____ Designer: ____ Project Management Initials: ____

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TRAFFIC MANAGEMENT NOTES

GENERAL

1. ALL TRAFFIC MANAGEMENT AND WORK ZONE TRAFFIC CONTROL MEASURES SHALL CONFORM TO THE CURRENT MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (M.U.T.C.D.), MASSDOT - HIGHWAY DIVISION'S "STANDARD DETAILS AND DRAWINGS FOR THE DEVELOPMENT OF TRAFFIC MANAGEMENT PLANS", THE STANDARD SPECIFICATIONS, AND THE FOLLOWING NOTES.

2. THE TEMPORARY TRAFFIC CONTROL PLANS CONTAINED HEREIN ARE GIVEN AS A GUIDE FOR TYPICAL WORK ZONE TRAFFIC CONTROL APPLICATIONS FOR THE TYPES OF WORK ANTICIPATED FOR THIS PROJECT. THEY ARE NOT INTENDED TO COVER ALL POSSIBLE CONSTRUCTION OPERATIONS WHICH THE CONTRACTOR MAY CHOOSE TO EMPLOY. WORK ZONE TRAFFIC CONTROL FOR OTHER CONSTRUCTION OPERATIONS OR OTHER TRAFFIC SITUATIONS IF APPLICABLE SHALL BE IN ACCORDANCE WITH THE REFERENCES LISTED IN NOTE NO. 1 AND AS APPROVED OR DIRECTED BY THE ENGINEER.

3. WITH THE EXCEPTION OF THE PERMANENT LANE CLOSURES REQUIRED FOR STAGED CONSTRUCTION, LANE RESTRICTIONS MAY NOT REMAIN OVERNIGHT OR DURING NON-WORKING HOURS. AFTER EACH WORKING DAY, TRAFFIC CONTROL DEVICES THAT ARE NOT REQUIRED SHALL BE MOVED OFF THE ROADWAY OR FULL DEPTH CONSTRUCTION AREA AND PLACED SO AS NOT TO IMPEDE PEDESTRIAN AREAS, ABUTTER ACCESS OR CAUSE CONFUSION TO MOTORISTS. IN CERTAIN CIRCUMSTANCES, AND ONLY WITH THE APPROVAL OF MASSDOT AND THE ENGINEER, LANE RESTRICTIONS MAY REMAIN OVERNIGHT.

4. CONTRACTOR SHALL PROVIDE A SAFE TEMPORARY PEDESTRIAN ACCESS WHERE EXISTING SIDEWALKS OR OTHER PEDESTRIAN AREAS ARE AFFECTED BY CONSTRUCTION WORK. CONTRACTOR SHALL NOTIFY EACH ABUTTER AT LEAST 24 HOURS IN ADVANCE OF THE START OF ANY WORK THAT WILL REQUIRE THE TEMPORARY CLOSURE OF ACCESS, SUCH AS CONDUIT INSTALLATION, EXISTING PAVEMENT EXCAVATION, TEMPORARY DRIVEWAY PAVEMENT PLACEMENT AND SIMILAR OPERATIONS.

5. PLACE ALL CONSTRUCTION SIGNING, TRAFFIC CONTROL DEVICES AND TEMPORARY PAVEMENT MARKINGS FOR EACH PHASE PRIOR TO COMMENCEMENT OF CONSTRUCTION.

6. ONE (1) THRU TRAVEL LANE HAVING A MINIMUM WIDTH OF 11'-0" MUST BE PROVIDED FOR BOTH DIRECTIONS (LANE MAY BE SHARED AND DIRECTION OF TRAVEL TO ALTERNATE UNDER POLICE OFFICER OR FLAGGER CONTROL) DURING ALL PHASES OF CONSTRUCTION AS SHOWN ON THE TEMPORARY TRAFFIC CONTROL PLANS, UNLESS OTHERWISE DIRECTED BY THE ENGINEER. MINIMUM LANE WIDTH IS MEASURED FROM THE EDGE OF DRUMS OR MEDIAN BARRIER.

7. WHEN WORK INFRINGES UPON THE TRAVELED WAY, WORK SHALL BE RESTRICTED TO OFF-PEAK HOURS ONLY (NORMALLY 9:00am TO 4:00pm, MONDAY TO FRIDAY). THE CONTRACTOR SHALL NOTIFY EACH ABUTTER AT LEAST 24 HOURS IN ADVANCE OF ROAD CLOSURE.

8. TAPER LENGTH FORMULAE FOR CHANNELIZATION DEVICES: ENGLISH UNITS:
   L = WxS FOR SPEED EQUAL TO OR GREATER THAN 45 M.P.H.
   L = $(WxS^2)/60$ FOR SPEED EQUAL TO OR LESS THAN 40 M.P.H.
   WHERE: L = MIN. LENGTH OF TAPER, S = POSTED SPEED, W = OFFSET WIDTH.

9. ADVISORY SPEED LIMIT, IF USED, SHALL BE SET IN THE FIELD BY THE ENGINEER. W13-1 PLATES SHALL BE USED WHERE APPROPRIATE.

10. FLASHING ARROW PANEL SHALL BE SET IN "ARROW MODE" WHEN USED FOR ACTUAL LANE CLOSURES ONLY. FOR SHOULDER CLOSURES, BULBS TO BE ILLUMINATED IN A NON-DIRECTIONAL CAUTION CONFIGURATION TO AVOID UNNECESSARY LANE SHIFTS.

11. DISTANCES SHOWN ON THE TEMPORARY TRAFFIC CONTROL PLANS ARE A GUIDE ONLY, AND MAY BE ADJUSTED IN THE FIELD BY THE ENGINEER.

GRADE DIFFERENCES

12. WHERE THERE IS A LONGITUDINAL DIFFERENCE IN ELEVATION BETWEEN EXISTING PAVEMENT AND ADJACENT TRAVEL SURFACE (UNDER REPAIR OR RECONSTRUCTION), THE CONTRACTOR SHALL PATCH A TEMPORARY HMA WEDGE WITH A 12:1 (OR FLATTER) SLOPE FOR SMOOTH TRANSITION. SEE DETAIL, THIS SHEET.

13. CROSS-SECTIONAL GRADE DIFFERENCES IN EXCESS OF 2" DURING NON-WORKING HOURS WILL REQUIRE DELINEATION BY USE OF REFLECTORIZED DRUMS.

14. CROSS-SECTIONAL GRADE DIFFERENCES IN EXCESS OF 4" DURING NON-WORKING HOURS SHALL BE PROTECTED BY BACKFILLING WITH A WEDGE OF EARTHWORK TO BE COMPACTED AT 4:1 SLOPE AND WILL ALSO REQUIRE DELINEATION BY USE OF DRUMS.

15. A SLOPE OF 4:1 (OR FLATTER) MUST BE MAINTAINED AFTER WORKING HOURS DURING SUBBASE AND BASE COURSE INSTALLATION ALONG EDGE OF THE TRAVELWAY (SEE DETAIL, THIS SHEET). A SLOPE OF 8:1 (OR FLATTER) MUST BE MAINTAINED ON ALL ABUTTER ACCESS DRIVES AND A SLOPE OF 12:1 (OR FLATTER) MUST BE MAINTAINED ON ALL SIDEWALKS.

CONSTRUCTION SIGNING

16. ALL CONSTRUCTION SIGNS SHALL BE BLACK LEGEND ON A REFLECTORIZED ORANGE BACKGROUND UNLESS OTHERWISE NOTED.

17. CONSTRUCTION SIGNING SHOWN ON THE ADVANCE SIGNING PLAN SHALL REMAIN IN PLACE FOR THE ENTIRE PROJECT DURATION, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

18. STANDARD ORANGE OR FLUORESCENT RED-ORANGE FLAGS (16"x16" MIN.) MAY BE ATTACHED TWO (2) EACH ON ALL ADVANCE WARNING SIGNS. FLAGS SHALL NOT INTERFERE WITH A CLEAR VIEW OF THE SIGN FACE. IF USED, THE COST FOR THE FLAGS SHALL BE CONSIDERED INCIDENTAL TO THE COST OF THE SIGNS WITH NO ADDITIONAL PAYMENT.

19. EXISTING GUIDE SIGNS SHALL BE TEMPORARILY RESET AS DIRECTED BY THE ENGINEER.

20. ALL SIGNS, INCLUDING EXISTING, THAT ARE NOT REPRESENTATIVE OF ACTUAL WORK CONDITIONS SHALL BE EITHER COVERED OR REMOVED WHEN NOT APPLICABLE.

21. IF USED, ALL W20-4 AND W20-5 SIGNS SHALL BE TAKEN DOWN OR COVERED AT THE CLOSE OF EACH DAY UNLESS LANE RESTRICTIONS ARE PERMITTED TO REMAIN OVERNIGHT IN ACCORDANCE WITH NOTE NO. 3 ABOVE.

CONSTRUCTION SIGNING (CONT.)

22. USE W20-7b OR W20-7 SIGNS ONLY WHILE POLICE OR FLAGGERS ARE DIRECTING TRAFFIC. THEY SHALL BE TAKEN DOWN OR COVERED AT THE CLOSE OF EACH DAY OR WHEN NOT IN USE.

PAVEMENT MARKINGS

23. PAVEMENT MARKINGS WHICH ARE NO LONGER APPLICABLE SHALL BE REMOVED. APPLY TEMPORARY MARKINGS WHERE SHOWN ON THE TEMPORARY TRAFFIC CONTROL PLANS.

24. ON PROJECTS WHERE PAVEMENT OVERLAY IS NOT DESIGNATED, EXISTING PAVEMENT MARKINGS WHICH ARE IN CONFLICT WITH TEMPORARY TRAFFIC CONTROLS SHOULD BE COVERED TEMPORARILY WITH BLACKOUT TAPE, AS DIRECTED BY THE ENGINEER. FOR THE FULL DURATION OF THE PHASE IN PROGRESS. TEMPORARY PAINTED OR REMOVABLE TAPE MARKINGS SHALL BE USED AS NECESSARY FOR ALL PHASES OF CONSTRUCTION.

CHANNNELIZATION

25. THE MAXIMUM SPACING BETWEEN CHANNELIZATION DEVICES (DRUMS OR CONES) SHALL BE APPROXIMATELY EQUAL IN FEET TO THE POSTED SPEED LIMIT. THE MINIMUM SPACING SHALL BE 25' O.C.

26. REFLECTORIZED CONES SHALL BE 36" HIGH.

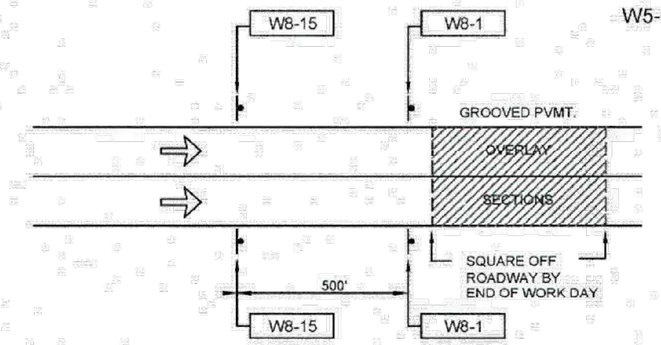
27. PLASTIC DRUMS MUST PASS THE CRITERIA SET FORTH IN NCHRP 350 "RECOMMENDED PROCEDURES FOR THE SAFETY PERFORMANCE EVALUATION OF HIGHWAY FEATURES." IF THEY DO NOT MEET THESE CRITERIA, THEY MUST BE REMOVED FROM THE PROJECT.

28. TEMPORARY IMPACT ATTENUATORS MUST MEET THE PERFORMANCE STANDARDS OF NCHRP 350.

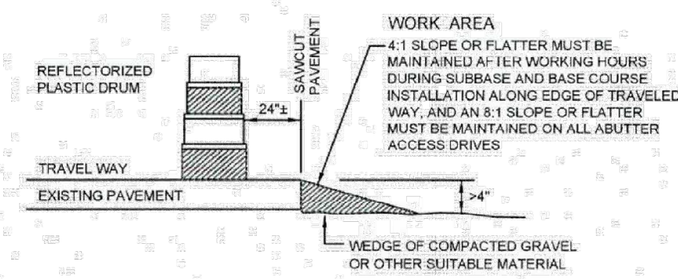
29. SIGNS AND SIGN SUPPORTS LOCATED ON OR NEAR THE TRAVELED WAY MUST PASS THE CRITERIA SET FORTH IN NCHRP 350 "RECOMMENDED PROCEDURES FOR THE SAFETY PERFORMANCE EVALUATION OF HIGHWAY FEATURES." IF THEY DO NOT MEET THIS CRITERIA, THEY MUST BE REMOVED FROM THE PROJECT.

TRAFFIC MANAGEMENT LEGEND

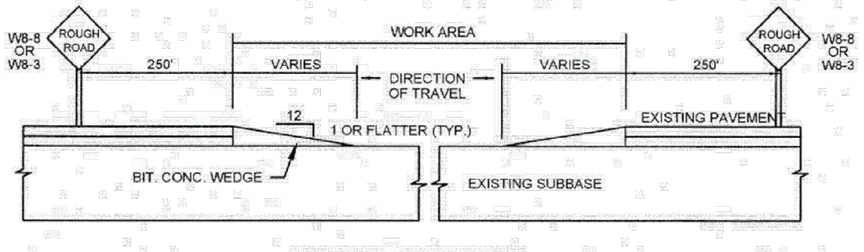
- WORK AREA
- DIRECTION OF TRAVEL
- REFLECTORIZED PLASTIC DRUM OR 36" CONE
- A — REFLECTORIZED PLASTIC DRUM WITH TYPE 'A' FLASHING WARNING LIGHT
- P / — POLICE OFFICER OR FLAGGER CONTROL
- PORTABLE TYPE III BARRICADE (4' WIDE, MIN.)
- FLASHING ARROW BOARD (30"x 60" STD. SIZE WITH 13 LAMPS, MIN.)
- TEMPORARY PRECAST CONCRETE BARRIER WITH TEMPORARY FENCE & WHITE REFLECTORS
- TEMPORARY IMPACT ATTENUATOR
- PAVEMENT MARKINGS TO COVER OR REMOVE (SEE NOTES 23 & 24)
- PORTABLE CHANGEABLE MESSAGE SIGN
- MOVABLE IMPACT ATTENUATOR



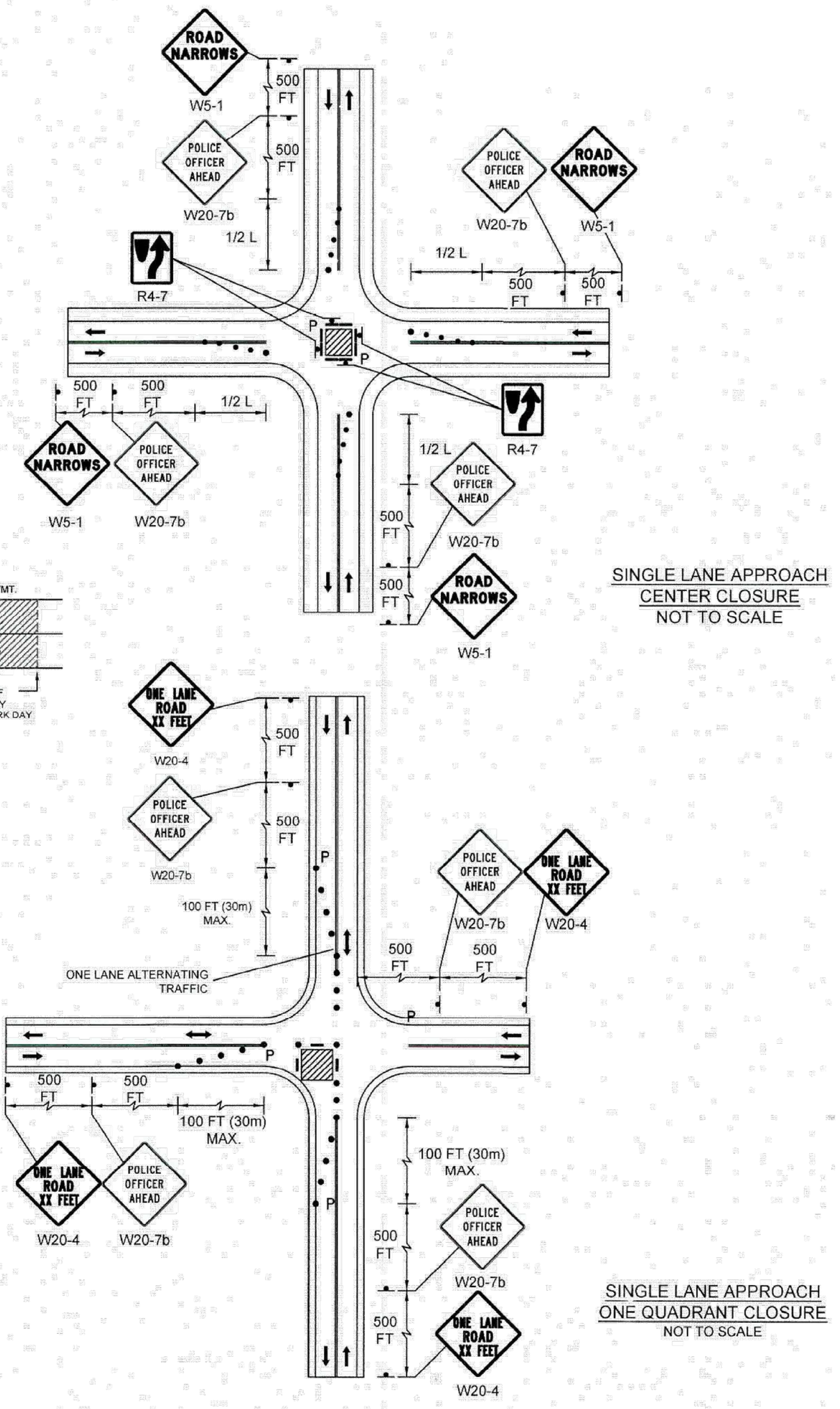
AFTER WORK HOURS TREATMENT FOR AREAS RECEIVING OVERLAY



AFTER WORK HOURS TREATMENT FOR LATERAL SLOPING



TEMPORARY RAMP



SINGLE LANE APPROACH
CENTER CLOSURE
NOT TO SCALE

SINGLE LANE APPROACH
ONE QUADRANT CLOSURE
NOT TO SCALE

AECOM

PROJECT

Downtown Area
Sewer Expansion

Main Street at
Route 6A and Route 28

CLIENT

Town of Orleans, MA
19 SCHOOL ROAD
ORLEANS, MA 02653
(508) 240-3700

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THOMAS E. PARECE
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	2018-01-31	MASSDOT PERMIT SET
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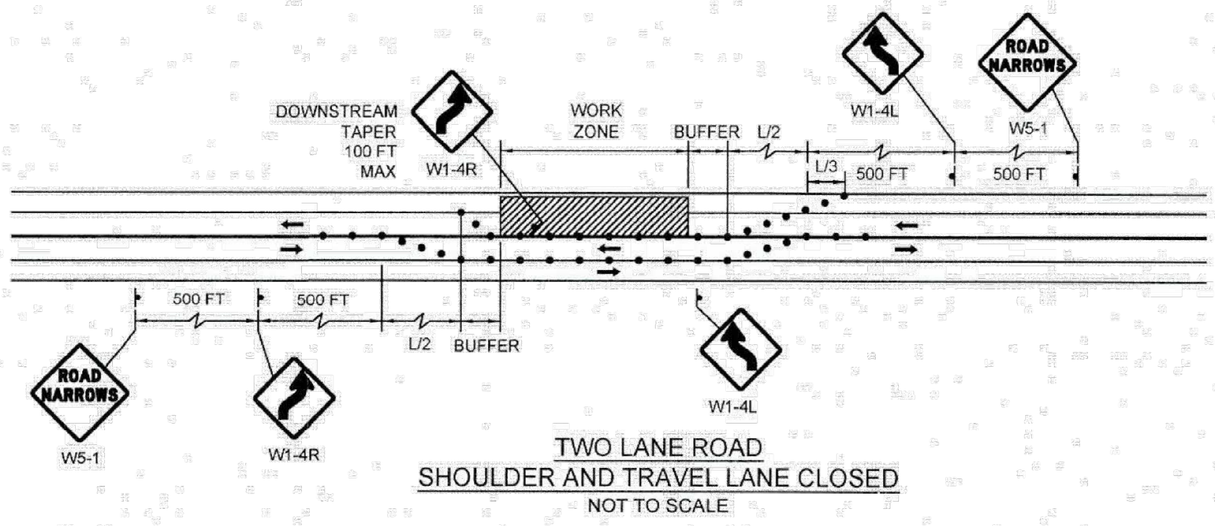
TYPICAL TRAFFIC MANAGEMENT PLAN I

SHEET NUMBER

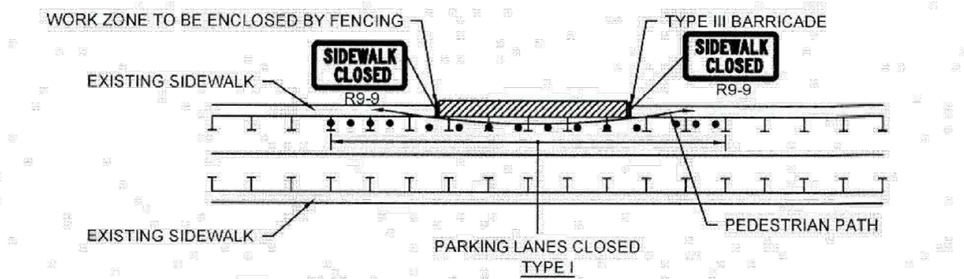
T-101

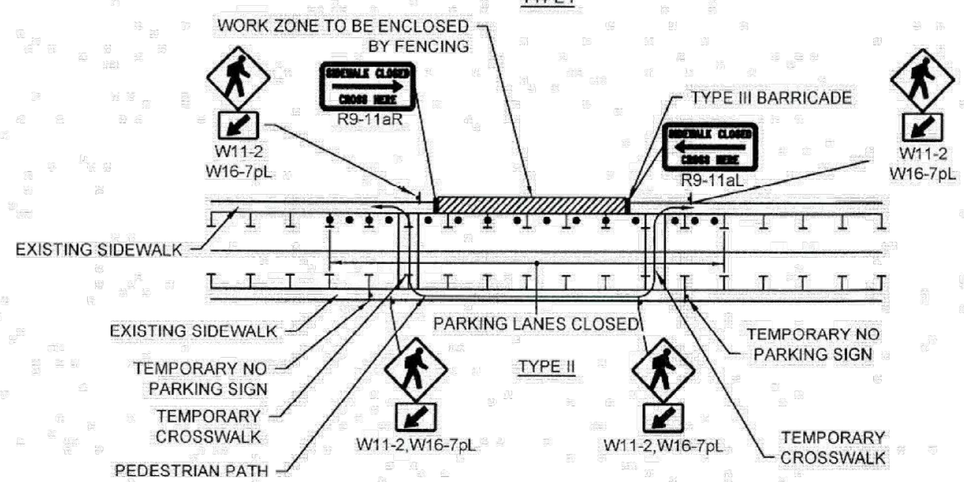
Approved: ____ Checked: ____ Designer: ____ Project Management Initials: ____

Last saved by: CURRANM (2019-07-08) Last Plotted: 2019-07-08
Filename: L:\WORK\60476644 - ORLEANS DOWNTOWN SEWER\SHEETS - MAIN ST 6A\CIT-101_103.DWG



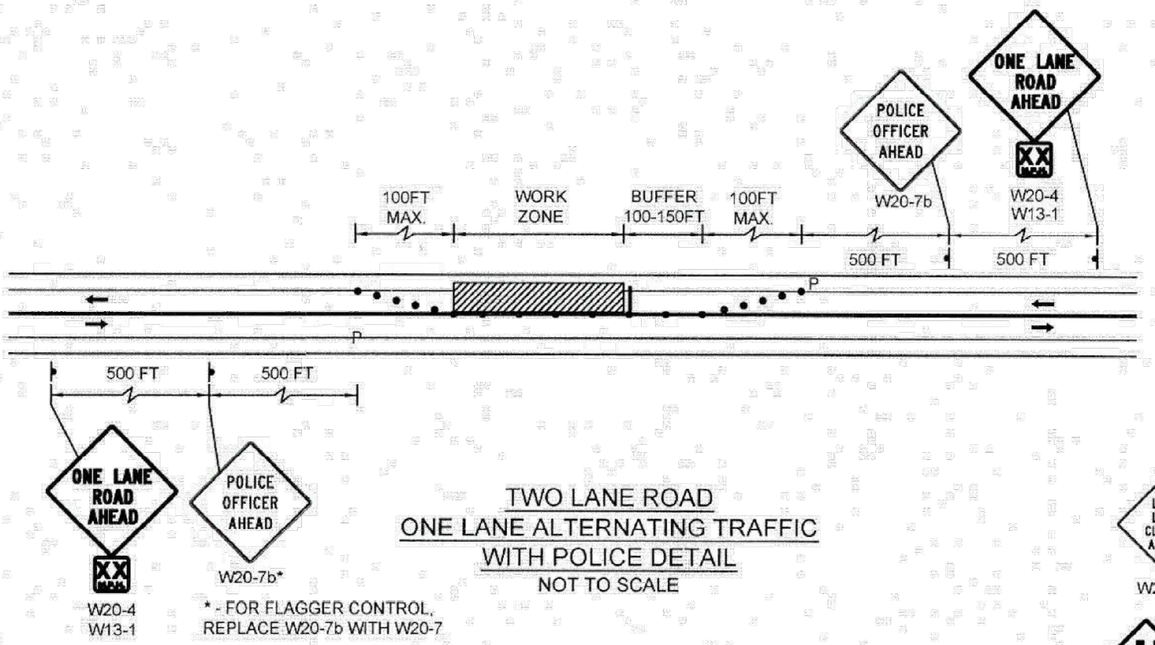
TWO LANE ROAD
SHOULDER AND TRAVEL LANE CLOSED
NOT TO SCALE



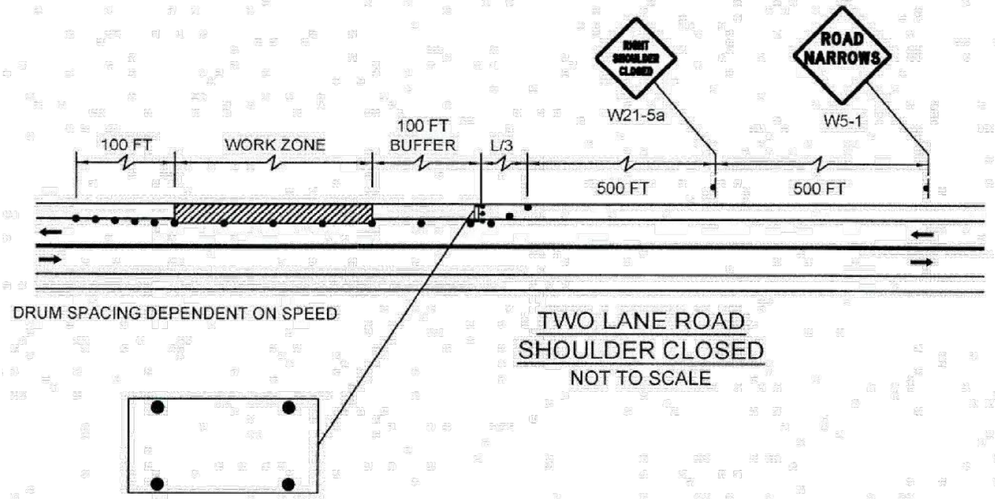


PEDESTRIAN BYPASS
NOT TO SCALE

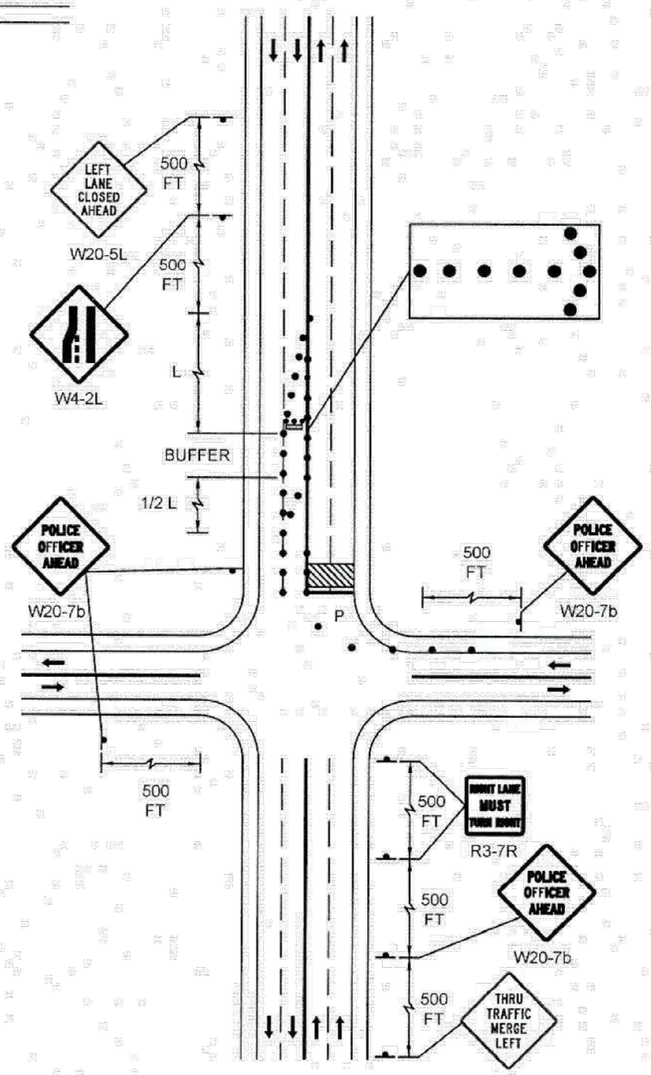
NOTES
1. ADDITIONAL ADVANCE WARNING MAY BE NECESSARY.
2. CONTROLS ONLY FOR PEDESTRIAN TRAFFIC ARE SHOWN. VEHICULAR TRAFFIC SHOULD BE HANDLED AS SHOWN ELSEWHERE.
3. STREET LIGHTING SHOULD BE CONSIDERED WHEN LOCATING CONTROL DEVICES.
4. IF THE WORK ZONE DOES NOT PERMIT PEDESTRIANS TO TRAVEL ADJACENT TO IT AS SHOWN IN PEDESTRIAN BYPASS TYPE I, TEMPORARY CROSSWALKS WITH APPROPRIATE SIGNS SHOULD BE INSTALLED TO CROSS PEDESTRIANS TO THE OPPOSITE SIDE OF THE STREET AS SHOWN IN PEDESTRIAN BYPASS TYPE II, AND AS DIRECTED BY THE ENGINEER.
5. BYPASS IS TO BE USED IN CONJUCTION WITH THE PROPOSED LANE CLOSURE DETAILS AND DURING CONSTRUCTION STAGING, AS DIRECTED BY THE ENGINEER.
6. THE TEMPORARY SIDEWALK SHOULD BE A MINIMUM OF 4 FEET WIDE. IF THIS WALKWAY EXCEEDS 200 FEET THEN A 5 FOOT X 5 FOOT PASSING ZONE IS REQUIRED.



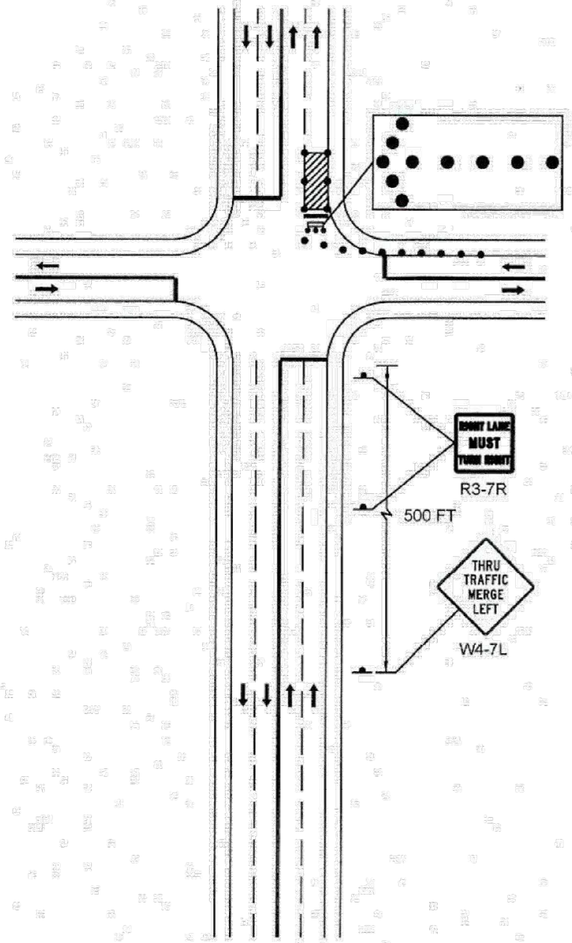
TWO LANE ROAD
ONE LANE ALTERNATING TRAFFIC
WITH POLICE DETAIL
NOT TO SCALE



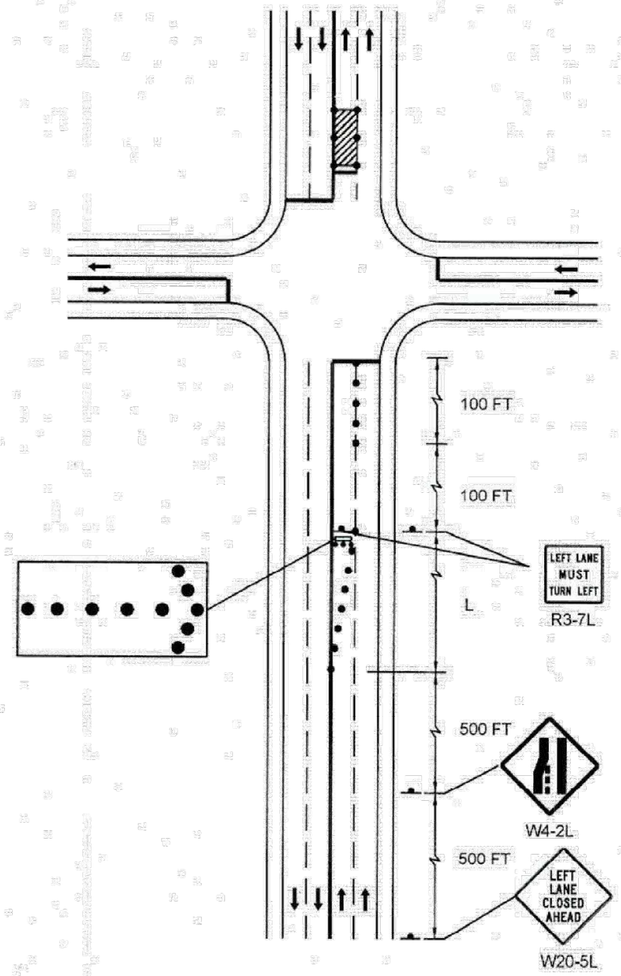
TWO LANE ROAD
SHOULDER CLOSED
NOT TO SCALE



DOUBLE LANE APPROACH
HALF ROAD CLOSURE
NOT TO SCALE



DOUBLE LANE APPROACH
FAR SIDE CLOSURE
RIGHT LANE
NOT TO SCALE



DOUBLE LANE APPROACH
FAR SIDE CLOSURE
INSIDE LANE
NOT TO SCALE

AECOM

PROJECT

Downtown Area
Sewer Expansion

Main Street at
Route 6A and Route 28

CLIENT

Town of Orleans, MA
19 SCHOOL ROAD
ORLEANS, MA 02653
(508) 240-3700

CONSULTANT

AECOM TECHNICAL SERVICES, INC.
9 JONATHAN BOURNE DRIVE
POCASSET, MA 02559
PHONE: (508) 833-6950
www.aecom.com

CONSULTANTS

REGISTRATION

07/29/19
COMMONWEALTH OF MASSACHUSETTS
THOMAS E. PARECE
CIVIL
No. 34463
REGISTERED PROFESSIONAL ENGINEER

ISSUE/REVISION

I/R	DATE	DESCRIPTION
	2019-07-08	RECORD DRAWING
	2018-01-31	MASSDOT PERMIT SET
	2017-12-06	ISSUED FOR BID

PROJECT NUMBER

60476644

Designed By:	M. CURRAN
Drawn By:	M. CURRAN
Dept Check:	T. PARECE
Proj Check:	M. DONOGHUE
Date:	JULY 2019
Scale:	AS NOTED

DISCIPLINE

CIVIL

SHEET TITLE

TYPICAL TRAFFIC MANAGEMENT PLAN II

SHEET NUMBER

T-102

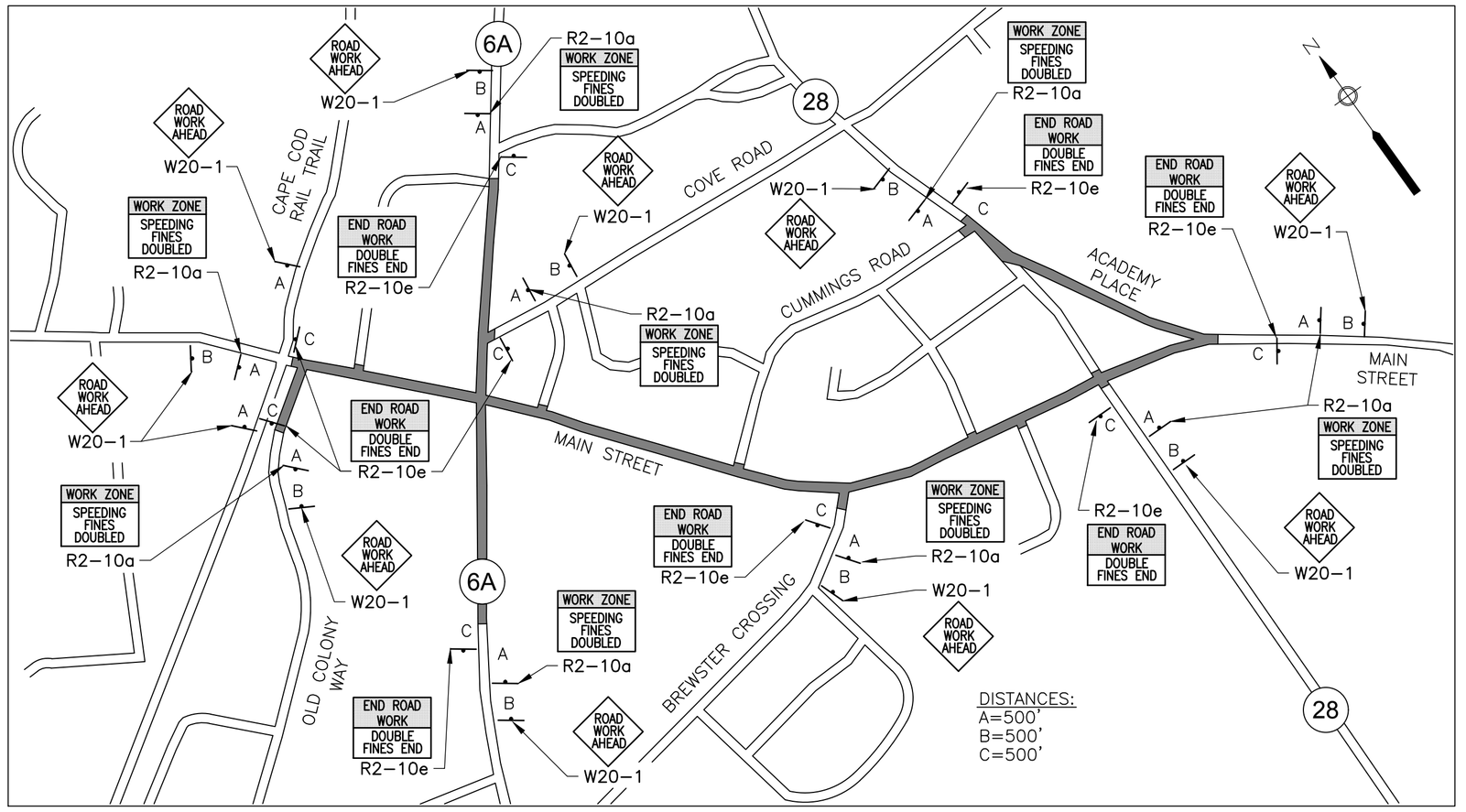
Approved:
Checked:
Designer:
Project Management Initials:

Last saved by: CURRANM(2019-07-08) Last Plotted: 2019-07-08
Filename: L:\WORK\60476644 - ORLEANS DOWNTOWN SEWER\SHEETS - MAIN ST 6A\CIT-101_103.DWG

TRAFFIC SIGN SUMMARY

IDENTIFICATION NUMBER	SIZE OF SIGN (INCHES) WIDTH	HEIGHT	TEXT	TEXT DIMENSIONS (INCHES) LETTER HEIGHT	VERTICAL SPACING	ARROW RTE. MKR.	NUMBER OF SIGNS REQUIRED	COLOR BACK-GROUND	LEGEND	BORDER	UNIT AREA IN SQUARE FEET	AREA IN SQUARE FEET
R2-10a	36	24	WORK ZONE SPEEDING FINES DOUBLED	MASSDOT STANDARD			10	MASSDOT STANDARD			6.00	60.00
R2-10e	36	48	END ROAD WORK DOUBLE FINES END	MASSDOT STANDARD			10	MASSDOT STANDARD			12.00	120.00
R3-7L	36	36	LEFT LANE MUST TURN LEFT	MUTCD STANDARD			2	MUTCD STANDARD			9.00	18.00
R3-7R	36	36	RIGHT LANE MUST TURN RIGHT				2				9.00	18.00
R4-7	30	30					4				6.25	25.00
R9-9	24	12	SIDEWALK CLOSED				2				2.00	4.00
R9-11aL	24	12	SIDEWALK CLOSED CROSS HERE				1				2.00	2.00
R9-11aR	24	12	SIDEWALK CLOSED CROSS HERE				1				2.00	2.00
W1-4L	36	36					2				9.00	18.00
W1-4R	36	36					2				9.00	18.00
W4-2L	36	36					2				9.00	18.00
W4-7L	36	36	THRU TRAFFIC MERGE LEFT				2				9.00	18.00
W5-1	36	36	ROAD NARROWS				4				9.00	36.00
W8-1	36	36	BUMP				2				9.00	18.00
W8-3	36	36	PAVEMENT ENDS				2				9.00	18.00
W8-8	36	36	ROUGH ROAD				2				9.00	18.00
W8-15	36	36	GROOVED PAVEMENT				2				9.00	18.00
W11-2	30	30					4				6.25	25.00
W13-1	24	30	XX M.P.H.				2				5.00	10.00

ADVANCE WARNING SIGNING PLAN



TRAFFIC SIGN SUMMARY

IDENTIFICATION NUMBER	SIZE OF SIGN (INCHES) WIDTH	HEIGHT	TEXT	TEXT DIMENSIONS (INCHES) LETTER HEIGHT	VERTICAL SPACING	ARROW RTE. MKR.	NUMBER OF SIGNS REQUIRED	COLOR BACK-GROUND	LEGEND	BORDER	UNIT AREA IN SQUARE FEET	AREA IN SQUARE FEET
W16-7pL	24	12		MUTCD STANDARD			4	MUTCD STANDARD			2.00	8.00
W20-1	48	48	ROAD WORK AHEAD				12				16.00	192.00
W20-4	36	36	ONE LANE ROAD XX FT				4				9.00	36.00
W20-5L	36	36	LEFT LANE CLOSED AHEAD				2				9.00	18.00
W20-7	36"	36"	FLAGGER AHEAD				2				9.00	18.00
W20-7b	36	36	POLICE OFFICER AHEAD				4				9.00	36.00
W21-5a	36	36	RIGHT SHOULDER CLOSED				1				9.00	9.00
											TOTAL	781.00

AECOM

PROJECT

Downtown Area
Sewer Expansion

Main Street at
Route 6A and Route 28

CLIENT

Town of Orleans, MA
19 SCHOOL ROAD
ORLEANS, MA 02653
(508) 240-3700

CONSULTANT

AECOM TECHNICAL SERVICES, INC.
9 JONATHAN BOURNE DRIVE
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REGISTRATION

COMMONWEALTH OF MASSACHUSETTS
THOMAS E. PARECE
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No. 34463
REGISTERED PROFESSIONAL ENGINEER

ISSUE/REVISION

I/R	DATE	DESCRIPTION
	2019-07-08	RECORD DRAWING
	2018-01-31	MASSDOT PERMIT SET
	2017-12-06	ISSUED FOR BID

PROJECT NUMBER

60476644

Designed By:	M. CURRAN
Drawn By:	M. CURRAN
Dept Check:	T. PARECE
Proj Check:	M. DONOGHUE
Date:	JULY 2019
Scale:	AS NOTED

DISCIPLINE

CIVIL

SHEET TITLE

TYPICAL TRAFFIC MANAGEMENT PLAN III

SHEET NUMBER

T-103

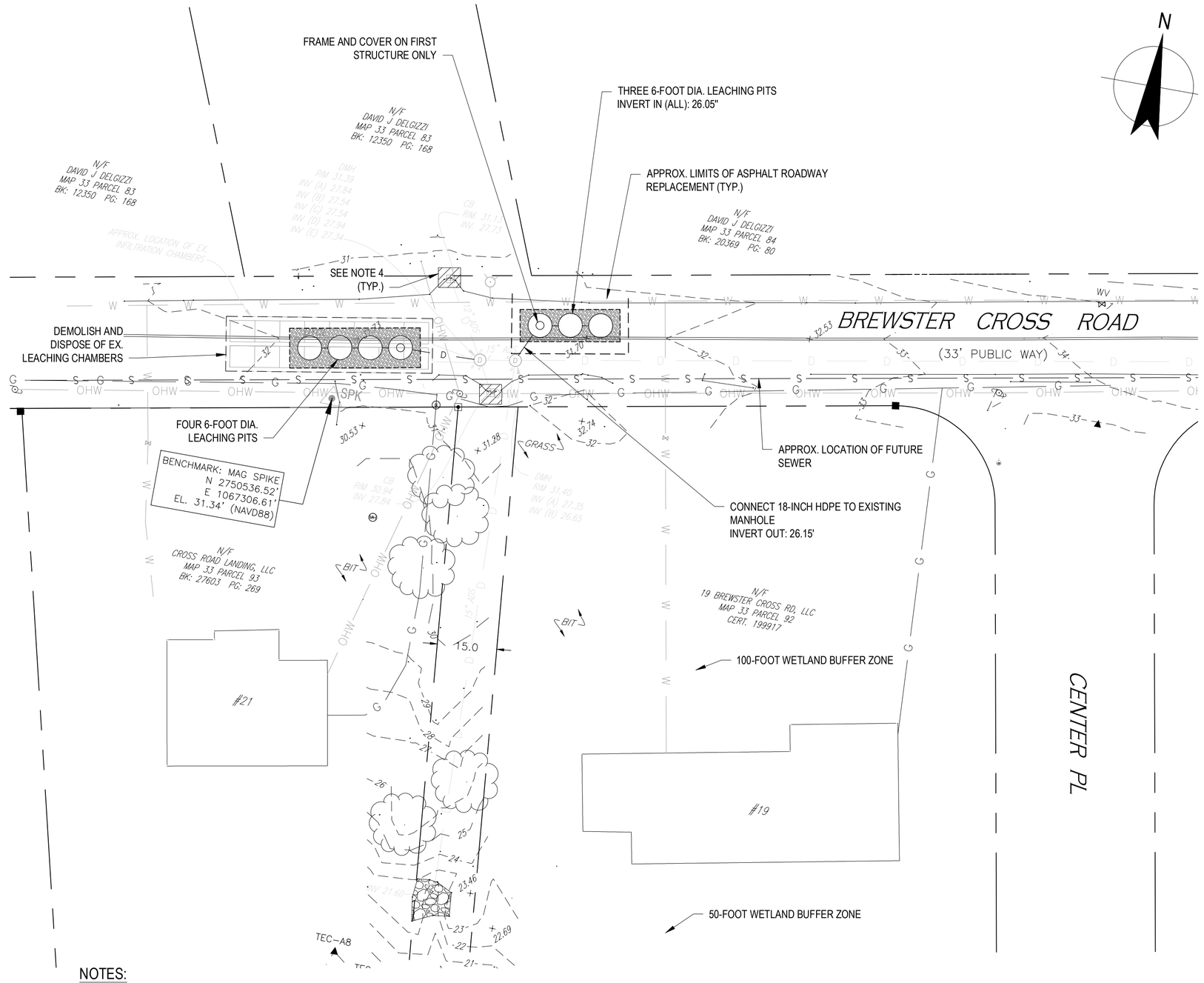
Approved:____ Checked:____ Designer:____ Project Management Initials:____

Last saved by: CURRANM(2019-07-08) Last Plotted: 2019-07-08
Filename: L:\WORK\60476644 - ORLEANS DOWNTOWN SEWER\SHEETS - MAIN ST 6A\CIT-101_103.DWG

ATTACHMENT B

Town of Orleans, MA, Locust Road and Brewster Cross Road Stormwater Improvement by GHD, Inc., September 2019

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NOTES:

1. WETLAND DELINEATION PERFORMED BY GREEN SEAL ENVIRONMENTAL, INC. ON OCTOBER 2, 2017.
2. FUTURE SEWER ALIGNMENT BASED ON 25% PRELIMINARY DESIGN REPORT PROVIDED BY TOWN.
3. CONTRACTOR SHALL TEMPORARILY PLUG EXISTING 15-INCH DISCHARGE PIPE (IN DRAIN MANHOLE) DURING CONSTRUCTION TO ELIMINATE TRANSPORT OF SEDIMENT TO POND.
4. CONTRACTOR SHALL CLEAN (REMOVE SEDIMENT, LEAVES, AND DEBRIS) CATCH BASINS.

BREWSTER CROSS ROAD SITE PLAN - PROPOSED

SCALE: 1" = 20'

PERMIT ONLY - NOT FOR CONSTRUCTION

No	Revision	Drawn	Job Manager	Project Director	Date
A	FOR PERMITTING	JWB	RHK	MRD	3/18

Note: * indicates signatures on original issue of drawing or last revision of drawing

NOTES: UNDERGROUND FACILITIES, STRUCTURES, AND UTILITIES HAVE BEEN PLOTTED FROM AVAILABLE SURVEYS AND RECORDS, AND THEREFORE THEIR LOCATIONS MUST BE CONSIDERED APPROXIMATE ONLY. THERE MAY BE OTHERS, THE EXISTENCE OF WHICH IS PRESENTLY NOT KNOWN. ANYONE USING UTILITY INFORMATION AND DATA PROVIDED HEREIN SHALL CALL DIG SAFE AT 811 SEVENTY TWO (72) HOURS, 3 BUSINESS DAYS IN ADVANCE TO VERIFY THE LOCATION OF UTILITIES PRIOR TO START OF CONSTRUCTION.

0 10 20 30 40'
SCALE 1"=20' AT ORIGINAL SIZE

GHD Inc.
1545 Iyannough Road, Hyannis Massachusetts 02601 USA
T 1 774 470 1630 **F** 1 774 470 1631
E hyamail@ghd.com **W** www.ghd.com

Drawn JWB		Designer JWB	
Drafting Check RHK		Design Check RHK	
Approved (Project Director)			
Date			
Scale AS SHOWN	This Drawing shall not be used for Construction unless Signed and Sealed For Construction		

Client TOWN OF ORLEANS, MA
Project WATER QUALITY IMPROVEMENTS
Title BREWSTER CROSS ROAD - SITE PLAN AND DETAILS
Contract No.
Original Size Arch D
Drawing No: 111-44280-C02
Rev: A

Plot Date: 17 January 2019 - 1:58 PM Plotted by: Jeff Bellino
Cad File No: G:\111\11144280 Town of Orleans Uncle Harvey and Boland Pond SWImprovements\CADD\Drawings\Civil\Option B.dwg

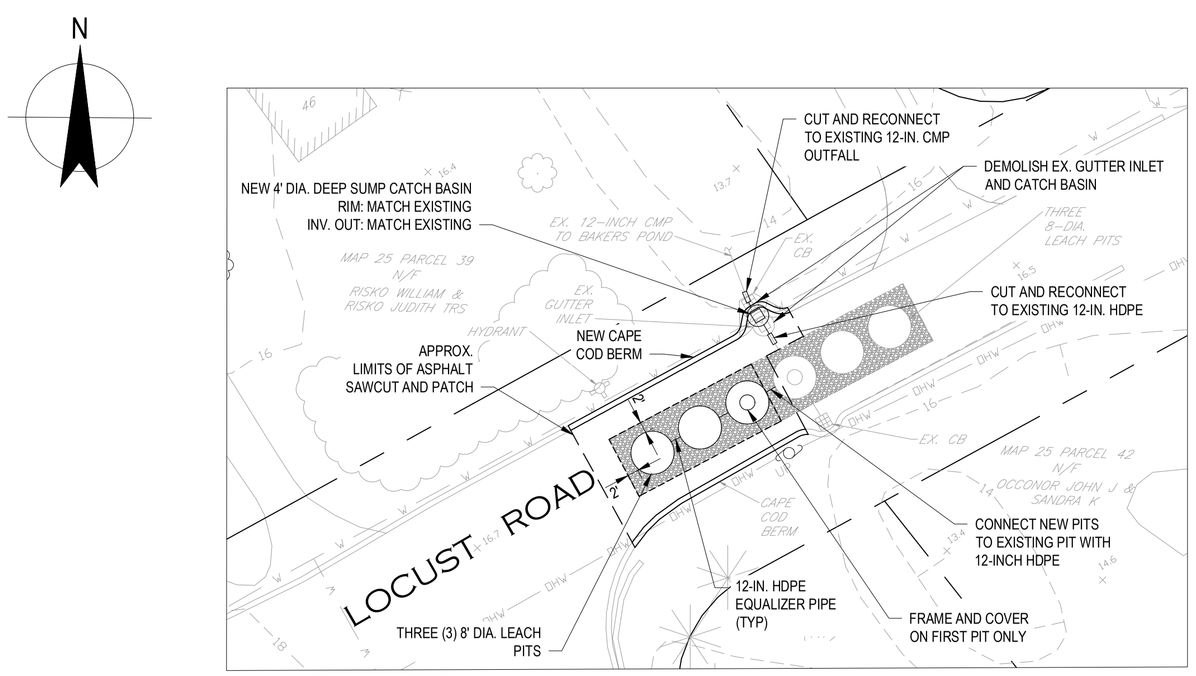
LEGEND

FOR EXISTING CONDITIONS

W — W	UNDERGROUND WATER–MAIN
X — X	6' HIGH CHAIN LINK FENCE
	EDGE OF PAVEMENT
OHW — OHW	OVERHEAD WIRES
9	MINOR CONTOURS
10	MAJOR CONTOURS
	UTILITY POLE

FOR PROPOSED CONDITIONS

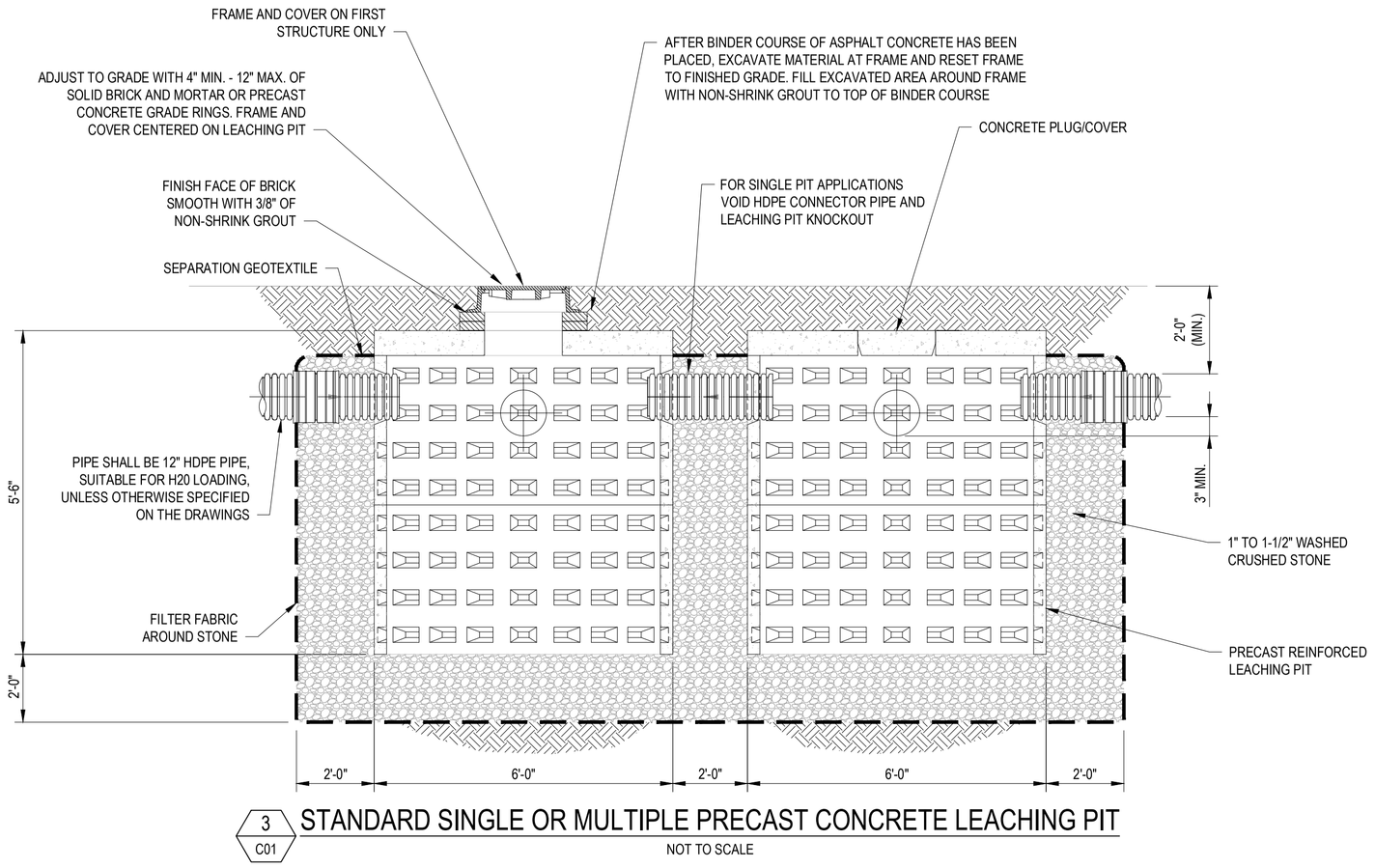
SF — SF	SILT FENCE/HAYBALE LIMIT
LOW	LIMITS OF WORK
	LIMITS OF NEW ASPHALT PAVING
	FILTER FABRIC
D	DRAIN PIPING



#46 LOCUST ROAD - SITE PLAN

SCALE: 1" = 20'

NOTES:
1. CONTRACTOR TO SET EQUALIZER PIPES (BETWEEN PITS) LEVEL AND SHALL HAVE INVERTS THAT MATCH THE EXISTING EQUALIZER PIPE INVERTS.

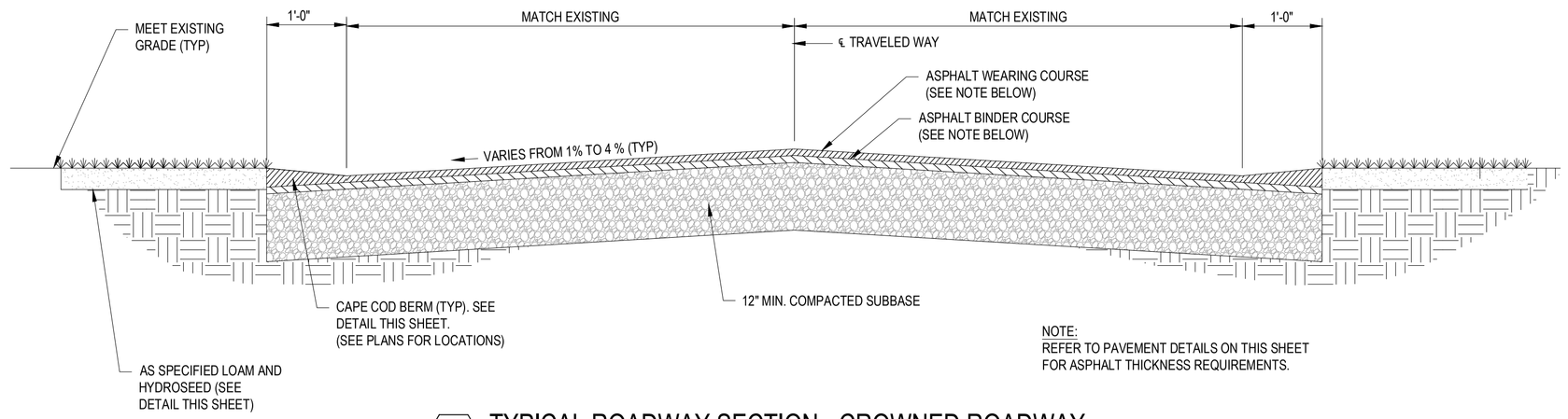


3 C01 STANDARD SINGLE OR MULTIPLE PRECAST CONCRETE LEACHING PIT

NOT TO SCALE

PRECAST CONCRETE NOTES:

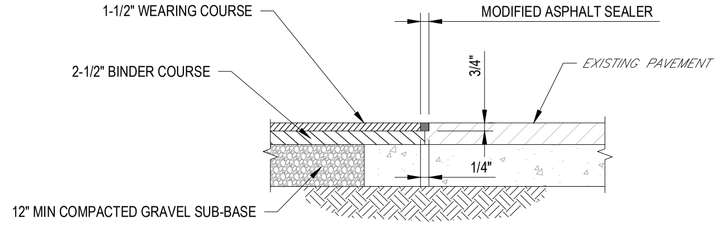
1. CONCRETE MINIMUM STRENGTH SHALL BE 4,000 PSI @ 28 DAYS.
2. STEEL REINFORCEMENT: AS-615, GRADE 60.
3. DESIGN LOADING: AASHO-HS-20.



NOTE:
REFER TO PAVEMENT DETAILS ON THIS SHEET FOR ASPHALT THICKNESS REQUIREMENTS.

4 C01 TYPICAL ROADWAY SECTION - CROWNED ROADWAY

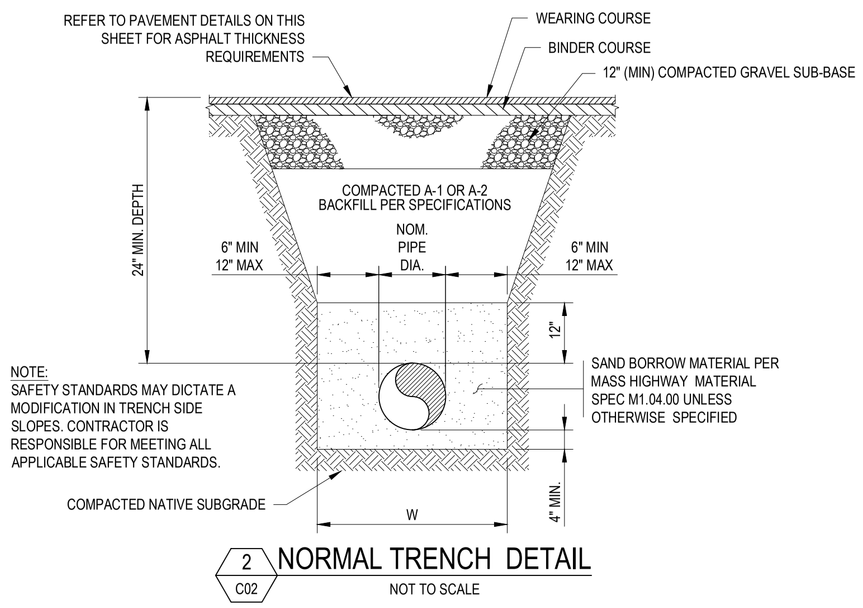
NOT TO SCALE



NOTES:
1. EXISTING BITUMINOUS PAVEMENT SHALL BE REMOVED TO A CLEAN STRAIGHT EDGE VIA SAW CUTTING. THE SAW CUT SHALL BE COMPLETED PERPENDICULAR TO THE ROADWAY/SIDEWALK.
2. PRIOR TO INSTALLING THE WEARING COURSE THE EXISTING VERTICAL PAVEMENT SURFACE SHALL BE SWEPT COMPLETELY CLEAN.
3. AFTER PROPER COMPACTION (SEE PAVEMENT DETAILS ON THIS SHEET) SAW CUT NEW PAVEMENT ABUTMENT 3/4" DEEP AND FILL WITH FIBER MODIFIED ASPHALT SEALER AS SHOWN.

1 C01 SURFACE RESTORATION DETAIL
PAVEMENT PATCH

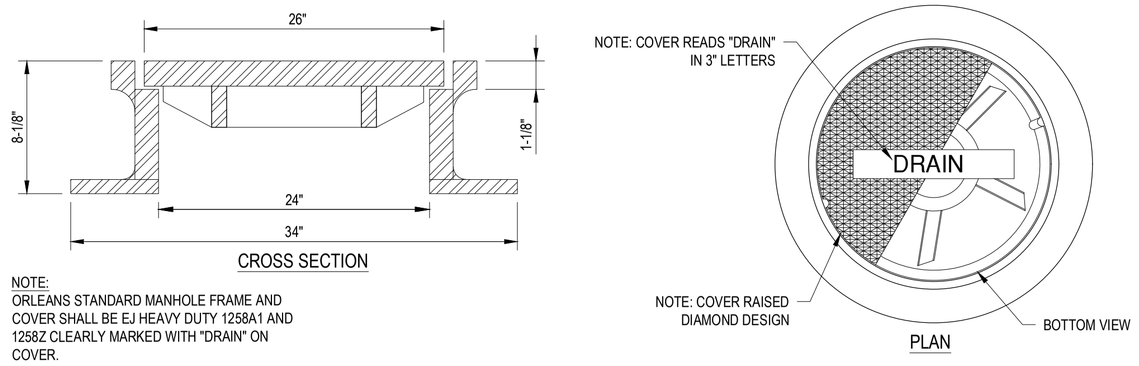
NOT TO SCALE



NOTE:
SAFETY STANDARDS MAY DICTATE A MODIFICATION IN TRENCH SIDE SLOPES. CONTRACTOR IS RESPONSIBLE FOR MEETING ALL APPLICABLE SAFETY STANDARDS.

2 C02 NORMAL TRENCH DETAIL

NOT TO SCALE



NOTE:
ORLEANS STANDARD MANHOLE FRAME AND COVER SHALL BE EJ HEAVY DUTY 1258A1 AND 1258Z CLEARLY MARKED WITH "DRAIN" ON COVER.

5 C01 STANDARD MANHOLE FRAME AND COVER DETAIL

NOT TO SCALE

NOT FOR CONSTRUCTION

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	FOR REVIEW		JWB	RHK	MRD	1/19

0 5 10 15 20'
SCALE 1"=10' AT ORIGINAL SIZE

NOTES: UNDERGROUND FACILITIES, STRUCTURES, AND UTILITIES HAVE BEEN PLOTTED FROM AVAILABLE SURVEYS AND RECORDS, AND THEREFORE THEIR LOCATIONS MUST BE CONSIDERED APPROXIMATE ONLY. THERE MAY BE OTHERS, THE EXISTENCE OF WHICH IS PRESENTLY NOT KNOWN. ANYONE USING UTILITY INFORMATION AND DATA PROVIDED HEREIN SHALL CALL DIG SAFE AT 811 SEVENTY TWO (72) HOURS, 3 BUSINESS DAYS IN ADVANCE TO VERIFY THE LOCATION OF UTILITIES PRIOR TO START OF CONSTRUCTION.

GHD Inc.
1545 Iyannough Road, Hyannis Massachusetts 02601 USA
T 1 774 470 1630 **F** 1 774 470 1631
E hyamail@ghd.com **W** www.ghd.com

Drawn JWB		Designer JWB	
Drafting Check RHK		Design Check RHK	
Approved (Project Director)			
Date			
Scale AS SHOWN	This Drawing shall not be used for Construction unless Signed and Sealed For Construction		

Client TOWN OF ORLEANS, MA
Project LOCUST ROAD STORMWATER IMPROVEMENTS
Title #46 LOCUST ROAD SITE PLAN AND DETAILS
Contract No.
Original Size Arch D
Drawing No: 111-86085-C01
Rev: A

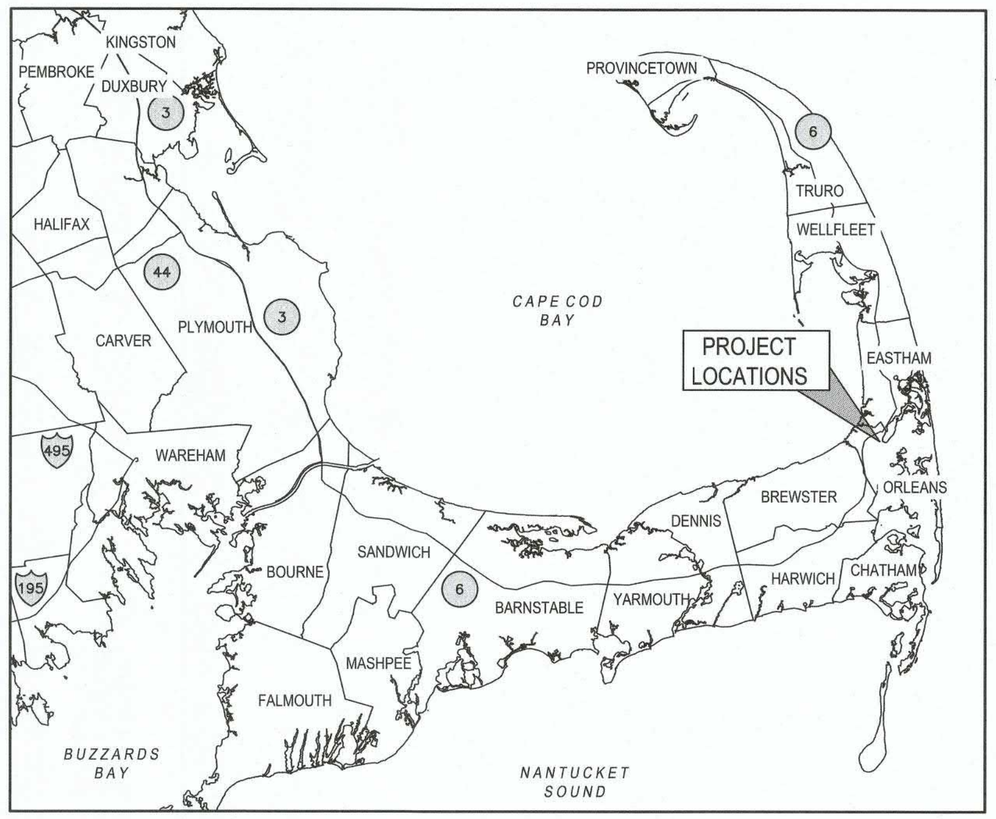
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Cad File No: G:\111\11186085 Town of Orleans Auth 42 Locust Road Final Design - Bidding - Const\CADD\Drawings\Civil\111-86085-C01.dwg

TOWN OF ORLEANS, MASSACHUSETTS
LOCUST ROAD AND BREWSTER CROSS ROAD STORMWATER IMPROVEMENTS

SEPTEMBER 2019

DRAWING LIST

DRG No.	DRAWING TITLE
111-86065-G01	COVER SHEET, DRAWING LIST, VICINITY, AND LOCATION MAPS
111-86065-C01	LOCUST ROAD - SITE PLAN AND DETAILS
111-86065-C02	BREWSTER CROSS ROAD - SITE PLAN AND DETAILS



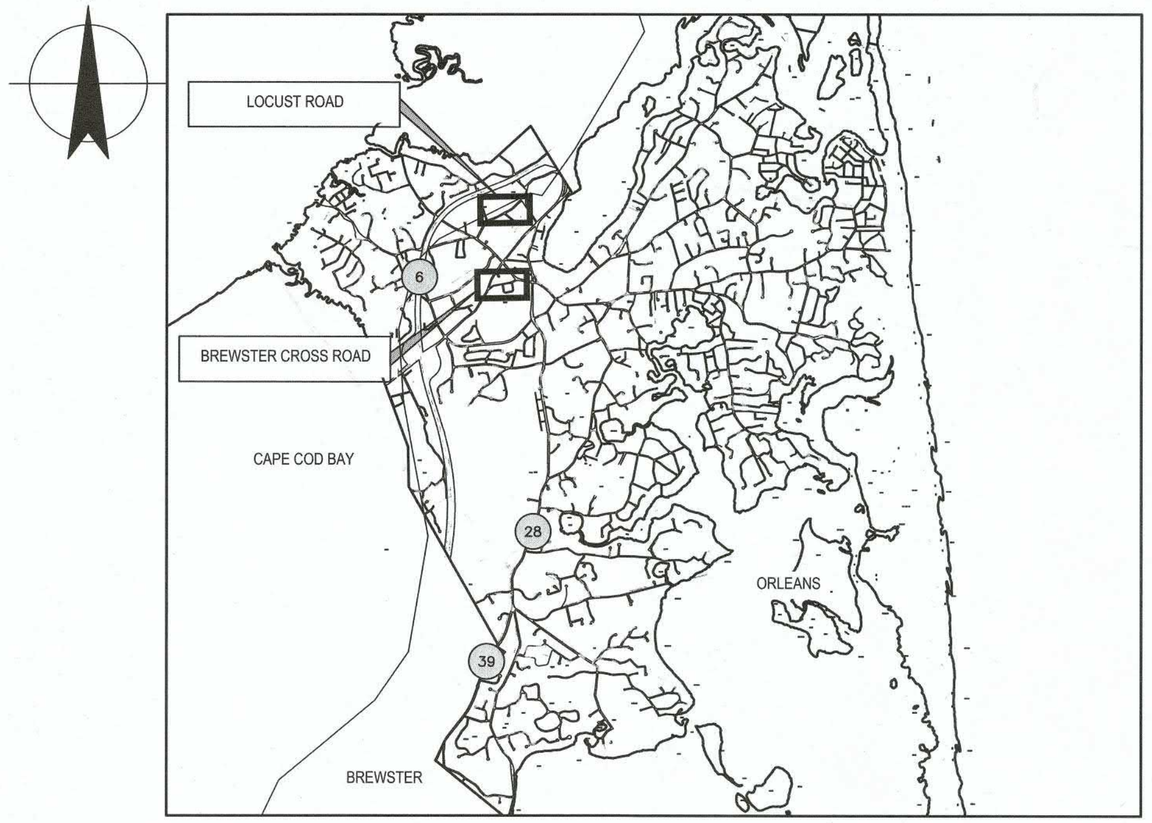
VICINITY MAP
NOT TO SCALE

TOWN PERSONNEL

TOWN ADMINISTRATOR
JOHN KELLY

DEPARTMENT OF PUBLIC WORKS AND NATURAL RESOURCES DIRECTOR
TOM DALEY, P.E.

DEPARTMENT OF PUBLIC WORKS OPERATIONS MANAGER
RON TRUDEAU



LOCATION MAP
NOT TO SCALE

0

No.	Issue	Drawn	Approved	Date
0	FOR CONSTRUCTION	JWB	MRD	9/20/19

Bar is one inch on original size sheet
0 1"

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COMMONWEALTH OF MASSACHUSETTS
MARC DRAINVILLE
ENVIRONMENTAL
No. 43294
REGISTERED
PROFESSIONAL ENGINEER
9/20/19

GHD Inc.
1545 Iyannough Road
Hyannis MA 02601 USA
T 1 774 470 1630 F 1 774 470 1631 W www.ghd.com

This document shall not be used for construction unless signed and sealed for construction.

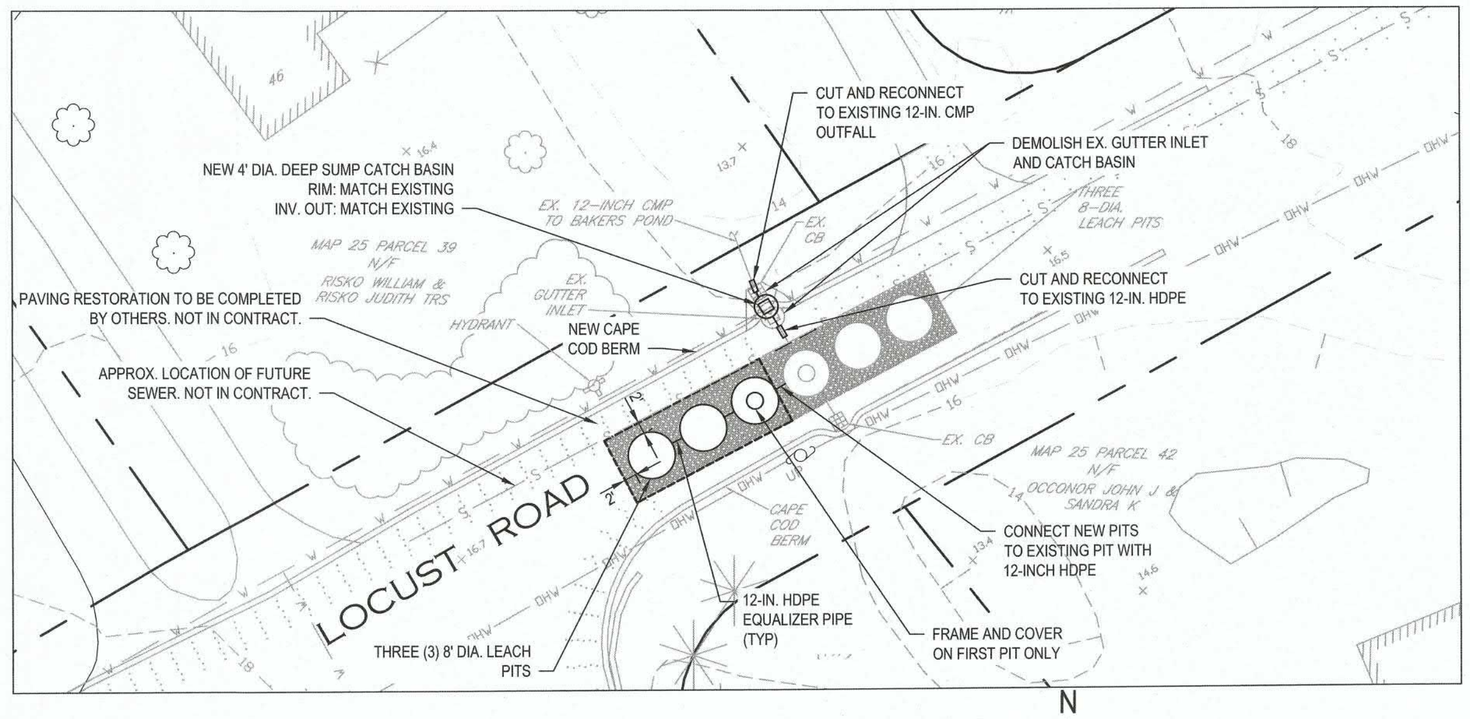
Drawn	JWB	Designer	JWB
Drafting Check	RHK	Design Check	RHK
Project Manager	RHK	Date	9/20/19
		Scale	AS SHOWN

Client TOWN OF ORLEANS, MA
Project LOCUST ROAD AND BREWSTER CROSS ROAD
Title COVER SHEET, DRAWING LIST, VICINITY, AND LOCATION MAPS
Project No. 111-86085
Original Size ANSI D
Sheet No. 111-86085-G01
Sheet 1 of 3

Plot Date: 19 September 2019 - 5:42 PM
Plotted By: Craig Curtin
Filename: G:\111\111186085 Town of Orleans Auth 42 Locust Road Final Design - Bidding - Const\CADD\Drawings\General\111-86085-G01.dwg

LEGEND

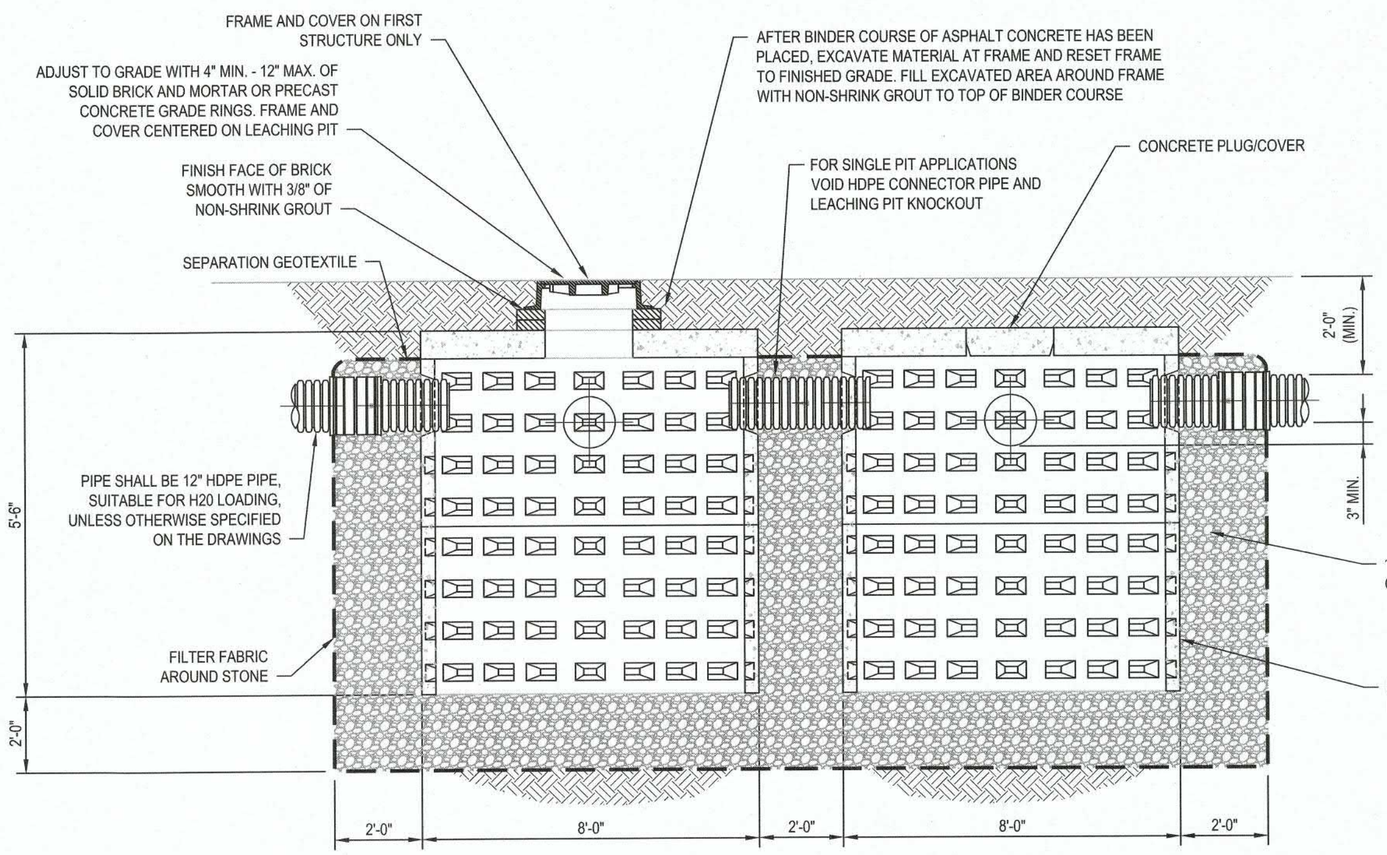
FOR EXISTING CONDITIONS		FOR PROPOSED CONDITIONS	
W W	UNDERGROUND WATER-MAIN	SF SF SF SF	SILT FENCE/HAYBALE LIMIT
X X	6' HIGH CHAIN LINK FENCE	LOW	LIMITS OF WORK
	EDGE OF PAVEMENT		LIMITS OF NEW ASPHALT PAVING
OHW OHW	OVERHEAD WIRES		FILTER FABRIC
9	MINOR CONTOURS		DRAIN PIPING
10	MAJOR CONTOURS		
	UTILITY POLE		



#46 LOCUST ROAD - SITE PLAN

SCALE: 1" = 20'

NOTE:
1. CONTRACTOR TO SET EQUALIZER PIPES (BETWEEN PITS) LEVEL AND SHALL HAVE INVERTS THAT MATCH THE EXISTING EQUALIZER PIPE INVERTS.

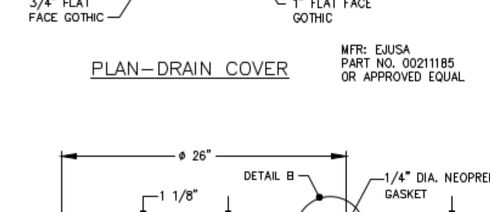


1 C01 **8' DIA MULTIPLE PRECAST CONCRETE LEACHING PIT**

NOT TO SCALE

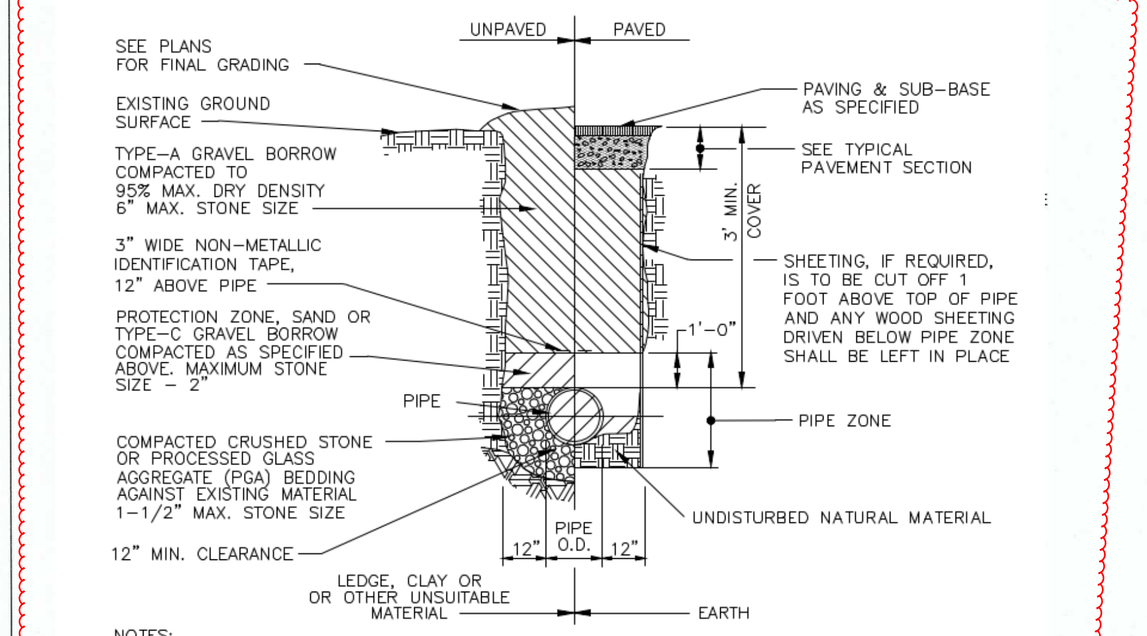
PRECAST CONCRETE NOTES:

1. CONCRETE MINIMUM STRENGTH SHALL BE 4,000 PSI @ 28 DAYS.
2. STEEL REINFORCEMENT: AS-615, GRADE 60.
3. DESIGN LOADING: AASHO-HS-20.



3 C01 **LOAM AND SEED-SECTION**

NOT TO SCALE



NOTES:

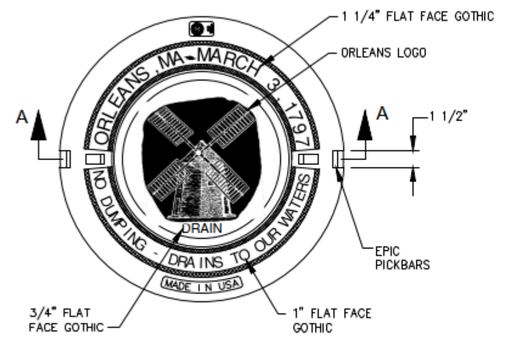
1. GRAVEL BORROW SHALL CONFORM TO MASS HIGHWAY SPECIFICATION M1.03.0
2. CRUSHED STONE BEDDING SHALL CONFORM TO MASS HIGHWAY SPECIFICATION M2.01.1

ADD 1.

TYPICAL H.D.P.E. DRAIN TRENCH DETAIL

NOT TO SCALE

ADD 1.

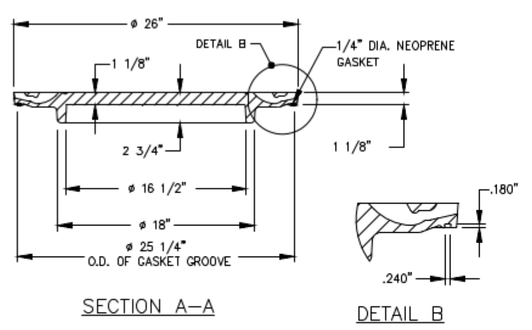


PLAN-DRAIN COVER

MFR: EJUSA PART NO. 00211185 OR APPROVED EQUAL

PLAN-SEWER COVER

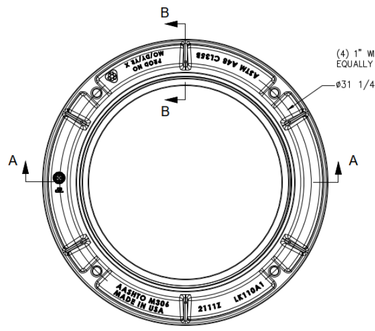
MFR: EJUSA PART NO. 00211186 OR APPROVED EQUAL



SECTION A-A

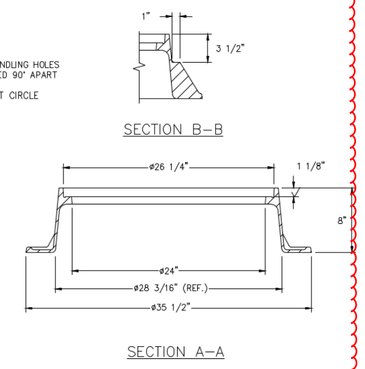
DETAIL B





ORLEANS STANDARD MANHOLE FRAME

(NOT TO SCALE)



MFR: EJUSA PART NO. 00211111 OR APPROVED EQUAL

ORLEANS STANDARD DRAIN AND SEWER MANHOLE COVER

(NOT TO SCALE)

No.	Issue	Drawn	Approved	Date
0	FOR CONSTRUCTION	JWB	MMD	9/20/19

SCALE 1"=20' AT ORIGINAL SIZE

Bar is one inch on original size sheet

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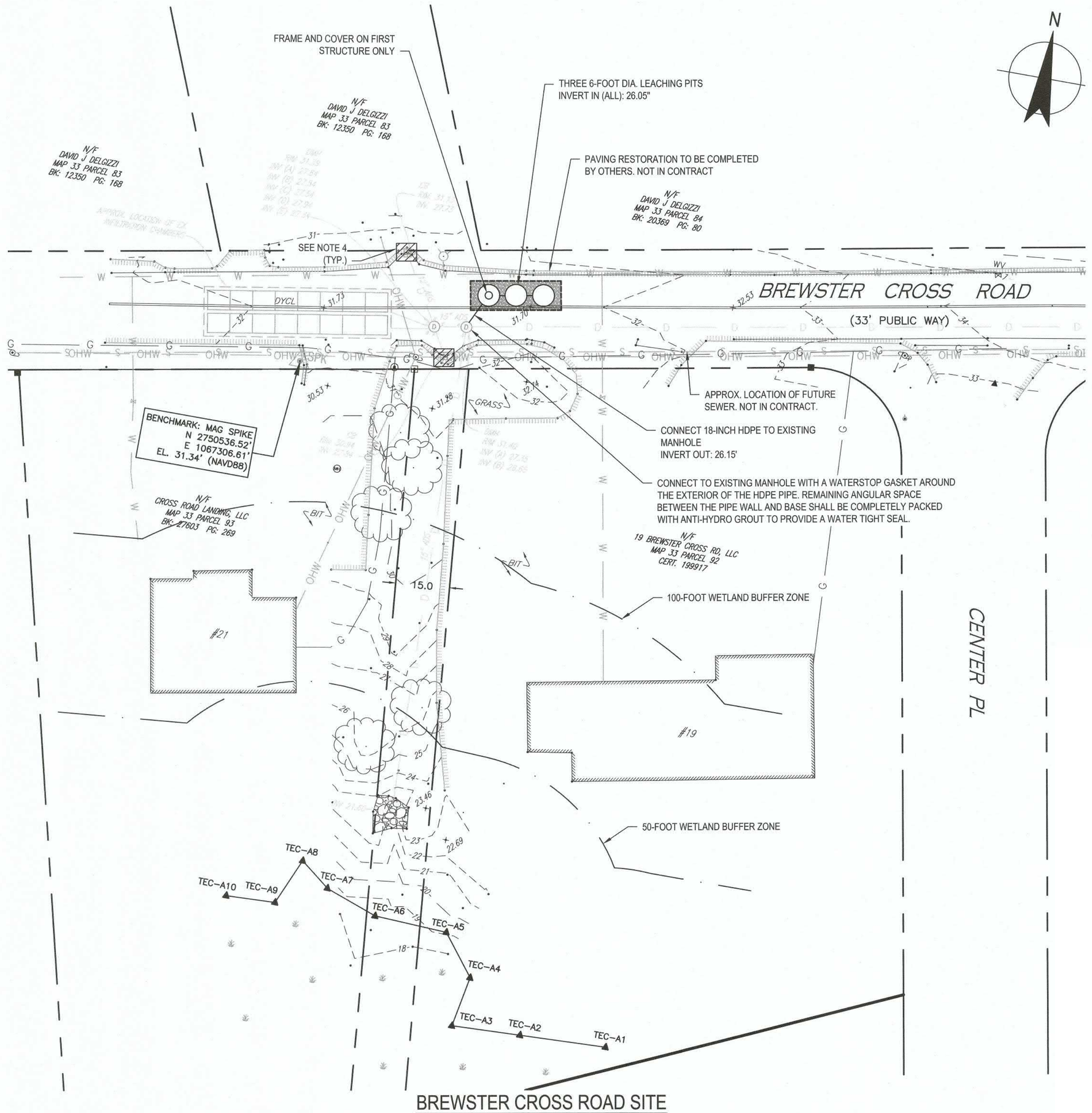
COMMONWEALTH OF MASSACHUSETTS MARC DRAINVILLE ENVIRONMENTAL No. 43294 REGISTERED PROFESSIONAL ENGINEER 9/20/19

GHD Inc.
1545 Iyannough Road
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Drawn	JWB	Designer	JWB
Drafting Check	RHK	Design Check	RHK
Project Manager	RHK	Date	9/20/19
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Client: TOWN OF ORLEANS, MA
Project: LOCUST ROAD AND BREWSTER CROSS ROAD
Title: LOCUST ROAD - SITE PLAN AND DETAILS
Project No. 111-86085
Original Size ANSI D
Sheet No. 111-86085-C01
Sheet 2 of 3

Plot Date: 20 September 2019 - 7:46 AM Plotted By: Craig Curtin Filename: G:\111\11186085 Town of Orleans Auth 42 Locust Road Final Design - Bidding - Const\CADD\Drawings\Civil\111-86085-C01.dwg

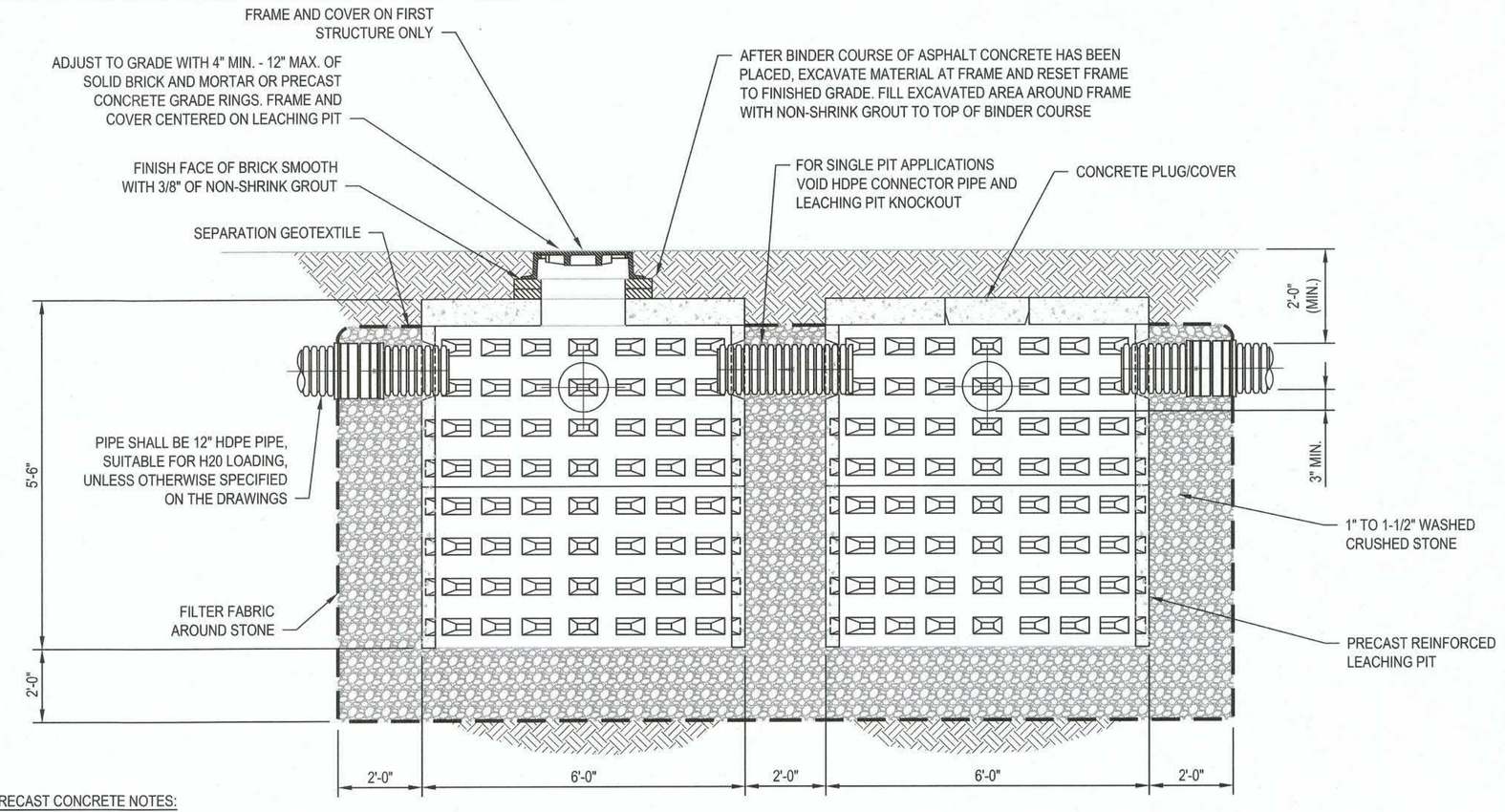


BREWSTER CROSS ROAD SITE PLAN - PROPOSED

SCALE: 1" = 20'

NOTES:

1. WETLAND DELINEATION PERFORMED BY GREEN SEAL ENVIRONMENTAL, INC. ON OCTOBER 2, 2017.
2. FUTURE SEWER ALIGNMENT BASED ON 90% PRELIMINARY DESIGN REPORT PROVIDED BY TOWN.
3. CONTRACTOR SHALL TEMPORARILY PLUG EXISTING 15-INCH DISCHARGE PIPE (IN DRAIN MANHOLE) DURING CONSTRUCTION TO ELIMINATE TRANSPORT OF SEDIMENT TO POND.
4. CONTRACTOR SHALL CLEAN (REMOVE SEDIMENT, LEAVES, AND DEBRIS) CATCH BASINS. CATCH BASINS SHALL HAVE FILTER BAGS INSTALLED FOR THE DURATION OF CONSTRUCTION.



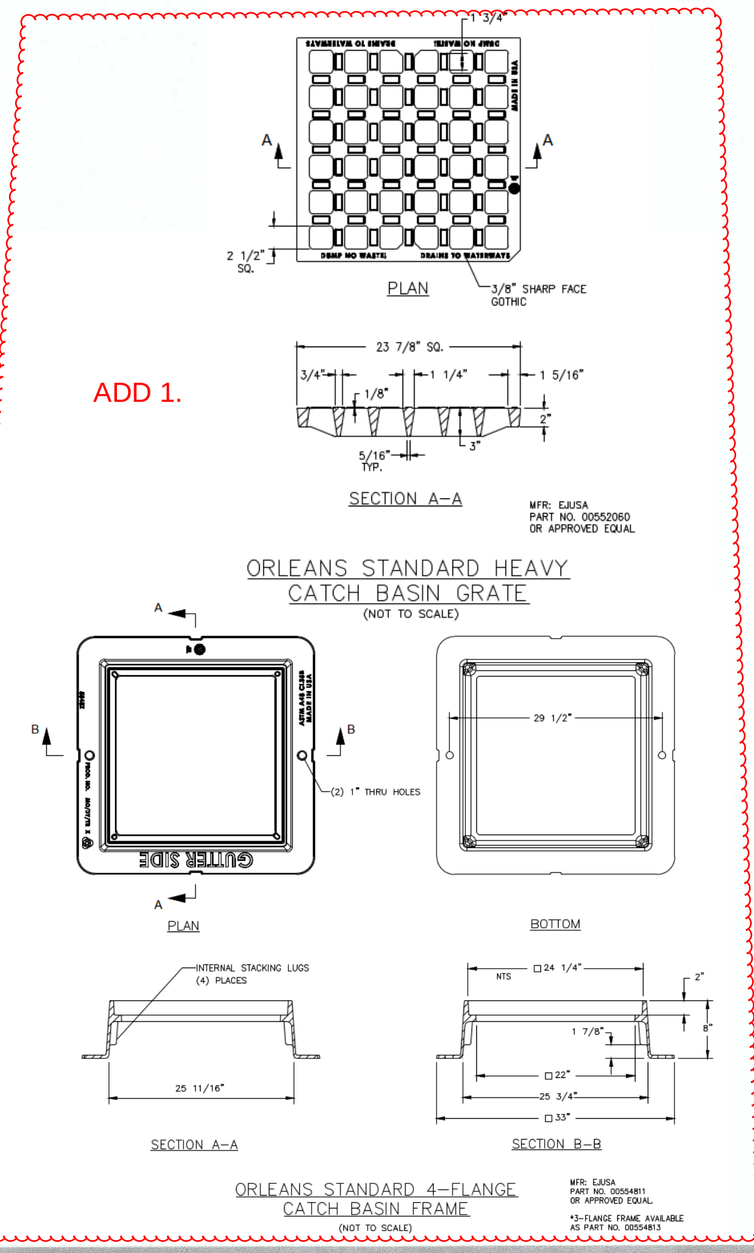
PRECAST CONCRETE NOTES:

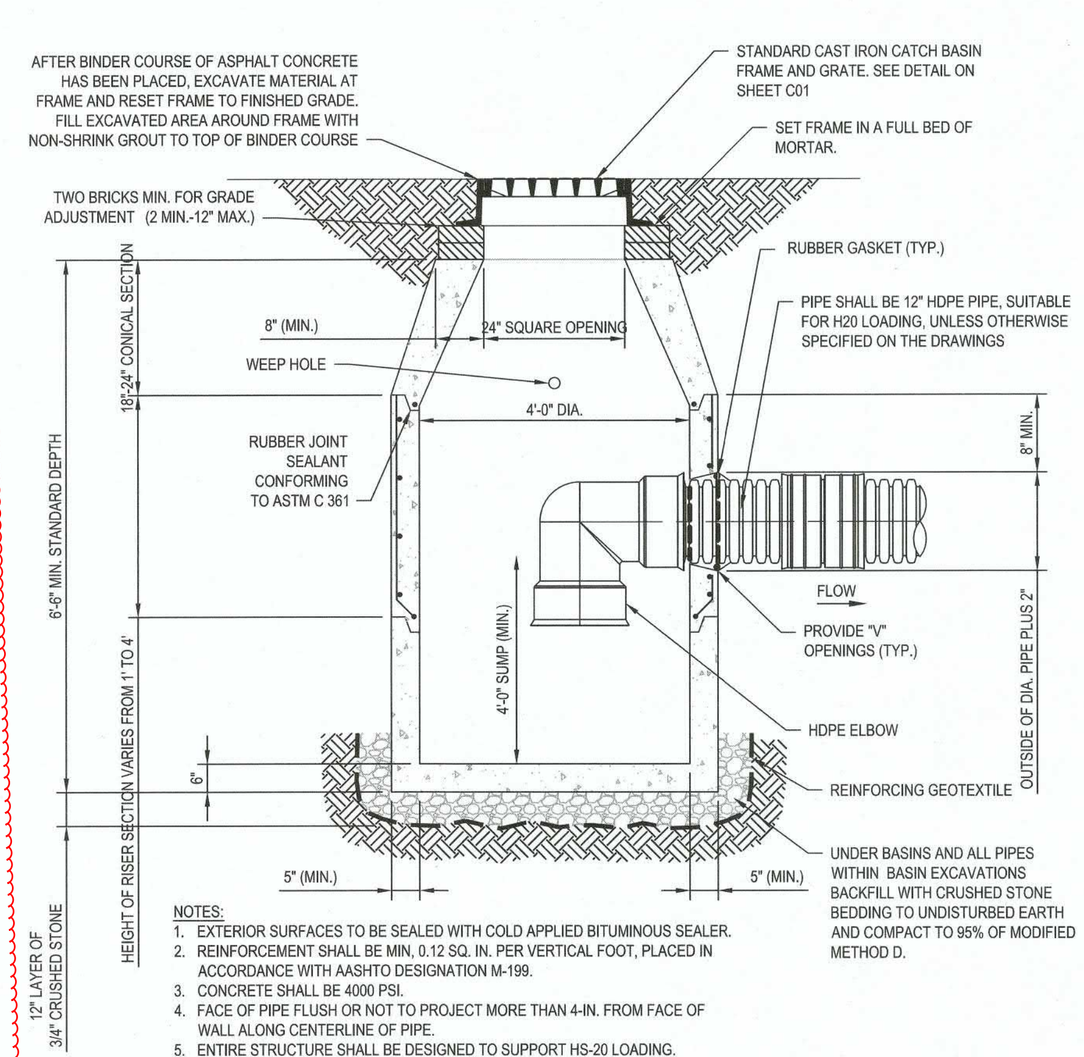
1. CONCRETE MINIMUM STRENGTH SHALL BE 4,000 PSI @ 28 DAYS.
2. STEEL REINFORCEMENT: AS-615, GRADE 60.
3. DESIGN LOADING: AASHO-HS-20.

1 / C02 — 6' DIA MULTIPLE PRECAST CONCRETE LEACHING PIT

NOT TO SCALE

ADD 1.





NOTES:

1. EXTERIOR SURFACES TO BE SEALED WITH COLD APPLIED BITUMINOUS SEALER.
2. REINFORCEMENT SHALL BE MIN. 0.12 SQ. IN. PER VERTICAL FOOT, PLACED IN ACCORDANCE WITH AASHTO DESIGNATION M-199.
3. CONCRETE SHALL BE 4000 PSI.
4. FACE OF PIPE FLUSH OR NOT TO PROJECT MORE THAN 4-IN. FROM FACE OF WALL ALONG CENTERLINE OF PIPE.
5. ENTIRE STRUCTURE SHALL BE DESIGNED TO SUPPORT HS-20 LOADING.
6. ALL CATCH BASINS SHALL MEET THE REQUIREMENTS OF THE TOWN OF ORLEANS DEPARTMENT OF PUBLIC WORKS. ANY CATCH BASINS INSTALLED ADJACENT TO GRANITE CURBING MUST RECEIVE GRANITE THROAT STONES.

3 / C02 — STANDARD PRECAST CONCRETE CATCH BASIN DETAIL

NOT TO SCALE

0

No.	Issue	Drawn	Approved	Date
0	FOR CONSTRUCTION	JWB	MM	9/20/19

SCALE 1"=20' AT ORIGINAL SIZE

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0 1"

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COMMONWEALTH OF MASSACHUSETTS MARC DRAINVILLE ENVIRONMENTAL No. 43294 REGISTERED PROFESSIONAL ENGINEER 9/20/19

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Drawn	JWB	Designer	JWB
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Client: TOWN OF ORLEANS, MA
Project: LOCUST ROAD AND BREWSTER CROSS ROAD
Title: BREWSTER CROSS ROAD - SITE PLAN AND DETAILS
Project No. 111-86085
Original Size: ANSI D
Sheet No. 111-86085-C02
Sheet 3 of 3

Plot Date: 19 September 2019 - 5:43 PM Plotted By: Craig Curtin Filename: G:\111\11144280 Town of Orleans Uncle Harvey and Boland Pond SWImprovements\CADD\Drawings\Civil\111-44280-C002.dwg

SECTION 02110

SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of surface debris, rubbish, snow, and water without unnecessary excavation of topsoil and subsoil.

B. Removal of paving.

C. Removal of stumps and root system of trees and shrubs.

D. Disposal of excess materials, trash, and debris.

E. Topsoil excavation and stockpile reusable topsoil for later use.

1.02 RELATED SECTIONS

A. Section 01500 - TEMPORARY FACILITIES

B. Section 02112 - PAVEMENT CUTTING

1.03 REGULATORY AND DISPOSAL REQUIREMENTS

A. Coordinate clearing Work with utility companies.

B. Conform to applicable local, state, and federal codes for environmental requirements and disposal of debris.

C. Make all arrangements for disposal sites, unless the Owner designates special locations. All expenses for disposal shall be borne by the Contractor. Bidders shall carefully investigate all aspects of surplus material disposing operations.

D. Prior to depositing surplus material at any off-site location, obtain a written agreement between Contractor and the owner of the property on which the disposal of the material is proposed. The agreement shall state that the owner of the property gives permission for the Contractor to enter and deposit material of a particular classification on the owner's property at no expense to the project Owner, and shall include any other conditions pertinent to the situation as agreed upon by each party. A copy of said agreement shall be furnished to the Owner.

PART 2 PRODUCTS

2.01 MATERIALS

Not used.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that existing plant life designated to remain is tagged or identified.

B. Mark limits of clearing by flagging, fencing, or other approved methods.

C. Vehicles used to haul soft or wet material over streets or pavements shall be sufficiently watertight to prevent deposits on the streets or pavements. In all cases where any materials are dropped from the vehicles of the Contractor, he shall clean up the same, and keep the crosswalks, street, and pavements clean and free from debris.

D. Identify on-site waste or salvage areas for placing removed materials.

3.02 PROTECTION

A. Locate, identify, and protect existing utilities that are to remain, including notification of “Dig Safe” (1-888-344-7233).

B. Protect benchmarks, survey control points, and existing structures from damage or displacement.

3.03 CLEARING

A. Clear areas required for access to Site and execution of Work.

B. Partially remove paving as indicated. Neatly saw cut edges at right angle to surface.

C. Remove trees and shrubs within marked areas indicated. Remove stumps, main root ball, and surface rocks.

3.04 DISPOSAL OF MATERIAL

A. All material shall be treated as surplus material and disposed of off-site in a legal manner per Article 1.03.

END OF SECTION

SECTION 02112

PAVEMENT CUTTING

PART 1 GENERAL

1.01. SECTION INCLUDES

A. Pavement cutting.

B. Pavement scoring.

C. Pavement (concrete) breaking.

D. Pavement grinding.

E. Pavement removal and disposal.

1.02. REFERENCES

A. Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges, including all applicable supplements.

1.03. RELATED SECTIONS

A. Section 01500 – TEMPORARY FACILITIES

B. Section 02225 - TRENCHING

1.04. REGULATORY REQUIREMENTS

A. Coordinate pavement cutting with utility companies.

B. Conform to applicable local, state, and MassDOT codes and regulations for legal disposal of pavement materials.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.01. PREPARATION

A. Notify local officials, Fire, and Police Departments of streets to be blocked off, detours, or restrictions to maintaining of traffic on a daily basis.

B. Set up barricades, warning signs, and traffic direction information prior to start of pavement cutting. See Section 01500.

3.02. PAVEMENT CUTTING AND BREAKING

A. Pavements covering those areas to be excavated shall be broken up, removed, and then disposed of in accordance with Article 1.04 above. All paved areas shall be first cut or scored continuously along a straight line, parallel to and on each side of the centerline of the trench or excavation, at a width sufficient for the trench excavation or structure excavation.

B. Pavement cuts in concrete pavement or pavement with a concrete base shall be made by scoring or cutting the concrete with a concrete saw. The depth of the saw cut shall be a minimum of one-third the concrete pavement thickness. Before excavation, the concrete pavement shall then be broken up with hand operated, pneumatic paving breakers, or mechanical drop hammers designed for such purpose, providing they may be used without endangering existing utilities or causing undesirable vibrations. “Headache balls” will not be permitted for breaking up concrete pavement.

C. Pavements cuts in bituminous pavement shall be made by scoring or cutting the pavement with a concrete saw, wheel cutter, pneumatic paving breaker, or drop hammer type pavement cutter. The pavement cut must be continuous, and made for the full depth of the pavement.

D. Pavement cuts in driveways shall be made in a straight alignment perpendicular or parallel to the driveway and for its full width.

E. Pavement cuts in parking areas shall be made in a straight alignment parallel to the centerline of trench.

3.03. PAVEMENT GRINDING/MILLING

A. Where shown on the Contract Drawings, the Contractor shall remove a portion of an existing pavement including Portland cement concrete pavement, asphalt Portland cement concrete pavement base course, to the limits and profile specified by grinding, milling, or planing methods. This process shall yield a base upon which a final pavement course will be applied. The Contractor shall employ equipment especially designed and manufactured for the grinding, milling, or planing of pavements.

B. The resulting ground, milled, or planed surfaced shall be thoroughly cleaned and free from dust, loose pavement material, or other material. The surface shall be free from gouges, large cracks, and unsound, soft, or broken-up areas. Gouges from lack of proper control of the grinding, milling, or planing machine shall be made level and true by the use of a trueing and leveling course of asphalt concrete if allowed by the Engineer. Cracks greater than 1/4-inch shall be cleaned and filled in accordance with MassDOT requirements. Unsound, soft, or broken-up areas shall be excavated and repaired to the satisfaction of the Owner.

END OF SECTION

SECTION 02141

REMOVAL OF WATER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Providing equipment, materials, and labor required to successfully complete the work included in this Section.

B. Maintaining and operating pumps and related equipment, including standby equipment, of sufficient capacity to adequately perform dewatering as required by this Section.

C. Lowering the groundwater table elevation.

D. Intercepting seepage from excavation slopes.

E. Controlling groundwater flow that may adversely affect excavation or construction activities.

F. Collecting, removing, and disposing of excess groundwater.

G. Removing and/or disposing of spoil, excess materials, equipment, trash, and debris used for or resulting from the work included in this Section.

1.02 RELATED SECTIONS

A. Refer to Article 4 of the General Conditions for identification of subsurface investigations.

B. Section 01026 - LUMP SUM ITEMS: Requirements applicable to Lump Sum Prices for the Works of this Section.

C. Section 01500 - TEMPORARY FACILITIES

D. Section 01564 - EROSION CONTROLS

E. Section 02222 - EXCAVATING

F. Section 02225 - TRENCHING

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable local and state codes for legal disposal of water.

B. Temporary water supplies shall meet requirements of local, state, and federal regulatory agencies.

C. Conform to applicable OSHA standards.

1.04 DEWATERING PLAN

A. Contractor shall prepare a Dewatering Plan outlining and addressing the Contractor’s approach to dewatering the project site, if required, in support of his construction activities.

B. The Dewatering Plan shall include:

1. Proposed dewatering technique for each site and situation (well points, trench sumps, etc.).

2. Volume of water to be managed by the dewatering system.

3. Dewatering equipment type and size.

4. Proposed treatment of water.

5. Dewatering system backup plan.

6. Method for disposal of water.

C. The Dewatering Plan shall be sealed by a Professional Engineer registered in the Commonwealth of Massachusetts.

D. The Dewatering Plan shall be submitted for review and comment a minimum of three weeks prior to excavation or trenching in an area requiring dewatering. Review comments by Owner and Engineer concerning the proposed plan shall not relieve Contractor of his responsibilities for dewatering his excavations in conformance with this Section of the Specifications and as necessary to complete his work. Contractor shall not proceed with construction in any area until the Dewatering Plan has been reviewed and comments provided.

PART 2 PRODUCTS AND MATERIALS

Not Used.

PART 3 EXECUTION

3.01 PREPARATION

A. Review the subsurface investigation data and conduct appropriate investigations to become familiar with the groundwater conditions at the sites. Allocate sufficient time and use appropriate procedures based on these conditions for dewatering excavations.

B. Examine adjacent structures and utilities, both existing and under construction, for possible settlement, movement or other adverse effects resulting from dewatering methods or water removal. Take necessary precautionary steps to protect such structures and utilities. Provide to Engineer a listing of structures which the Contractor deems will require protective measures along with the planned protective measures.

C. Should the drawdown of groundwater levels by removal or dewatering systems reduce or disrupt public or private water supplies, the Contractor shall be prepared to:

1. Provide adequate potable water, at a level acceptable to the Engineer, to the owners or users of the affected water supplies until groundwater levels have recovered, so as to sufficiently provide water supplies equal to that which existed prior to construction.

2. Provide documentation to the Engineer to confirm that temporary water supplies meet the requirements of Local, State, and Federal Regulatory Agencies.

3.02 REMOVAL OF WATER

A. Contractor shall at all times provide and maintain ample means and equipment with which to remove and properly dispose of water entering the excavation or other parts of the Work, and shall keep all excavations dry until such time as structures are placed and backfilled and/or piping is placed and backfilled.

B. Assume responsibility for site, surface, and subsurface drainage. Maintain such drainage as specified herein during the life of the contract.

C. Maintain groundwater in or below the bearing strata at a safe level at all times by methods which prevent loss of fines, which preserves the undisturbed state of subgrade soils and which sufficiently lowers the groundwater level in permeable strata at or below excavation and fill levels such that blowing or unstable conditions do not develop in the bottom or sides of excavation or fill areas.

D. Protect all adjacent structures, existing and under construction, from settlement, flotation, damage, or other adverse effects resulting from water removal or dewatering methods.

E. Install all drains, ditching, sluiceways, pumping and bailing equipment, wicking, sumps, wells, well points, cutoff trenches, curtains, sheeting and all other equipment and structures necessary to create and maintain a dry excavation and a groundwater level at a minimum of 2 feet below excavation subgrades for structures, or 1 foot below the bottom of trench for pipe installations.

   1. As part of any dewatering system, observation wells or piezometers shall be provided and installed, as required, to effectively and efficiently monitor drawdown to required levels.

F. Discharge water removed from the site to natural water courses, storm drains, or channels.

   1. Large quantities of water shall not be discharged as overland flow. Overland flow is not permitted onto private property.

   2. All discharged water shall be filtered to minimize the amount of sediment ultimately discharged to natural waterways.

   3. Direct discharge to natural waterways is discouraged. Discharge to storm drain systems or drainage channels is preferred. Limit discharge volume to the capacity of the receiving storm drain system or drainage channel.

   4. If discharge to a natural water body is proposed, energy dissipation shall be employed.

   5. No water shall be discharged to sanitary sewers.

G. Construct surface water control measures, including dikes, ditches, sumps, and other methods to prevent flow of surface water into excavation.

H. Dewatering operations shall cease when all foundations, structures, pipe installations, and other excavated areas have been properly backfilled and compacted, and are safe from damage, flotation, settlement, and displacement.

3.03 EXTERNAL DEWATERING SYSTEMS

A. Where required as determined by the Contractor's Professional Engineer, an external dewatering system shall be placed. An external dewatering system is defined as a system which dewaters an area to be excavated from outside of the trench or excavation. An example is a well-point system. The external dewatering system will be placed parallel to a gravity sewer, force main, or low pressure sewer trench; or outside of an excavation for an underground structure; and at an elevation deeper than the bottom of the trench or excavation.

B. An external dewatering system shall be considered successful if it dewaters the excavation or trench to the elevation described in Paragraph 3.02.E. There shall be no observable standing water at the bottom of the excavation or trench, and no more than 5 gallons per minute per foot of trench / excavation of water entering into the trench/excavation through the trench / excavation walls.

C. If the dewatering system is not successful (or fails), the Contractor shall design another dewatering system at no additional cost to the Owner.

D. For external dewatering systems installed for Work associated with construction of either of the stormwater systems, the cost of the system shall be included in the lump sum price established for the respective Bid Item.

3.04 INTERNAL DEWATERING SYSTEMS

A. An internal dewatering system is one that relies on removal of water from within the trench or excavation; for example sumps placed in the bottom of the trench whether placed in a stone or gravel sump or at the low end of the trench.

B. The same dewatering standards apply to internal dewatering systems as to external dewatering systems.

C. For internal dewatering systems installed for Work associated with the construction of either of the stormwater systems, the cost of the system shall be included in the lump sum price established for the respective Bid Item.

D. The cost for internal dewatering systems associated with trenched construction shall be included in the price of the pipe or facility being installed.

3.05 MAINTENANCE

A. Operate and maintain dewatering and removal operations on a 24-hour basis for the time required to complete that portion of the Work which requires dewatering prior to its construction and which requires protection from flotation or displacement of such Work until proper backfilling and compaction is completed.

3.06 REMOVAL

A. After groundwater levels have returned to elevations appropriate for conditions and time of year, without causing damage to the work, remove all dewatering equipment and related equipment from the site and restore site to original conditions or rehabilitate site to meet requirements of Contract Documents.

END OF SECTION

SECTION 02205

PROTECTION OF EXISTING FACILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Location of facilities.

B. Notification of owners and authorities.

C. Coordination and preparation.

D. Protection of facilities.

E. Relocation of facilities.

F. Protection of sewers and storm drains.

G. Protection of water mains near sewers.

H. Abandonment of utilities.

I. Restoration of property markers.

1.02 RELATED SECTIONS

A. Section 01010 – SUMMARY OF WORK

B. Section 01380 – CONSTRUCTION DOCUMENTATION: Construction photographs.

C. Section 02225 – TRENCHING

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.01 LOCATION OF FACILITIES

A. Prior to construction, verify location of existing underground facilities near or adjacent to project.

1. Consult with “Dig Safe” and owners of facilities not included in the Dig Safe program, and arrange for field stakeout or other marking to show locations.

2. Perform exploratory excavation at key junctures and other critical points to aid in ascertaining locations.

B. Report field stakeout findings and results of exploratory excavations to Engineer if possible changes in project location or design are indicated because of suspected interferences with existing facilities. Allow Engineer sufficient time to determine magnitude of changes and to formulate instructions in that regard.

C. If location of an existing underground facility is uncertain, apply careful excavation and probing techniques during construction to locate and avoid damage to same.

3.02 NOTIFICATIONS OF OWNERS AND AUTHORITIES

A. Prior to construction, notify owners of existing facilities, including local Police and Fire Departments, of general scope, nature, and planned progress schedule of the Work.

B. Notify owners of nearby underground facilities when excavating or blasting is to take place in a particular area, allowing them reasonable time to institute precautionary procedures or preventive measures which they deem necessary for protection of their facilities.

C. When existing utilities, such as sewer, water, gas, telephone, or electric power are damaged or disturbed during construction, immediately notify affected owner and project Owner.

D. Notify Police and Fire Departments, including affected owners, immediately if hazardous conditions are created or have the potential for occurring, as a result of damage to an existing facility or as a result of other activities at project site. Hazardous conditions could be created from: fire, explosion, escape of gas, escape of fuel oil, gasoline or industrial fluids, downed electrical wires, and disrupted underground electrical cables.

3.03 COORDINATION AND PREPARATION

A. Discuss anticipated work schedule with local authorities and owners of utilities at preconstruction meeting, including procedures to be followed if one or more utilities are damaged or disrupted. Develop contingency plans to address Contractor's role in repair of damaged utilities.

B. Make preparations beforehand to repair and restore damaged utilities, including arrangements for standby materials and equipment to be promptly assembled at site and utilized immediately.

C. Adjust work schedules and personnel assignments as necessary to conform with requirements of utility owner whose utility is to be temporarily interrupted during construction. Cooperate with utility owner in this regard to minimize the time of interruption.

D. Make preparations for and conform to applicable federal, state, and local regulations regarding use of proper safeguards and procedures when excavation and/or blasting is to take place in close proximity to existing facilities and structures.

3.04 PROTECTION OF FACILITIES

A. Plan and conduct construction operations so that operation of existing facilities near or adjacent to the Work, including electric, telephone, sewer, water, gas or drainage utilities, are sustained insofar as the requirements of the project will permit.

B. Protect existing facilities from damage or movement through installation of adequate support systems and use of proper equipment, including application of careful excavation and backfilling techniques in sensitive areas.

C. In locations where blasting is to take place, and in cooperation with owners of nearby facilities, provide special protection and support of underground facilities which may be vulnerable to damage by virtue of their physical location or condition, and which could create hazardous conditions if damaged.

D. Existing utilities and other facilities which are damaged by the Contractor's construction operations shall be promptly repaired by Contractor to the satisfaction of the affected owner or, if he so elects, that owner will perform the repairs with his own forces. Under either arrangement, such repair work shall be done at Contractor's expense.

E. When aboveground visible facilities such as poles, wires, cables, fences, signs or structures constitute an unavoidable interference, notify Engineer and consult with affected owner regarding temporary removal and later restoration of the interfering item. Arrange with that owner to remove and later restore the interfering item to the satisfaction of the owner, subject to approval of the project Owner; or, allow affected owner to perform such work with his own forces. Under either arrangement, such work shall be done at Contractor's expense. Mailboxes may only be moved by property owner, unless prior approval has been granted to the Contractor by said property owner.

F. Take all necessary precautions to prevent fires at or adjacent to the work, buildings, and other facilities. No burning of trash or debris is permitted. If permanent fire extinguishers are used, they shall be recharged and in "new" condition when turned over to Owner.

3.05 RELOCATION OF FACILITIES

A. If the location or position of an existing gas or water pipe, public or private sewer or drain, conduit or structure be such as, in the opinion of Engineer, to require its removal, realignment, or change, such alteration shall be without cost to the Contractor for the work of removal, realignment or change only.

B. Uncovering, supporting, and sustaining such facility before its removal or before and after its realignment or change, shall be the Contractor's responsibility as part of the work of his Contract.

C. Contractor shall be entitled to extension of time for completion of entire Work as the Engineer determines that the entire Work was delayed by the removal, realignment, or change of such obstruction.

3.06 PROTECTION OF SEWERS AND STORM DRAINS

A. Where existing sanitary sewers or storm drain systems are being replaced or interrupted, provide temporary bypass pumping or piping to maintain flow around that segment of the Work such that no back-ups occur in existing systems.

B. Existing sanitary sewer laterals damaged in the work or temporarily disconnected shall be restored to operation by the end of each work day. Existing sanitary sewer laterals crossing over new pipelines to be restored in accordance with details shown on the Drawings.

C. Maintain existing manholes, catch basins, and other utility structures in their pre-work condition. Any material or debris entering same due to the Contractor's operation shall be promptly removed.

3.07 PROTECTION OF WATER MAINS NEAR SEWERS

A. Where a minimum 10-foot horizontal separation or minimum 18-inch vertical separation (bottom of water pipe to top of sewer pipe) cannot be maintained between a water main and sewer line, one or more of the following remedies shall be incorporated in the work:

1. The sewer lines shall be encased in 4,000 psi mix concrete for a length of 10 feet on either side of the water main.

2. Both the water main and sewer line shall be constructed of pressure type joints of ductile iron pipe, and shall be pressure tested to 100 psi to assure water tightness.

3. One full length of water main shall be centered over the sewer line, so that both joints will be as far from the sewer as possible.

4. Relocate water main to obtain 18-inches minimum vertical separation.

3.08 ABANDONMENT OF UTILITIES

A. Remove existing utilities to be abandoned within limits of trench excavation, or impinging on trench limits.

B. Open ends of abandoned utilities, or those scheduled for abandonment, shall be bulkheaded by brick masonry or 4,000 psi mix concrete; or by cast iron plugs or caps in small diameter water mains.

C. Abandoned sewers 36-inch diameter or larger shall be completely filled with sand or gravel or other approved material prior to bulkheading the open end(s).

D. Abandoned manholes and water valve casings shall be backfilled to grade with approved trench backfill material.

E. Frames, covers, grates, water valve casing, sections of water piping, hydrants (including standpipe and boot) valves and other items to be abandoned shall, if ordered by Owner, be salvaged for reuse and be delivered to Owner’s property yard.

3.09 RESTORATION OF PROPERTY MARKERS

A. Property corner markers, boundary monuments, etc., disturbed, or moved by the Contractor’s operation shall be restored, in conformance with the property deed description, by a licensed land surveyor. Restoration of the property corner markers or boundary monuments shall be certified by said surveyor on a map prepared by him which shows the work accomplished. One copy of the map shall be given to the property owner and one copy given to the project owner.

END OF SECTION

SECTION 02222

EXCAVATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavation for building foundations.

B. Excavation for slabs-on-grade, paving, and landscaping.

C. Excavation for site structures.

1.02 RELATED SECTIONS

A. Section 01400 - QUALITY CONTROL: Inspection of bearing surfaces.

B. Section 01500 – TEMPORARY FACILITIES

C. Section 01564 – EROSION CONTROL

D. Section 02110 - SITE CLEARING: Topsoil excavation.

E. Section 02205 - PROTECTION OF EXISTING FACILITIES

F. Section 02225 - TRENCHING: Excavation and backfilling for underground utilities.

1.03 FIELD MEASUREMENTS

A. Verify that survey benchmark and intended elevations for the Work are as indicated.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum. Review subsurface report and other available site information.

B. Identify known underground, above ground, and aerial utilities. Stake and flag locations.

C. Notify utility company to remove and relocate utilities.

D. Protect above and below grade utilities which are to remain.

E. Protect plant life, lawns, and other features remaining as a portion of final landscaping.

F. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.

G. Excavations shall be in complete accordance with all details of applicable codes, rules, and regulations including all local, state, and federal regulations including the Occupational Safety and Health Administration (OSHA) Title 29 Code of Federal Regulations Part 1926, Subpart P - Excavations and Trenching Standards. Contractor shall designate a "Competent Person" [29 CFR 1926.32(f)] who shall be responsible for inspections of excavations on a daily basis and document and maintain daily trenching and excavation logs per OSHA 29 CFR 1926.

3.02 CLASSIFICATION OF EXCAVATED MATERIAL

A. Classifications of excavated materials are as follows:

1. Unclassified Excavation - "Unclassified excavation" shall include all material excavated within the authorized lines and grades prescribed in the Drawings. Unclassified excavation shall include "rock excavation" as well as "common excavation" as defined herein.

2. Common Excavation - "Common excavation" shall include all excavation except "rock excavation." All unconsolidated and non-indurated material, rippable rock, loose rock, soft mineral matter, weathered rock or saprolite, and soft or friable shale which is removable with normal earth excavation equipment shall be considered "common excavation." All boulders and detached pieces of solid rock or concrete or masonry less than 1 cubic yard in volume shall be classified as "common excavation."

3. Rock Excavation - "Rock excavation" shall include all sound solid masses, layers and ledges of consolidated and indurated rock or mineral matter of such hardness, durability and/or texture that it is not rippable or cannot be excavated with normal earth excavation equipment. Should a conflict arise as to the classification of excavation as either "common" or "rock," the following test shall be used in the appropriate determination:

   a. Where practicable, a late model tractor mounted hydraulic ripper equipped with a one digging point of standard manufacturer's design adequately sized for use with and propelled by a crawler-type tractor rated between 210 and 240 net fly-wheel horsepower, operating in low gear, shall be utilized. Should the suspect material not be effectively loosened or broken down by ripping in a single pass with the aforementioned ripper, the material shall be classified as "rock."

   b. In situations where interbedded strata of "common excavation" material and "rock excavation" material are encountered in the same excavation, the individual classification of those materials shall be made on an average percentage basis of the occurrence of those materials as measured in stratigraphic sections and as approved by the Engineer.

   c. When rock is encountered in excavations, it shall be removed by rock hammering, jackhammering, or any other method suitable and safe considering the proximity of existing utilities or facilities. No blasting shall be permitted.

4. For this project all excavated material shall be classified as unclassified excavation.

3.03 EXCAVATING

A. Underpin adjacent structures which may be damaged by excavation work, including utilities and pipe chases.

B. Excavate subsoil required to accommodate building foundations, slabs-on-grade, paving and site structures, and construction operations.

C. Excavate to working elevation for piling work. Coordinate special requirements for piling.

D. Machine-slope banks to angle which is safe for specific material in which excavation is made.

E. Excavation cut not to interfere with normal 45 degree bearing splay of foundation. Undercutting of excavation faces will not be permitted.

F. Grade top perimeter of excavation to prevent surface water from draining into excavation.

G. Hand trim excavation to required undisturbed subgrade. Remove loose matter.

H. Remove lumped subsoil, boulders, and rock under 1 cubic yard, measured by volume. Refill voids with Mix “C” concrete or compacted gravel/crushed stone.

I. Notify Engineer of unexpected subsurface conditions, or of questionable soils encountered at required subgrade elevations, and discontinue work in area until notified to resume operations.

J. Should the Contractor, through negligence or otherwise carry his excavation below the designated subgrade, Mix ”C” concrete or such other materials as may be approved by the Engineer, shall be furnished and placed as backfill in sufficient quantities to reestablish the designated subgrade surface. Granular material used for backfilling shall be spread and compacted in conformance with the requirements of Section 02228, and to the percentage compaction outlined therein. The cost of this refilling operation, including any tests associated therewith, shall be borne by Contractor.

K. Contractor shall segregate excavated on-site materials into three categories for storage – sand, topsoil, and other materials (brush, trees, etc.).

L. Contractor shall not store any excavated materials except sand in any current or future sand bed areas, except those sand beds being eliminated as part of this project.

3.04 DISPOSAL OF MATERIAL

A. All excavated material except reusable topsoil or reusable fill shall be classified as surplus material and disposed of off-site unless Owner designates an on-site location.

B. On-site disposal of surplus material will be allowed only at locations designated by Owner and approved by Engineer. Reuse of excavated material as on-site fill shall conform with Section 02228.

C. Make all arrangements for disposal sites, unless the Owner designates special locations. All expenses for disposal shall be borne by the Contractor. Bidders shall carefully investigate all aspects of surplus material disposing operations.

D. Prior to depositing surplus material at any off-site location, obtain a written agreement between Contractor and the owner of the property on which the disposal of the material is proposed. The agreement shall state that the owner of the property gives permission for the Contractor to enter and deposit material of a particular classification on the owner’s property

at no expense to the project Owner, and shall include any other conditions pertinent to the situation as agreed upon by each party. A copy of said agreement shall be furnished to the Owner.

3.05 FIELD QUALITY CONTROL

A. Contractor shall perform field inspections under provisions of Section 01400.

B. Provide for visual inspection of bearing surfaces.

3.06 PROTECTION

A. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

B. Protect bottom of excavations and soil adjacent to and beneath foundation, from freezing.

C. Exposed subgrade surfaces shall remain undisturbed, drained, and maintained as uniform, plane areas, shaped to receive the foundation components of the building or structure.

END OF SECTION

SECTION 02225

TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating trenches for utilities.

B. Pipe foundations and bedding.

C. Backfilling and compacting.

D. Materials.

1.02 RELATED SECTIONS

A. Section 01019 - CONTRACT CONSIDERATIONS

B. Section 01500 - TEMPORARY FACILITIES

C. Section 02110 - SITE CLEARING

D. Section 02112 - PAVEMENT CUTTING

E. Section 02205 - PROTECTION OF EXISTING FACILITIES

F. Section 02228 - COMPACTION

1.03 REFERENCES

Standard Material Specifications for gravel, sand, crushed stone and gravel-cement mixtures published by the Department of Transportation (DOT) of the State in which project is located	
ASTM C136	Sieve Analysis of Fine and Course Aggregates
ASTM D1556	Density of Soil in Place by Sand-Cone Method
ASTM D1557	Laboratory Compaction of Soil Using Modified Effort
ASTM D2922	Density of Soil in Place by Nuclear Methods
ASTM D3017	Water Content of Soil in Place by Nuclear Methods
OSHA	Occupational Safety and Health Administration

1.04 SUBMITTALS

A. Granular Materials

1. Granular materials required for filling, backfilling, bedding, subbase and other purposes shall be as shown on the Drawings. Prior to bidding, prospective contractors shall familiarize themselves with the available quantities of approved on-site and off-site materials.

2. For each on-site or off-site material proposed, furnish to Engineer for approval a certified gradation analysis at least ten (10) days prior to date of anticipated use of

such material. Except as specified herein, only off-site approved materials shall be utilized.

3. The Engineer reserves the right to inspect proposed sources of off-site granular material and to order such tests of the materials as he deems necessary to ascertain its quality and gradation of particle size. The Contractor shall, at his own expense, engage an approved testing laboratory to perform such test, and submit certified test results to the Engineer. If similar tests of the material from a particular source were performed previously, submit results of these tests to the Engineer for consideration.

4. No granular materials shall be used on this project for fill, backfill, bedding, subbase, or other purpose until approval is obtained from the Engineer, and only material from approved sources shall be used.

B. Geotextile Fabric

1. Submit a 1 square foot sample of each geotextile to be used.

2. Submit manufacturer's specifications of average roll characteristics for standards ASTM geotextile tests for each geotextile to be used.

1.05 FIELD MEASUREMENTS

A. Verify that survey benchmark and intended elevations for the Work are as shown on Drawings, or as provided by the Engineer.

1.06 QUANTITY FACTORS FOR VOLUME MEASUREMENT

A. The tables on the Drawings shall be used as the basis for computing volumes of excavation below subgrade, trench lining material, special pipe foundation materials, and special backfill materials when such volumes constitute the basis for payment, as established elsewhere in the Contract Documents. No deviations from the factors shown shall be allowed because of variations between the several pipe materials and classes.

B. No special computations of quantities shall be made for structures such as manholes, valve pits, catch basins, etc., which may occur in the various pipelines, but the quantities for payment noted above, where applicable to such structures, shall be computed by assuming that the appurtenant pipeline continues uninterrupted through such structure; such as for center-to-center of manholes.

1. Excavation Below Subgrade, Trench Lining Material and Special Pipe Foundations - The quantity for which payment shall be made will be computed by using the Quantity Factors based on nominal inside pipe diameter multiplied by the measured depth and by the measured length without regard to actual width or actual quantity.

2. Special Backfill Material - The maximum quantity of special backfill material for which payment shall be made will be computed by using the Quantity Factors based on nominal inside pipe diameter multiplied by the measured length and the measured height of special backfill, except that where soil or rock conditions allow steeper side slopes and narrow trench conditions (minimum width pipe O.D. plus 2 feet 0 inches), the quantity of special backfill shall be based on actual width, height, and length.

PART 2 PRODUCTS

2.01 ON-SITE MATERIALS

A. Type A, Excavated Material - Material under this classification shall be derived solely from excavations necessary to construct the project to the lines and grades specified. If the excavated material on-site is approved for reuse and is suitable, it shall be used for filling or backfilling purposes. If he so elects, the Contractor may, at his own expense, substitute other types of material in place of Type A Material, provided such substitution is approved in advance by the Engineer. All replaced or surplus material shall be disposed of as outlined in Section 02110.

1. Unclassified Excavated Material

Type A-1 - Referred to as “excavated material” and from which all frozen material, boulders, trash and foreign debris greater than 6 inches in any dimension has been removed. Approved Type A-1 material shall be used for all backfilling except under structures.

Type A-2 - Referred to as “select excavated material” and from which all frozen material, humus, peat, roots, vegetation, ashes, trash, debris, and rocks or stones greater than 2 inches in any dimension have been removed.

2. Classified Excavated Material - Where the Contract Documents allow the reuse of excavated on-site materials as a substitute for off-site sources of Type “B” gravel or Type “C” sands, the minimum requirements for each of those excavated materials shall be the same as required for the equivalent off-site material. If such materials are used, submit for approval in writing the proposed methods of excavation, location of stockpiles, quantities of required sand and gravels, estimated excavation quantities and proposed excavation limits within the accepted excavation area. Provide a demonstration at least 10 days prior to commencement of excavation that the methods will provide consistent quantity and quality of material as specified for Type “B” gravels and Type “C” sands. The Engineer will require subsurface investigations, sampling, and testing to confirm the extent and quality of the proposed material. Cost of all investigations, sampling, and testing shall be the Contractor’s responsibility.

B. Type E - Borrow Material

1. “Borrow material” is defined as approved on-site material required for fill or backfill in excess of the quantity of available approved material designated as Type ”A” material.

2. No such borrow material shall be used on this project unless specified in the Contract Documents and except within the limits of borrow areas designated on the Drawings.

3. Approval of all borrow material must be obtained from the Engineer, and only material from approved sources shall be used.

4. Use of designated borrow areas shall be subject to the approval of the Engineer and Owner at all times. Test pits and analyses of borrow material shall be provided as required by the Engineer for each borrow area and at the expense of the Contractor. In addition, the Engineer may require full excavation and restoration plans for each borrow area. All borrow areas shall be stripped of topsoil and organic materials far enough in advance of operations that contamination of borrow material is prevented.

a. Unclassified Borrow Material

This material consists of a naturally occurring mixture of sand, silts, clay, gravel, deteriorated rock, or other inorganic particles.

Type E-1 - Referred to as “common borrow material”, from which all frozen material, boulders, trash or debris have been removed.

Type E-2 - Referred to as “select borrow material” and from which all frozen material, humus, peat, roots, vegetation, ashes, trash, debris, and rocks or stones greater than 6 inches in any dimension have been removed.

b. Classified Borrow Material - Where the Contract Documents allow the use of on-site borrow areas as a substitute for off-site sources of Type “B” gravels and Type “C” sands, the requirements for each of those on-site materials shall be the same as off-site sources.

In addition, all of the requirements for “classified excavated material” (Type “E” material) must be met at least 10 days prior to the acceptance of approved borrow areas for use as a source of Type “B” gravel or Type “C” sand.

2.02 OFF-SITE MATERIAL

Within the following specifications where grain size distributions require a maximum 10 percent or less material capable of passing the #200 mesh sieve, the percentage of material finer (than the #200 sieve) by weight shall be determined by wet screening in accordance with ASTM Standard D1140.

It is the intent of the specifications to allow the use of granular materials from local suppliers. Material specifications shall conform to the requirements of the Commonwealth of Massachusetts, MassDOT, Standard Specification for Highways and Bridges, 1988 edition, as amended.

No material specified in this Article 2.02 shall be used on this project until acceptance is obtained from the Engineer, and only material from approved sources shall be used. A certified sieve analysis from the supplier shall be submitted for the Engineer’s acceptance prior to the use of the material.

A. Gravel

1. Shall be a mixture of hard, durable gravel and sand.

2. Shall be free from organic matter, trash, shale, debris, snow, ice, and other frozen or mechanically deleterious material.

3. Each type of gravel fill material shall also meet the gradation requirements of Table 1.

4. Gravel Fill Materials

a. Type B - Gravel borrow.

TABLE 1

GRADATION REQUIREMENTS: GRAVEL

SIEVE SIZE	PERCENT PASSING BY WEIGHT GRAVEL TYPE TYPE B-1 (M1.03.0 TYPE a or b or c)	TYPE B-2 (M1.03.1)
3”	100	100
2"		
1-1/2"		70-100
3/4"		50-85
1/2”	50 – 85	
No. 4	40-75	30-60
No. 50	8-28	
No. 200	0-10	0-10

Maximum size of stone in gravel shall be as follows:
MassDOT Type a = 6 inches largest dimension
MassDOT Type b = 3 inches largest dimension
MassDOT Type c = 2 inches largest dimension

B. Type C - Sand

1. Shall be a mixture of natural fine gravel and sand.

2. Shall be free from loam or clay, surface coatings, and deleterious materials.

3. The allowable amount of material passing a No. 200 sieve shall not exceed 10 percent by weight. Each type of sand fill material shall also meet the gradation requirements of Table 2.

4. Sand Borrow Materials

   a. Type C-1 - Sand Borrow

   b. Type C-2 - Select Subdrain

TABLE 2

GRADATION REQUIREMENTS: TYPE C - SAND

SIEVE SIZE	PERCENT PASSING BY WEIGHT GRAVEL TYPE C-1 M1.04.0 TYPE B	C-2 M1.04.1
3/8"	100	100
No. 4		100
No. 16		80
No. 50		55
No. 100		10
No. 200	0-10	0-10

C. Type D - Dense Grade Crushed Stone

1. Shall be clean, hard, durable, angular crushed gravel.

2. Shall be free from organic matter, trash, debris, snow, ice, and other frozen or mechanically deleterious material.

3. Unless otherwise specified, crushed gravel shall be composed of granite or limestone pieces, chips, and fines.

4. All crushed stone shall also meet the gradation requirements of Table 3.

TABLE 3

GRADATION REQUIREMENTS: TYPE D - CRUSHED STONE

TYPE	TYPE D-1 M2.01.7	TYPE D-2 M2.01.3	TYPE D-3 M2.01.1
2”	100		100
1-1/2”	70-100	100	95-100
1-1/4”		85-100	
1”			35-70
3/4”	50-85	10-40	0-25
1/2”		0-8	
No. 4	30-55		
No. 50	8-24		
No. 100	3-10		

D. Reclaimed Materials

1. Reclaimed materials where allowed shall have the following gradations.

TABLE 4

GRADATION REQUIREMENTS: RECLAIMED MATERIALS

	PERCENT PASSING BY WEIGHT	
	RECLAIMED MATERIAL TYPE	
SIEVE SIZE	R-1 M1.11.0	R-2 M2.01.7
3 inch	100	100
2 inch		70-100
1-1/2 inch	70-100	
3/4 inch	50-85	50-85
No. 4	30-60	30-55
No. 50	8-24	8-24
No. 200	0-10	3-10

2. Aggregate for Crushed Stone for Blending, used to correct gradation deficiencies, shall conform to the requirements of MassDOT Standard Specifications for Highways and Bridges as amended Subsections M2.01.0 to M2.01.6 of Division III, Materials.

E. Controlled Density Fill (CDF)

1. CDF material shall be a flowable, self-consolidating, rigid setting, low density material that can substitute for compacted gravel for backfills, fills, and structural fills.

2. It shall be a mixture of Portland cement, sand and water designed to provide a compressive strength of 30 to 80 psi at 28 days, and 100 psi at 90 days.

3. CDF is to be batched at a ready mix plant and is to be used at a high or very high slump of approximately 10 to 12 inches.

4. Materials shall meet the following requirements:

Portland Cement..... AASHTO M85

Sand ..... MassDOT Specs, M4.02.02

Air Entraining Admixture..... M4.02.05

5. CDF material shall meet the requirements of the Commonwealth of Massachusetts, MassDOT Department Standard Specifications for Highways and Bridges Supplemental Specifications, as amended, Type 2E.

F. Type F - Gravel-Cement Mixtures

1. Shall be a mixture of 15 parts gravel to one part cement by weight.

2. Gravel shall be Type C.

3. Cement shall be Type I Portland cement.

4. Mixing of material shall be performed in an approved mixer.

5. The mixture shall be placed and compacted in accordance with Section 02228.

PART 3 EXECUTION

3.01 EXAMINATION

A. Submit for approval fill materials to be reused.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Prior to start of construction, notify the appropriate organization identified in Section 02205 (under Article 3.01), and have staked or marked all underground utilities. Utilities include water, gas, electrical, telephone, cable, storm sewer, sanitary sewers, laterals, and services. In the event such locations indicate a possible interference, or when needed to locate points of connection to existing facilities, perform exploratory excavations to determine the utilities' location and elevation. Provide the Engineer with the results of the exploratory excavations for his review. Allow the Engineer sufficient time to determine any changes required as a result of such exploratory excavations prior to start of construction.

C. When the project consists of reconstructing sanitary sewers and reconnection of existing sanitary laterals, only reconnect live laterals, unless otherwise shown on the Drawings. Verify whether the lateral is alive or abandoned and the source of the lateral using such methods as necessary including dyeing, flushing with water, rodding, pipe locators, and exploratory excavations.

D. Abandoned pipes and laterals shall be plugged in with 12 inches of concrete or grout or for large pipes with solid brick masonry.

E. Conduct the operations such that no interruptions to the existing utility system shall occur. Where existing sanitary sewers or storm drain systems are being replaced or interrupted provide temporary bypass pumping or temporary piping to maintain flow around the work site such that no backups occur in these sewer systems.

F. Existing sanitary sewer laterals damaged in the work or temporarily disconnected shall be restored to operation by the end of each work day. Existing sanitary sewer laterals where crossing over new pipelines to be restored in accordance with details shown on the drawings.

G. Maintain existing manholes, catch basins, and other utility structures above and below grade which are to remain in their pre-work condition. Any material or debris entering same due to the operation shall be promptly removed.

H. Protect plant life, lawns, and other features remaining as a portion of final landscaping.

I. Protect control points, bench marks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic. Preserve the control points provided by the Engineer throughout the life of the project, and accurately replace any such point, which is damaged or moved, at Contractor's expense.

J. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with Type III pipe foundation and compact to density equal to or greater than requirements for subsequent backfill material.

K. Brace walls and slabs of structures to support surcharge loads and construction loads imposed by backfilling operations.

L. Maintain a stable, dry backfill area.

M. Remove all water, snow, ice and debris from surfaces to accept fill materials and from the backfill material. No calcium chloride or other chemicals shall be used to prevent freezing.

N. Areas to receive compacted fill shall be graded to prevent surface runoff and ponding in accordance with Section 02110.

O. No fill or backfill material may be used without approval of the Engineer.

P. No geotextile fabric may be used without approval of the Engineer.

Q. Backfill operations shall be started at the lowest elevation in the area to be backfilled, and continue, in horizontal layers, upward to the limits specified.

R. Backfill material shall be within 2 percent of the optimum moisture content for that material.

S. Any crushed gravel stockpiles which have undergone excessive particle segregation shall be reviewed and approved by the Engineer prior to placement.

3.03 TRENCH EXCAVATION

A. Trenches for underground piping, ductwork, drains, and similar utilities shall be excavated and maintained as shown on the Drawings and specified in this Section. Trench widths shall be held within the minimum and maximum limits shown on the Drawings. If a prefabricated, mobile shield is utilized in lieu of conventional sheeting and bracing in pipe trenches, the bottom of the shield shall be maintained as high as possible (preferably above the spring line of the pipe) so as to prevent disturbance of the pipe foundation material and to avoid forces which would tend to pull pipe joints apart when the shield is dragged forward. Gouged openings or troughs left by the shield shall be filled with additional pipe foundation material and thoroughly compacted. Installation of sheeting and bracing and use of mobile shields shall be in complete accordance with all details of applicable safety codes, rules and regulations including all applicable local, State, Federal, and OSHA regulations.

B. Excavation shall be such that a flat bottom trench of allowable width is established at the required subgrade elevation for subsequent installation of pipe foundation material.

C. If indicated on the Drawings or when required as a result of unsuitable soil conditions, trench excavation shall be carried below the required subgrade and a special pipe foundation installed in conformance with the Contract Documents. In any event, operations shall result in stable trench walls and a stable base free from standing water, consistent with trench width requirements.

D. Bedrock, boulders and cobbles greater than 6 inches shall be trimmed back or removed on each side of the trench so that no rock protrudes within 6 inches of the installed pipe. Rock shall also be trimmed back across the bottom of the trench so that no rock, boulder, or cobble protrudes within 4 inches of the installed pipe.

E. In general, trenches shall not be opened for more than 50 feet in advance of installed pipe. Excavation of the trench shall be fully completed at least 5 feet in advance of pipe laying operations. No more than 40 feet of trench shall be left open overnight.

3.04 EXCAVATION CLASSIFICATION

A. All material excavated will be measured and classified as provided herein.

1. Unclassified Excavation - “Unclassified excavation” shall include all materials excavated within the authorized lines and grades prescribed in the Drawings. Unclassified excavation shall include “rock excavation” as well as “common excavation” as defined herein. Unless specifically designated otherwise in the appropriate bid items of the Bid Proposal, all excavation shall be considered to be “unclassified excavation.”

2. Common Excavation - “Common excavation” shall include all excavation except “rock excavation.” All unconsolidated and non-indurated material, rippable rock, loose rock, soft mineral matter, weathered rock or saprolite, and soft or friable shale which is removable with normal earth excavation equipment shall be considered “common excavation.” All boulders and detached pieces of solid rock or concrete or masonry less than 1 cubic yard in volume shall be classified as “common excavation.”

3. Rock Excavation - “Rock excavation” shall include all sound solid masses, layers and ledges of consolidated and indurated rock or mineral matter of such hardness, durability and/or texture that it is not rippable or cannot be excavated with normal earth excavation equipment. Should a conflict arise as to the classification of

excavation as either “common” or “rock,” the following tests shall be used in the appropriate determination:

a. Where practicable, a late model tractor-mounted hydraulic ripper equipped with a one digging point of standard manufacturer’s design adequately sized for use with and propelled by a crawler-type tractor rated between 210 and 240 net fly-wheel horsepower, operating in low gear, shall be utilized. Should the suspect material not be effectively loosened or broken down by ripping in a single pass with the aforementioned ripper, the material shall be classified as “rock.”

b. In situations where inter-bedded strata of “common excavation” material and “rock excavation” material are encountered in the same excavation, the individual classification of those materials shall be made on an average percentage basis of the occurrence of those materials as measured in stratigraphic sections and as approved by the Engineer.

c. When rock is encountered in excavations, it shall be removed by blasting methods, jack hammering, or any other method suitable and safe considering the proximity of existing utilities or facilities.

d. Blasting operations shall conform to the requirements of National Fire Protection Association (NFPA) 495 - Code for Explosive Materials, and by applicable State or local regulations.

3.05 UNAUTHORIZED EXCAVATION

A. The Contractor shall not be entitled to additional compensation for unauthorized excavations carried beyond or below the lines and subgrades prescribed in the Contract Documents. The Contractor shall refill such unauthorized excavations at his own expense, and in conformance with the following provisions of this Article.

B. Should the Contractor, through negligence or for reasons of his own, carry his excavation below the designated subgrade, fill concrete or such other material as may be approved by the Engineer, as specified in PART 2, shall be furnished and placed as backfill in sufficient quantities to reestablish the designated subgrade surface. Granular material used for backfilling shall be spread and compacted in conformance with the requirements of later Articles of the section, and to the percentage compaction outline therein. The cost of any tests associated with this refilling operation shall be borne by the Contractor.

C. If the maximum widths of pipe trenches are exceeded, the installed pipes shall be fully cradled in a minimum of 6 inches of fill concrete, as specified elsewhere, and at the Contractor’s expense. Excavation below subgrade which is ordered by the Engineer because the normal subgrade has been disturbed by the Contractor’s operations shall be considered as unauthorized excavation.

3.06 MAINTENANCE OF EXCAVATIONS

A. All excavations shall be properly and legally maintained while they are open and exposed. Sufficient and suitable barricades, warning lights, flood lights, signs, etc., to protect life and property shall be installed and maintained at all times until the excavation has been backfilled and graded to a safe and satisfactory condition. All signs, markers, barricades shall conform to the requirements of the manual of Uniform Traffic Control Devices. All barricades, signs, and markers shall be reflectorized.

B. To maintain traffic and safety temporary plating over trenches consisting of steel plates shall be used to temporarily bridge trench excavations. Plates shall be of size and positioned to provide adequate bearing at plate edges, shall be securely anchored, and shall be fitted in place in a manner to minimize noise when crossed by traffic. Plates shall be of sufficient thickness to safely carry heavy traffic without detrimental deflection; however, unless otherwise specified, the minimum thickness of plates shall be 1-inch.

C. Plate edges exposed to traffic shall be feathered with asphalt mix as part of trench excavation work. Work includes surveillance and adjustment of plating over trenches which shall be provided by the Contractor during non-working hours, weekends, and holidays.

3.07 PIPE FOUNDATIONS

A. All pipes, fittings or specials which are to be installed in the open trench excavation shall be properly bedded in, and uniformly supported on pipe foundations of the various types specified herein and shown on the Drawings. Flat-bottom trenches of required width shall be excavated to the necessary depth as required in the Table of Quantity Factors shown on the Drawings and maintained in accordance with this section prior to installing the foundation. Trenches shall be dewatered and all work performed in a dry trench.

B. Bedding material shall be spread in maximum of 8-inch layers to the midpoint of the pipe and each layer shall be compacted until the required total depth of the bedding has been built up. Compaction methods include hand tamping with T-bars, flat heads, shovel slicing, as well as mechanical compactors. The Contractor shall perform his bedding operations with care to maintain line and grade.

C. The pipe foundation above the midpoint of the pipe shall be spread and compacted in 12-inch layers to 12 inches above the top of the pipe. When PVC, plastic or polyethylene pipe is used, do not compact directly over pipe until the depth of backfill has reached 2 feet above the top of the pipe.

D. Type I - Normal Soil Conditions - Unless shown otherwise in the Drawings, all pipe shall be supported on Type I foundation. The trench shall be excavated from four to eight inches deeper than the bottom of the pipe, depending on the diameter of the pipe (see Table of Quantity Factors shown on the Drawings). Run-of-crusher stone standard bedding, Type “D-R-1" material as described above shall be furnished, placed and compacted in the trench for its full width such that, after the pipe has been uniformly bedded in this material, the required minimum depth of Type ”D-R-1" material remains between pipe and undisturbed trench bottom, as noted in the “Table of Quantity Factors.” Suitable holes shall be provided in the trench bottom to permit adequate bedding of bells, couplings, or similar projections. The run-of-crusher stone shall extend upward to a point 12 inches over the top of the pipe. Minimum width of pipe foundation shall be outside diameter of pipe plus 2'-0".

E. Type II - Moderately Unstable Soil Conditions - When specifically called for on the Drawings, or when ordered by the Engineer, the pipe shall be supported on Type II foundation. The foundation shall be installed where a suitable supporting soil or rock stratum occurs within two feet, more or less of the bottom of the pipe. The trench shall be excavated to the depth necessary to reach the suitable supporting stratum. Type “D-R-1" material or Type “D-2" crushed stone, as ordered by the Engineer as described above, shall then be furnished and placed in the trench for its full width. The material shall be spread in 12-inch layers, and each layer shall be compacted. The pipe foundation material to be supported on Type VII foundation, geotextile fabric foundation. The crushed stone or gravel depth shall extend from the supporting stratum up to an elevation 4, 6 or 8 inches below the bottom of the pipe depending upon the pipe diameter. The bedding material shall then be installed in accordance with Type I pipe foundation requirements.

F. Type III - Unstable Soil Conditions - When specifically called for on the Drawings, or when ordered by the Engineer, the pipe shall be supported on Type III foundation. The foundation shall be installed where no suitable supporting soil or rock stratum exists within two feet of the bottom of the pipe. The trench shall be excavated two feet deeper then the bottom of the pipe. Each side of the trench shall be supported and maintained by a permanent system of tight, continuous sheeting (and bracing) which shall be driven below the trench bottom as shown and which shall extend to an elevation of at least 12 inches above the top of the pipe. Minimum plank size to be 2" x 12" tongue and groove.

Type “D-R-2" material shall then be furnished and placed in the trench for its full width, and to a depth of 8 inches. The pipe foundation material to be supported on a Type VII Foundation, Geotextile Fabric Foundation. Crushed stone, “Type D-3" material shall then be furnished and placed in the trench for its full width. All material shall be spread in layers and each layer shall be compacted until their respective total depths have been built up as required. The “Type D-3" material depth shall extend a distance of 12 inches from the top of the compacted trench lining up to an elevation 4, 6 or 8 inches below the bottom of the pipe, depending upon the pipe diameter. Bedding material shall then be installed in accordance with Type I Pipe Foundation requirements. All installed sheeting below an elevation established at 12 inches above the top of the pipe shall be left in place and undisturbed. Only the cross struts and whalers shall be gradually removed as construction proceeds.

G. Type IV - Reinforced Concrete Encasement - When specifically called for on the Drawings, or when ordered by the Engineer, the pipe shall be supported on Type IV foundation. The trench shall be excavated to a depth below the bottom of the pipe equal to one-quarter of the inside diameter of the pipe or 6 inches, whichever is greater. The excavated space shall then be completely filled with, and the entire pipe encased in, concrete such that the minimum concrete encasement at any point around the outside barrel of the pipe measured 6 inches thick. The total minimum width of the concrete encasement shall equal the outside diameter of the pipe plus 12 inches and such minimum width shall be constant for the entire length of the encasement. Freshly placed concrete shall be maintained free from groundwater and no backfilling of the trench shall begin until initial set has taken place, but not less than 3 hours has elapsed after the encasement has been cast. Backfill a depth of 12 inches over top of concrete before beginning compaction with mechanical equipment.

H. Type V - Concrete Cradle - When specifically called for on the Drawings or when ordered by the Engineer, the pipe shall be supported on Type V foundation. The foundation shall be furnished and installed equal to the Type IV foundation, “Concrete Encasement,” except that only that portion of the encasement at and below the horizontal diameter of the pipe shall be encased, forming a true cradle under the bottom half of the pipe. Maintain cradle free from groundwater for a period of 3 hours or until initial set has taken place. Complete pipe foundation in 12-inch lifts as for Type I pipe foundation.

I. Type VI - Plain Concrete Encasement - When specifically called for on the Drawings, or when ordered by the Engineer, the pipe shall be supported on Type VI foundation. The foundation shall be furnished and installed equal to the Type IV foundation, “Reinforced Concrete Encasement,” except that no steel reinforcing is required. Maintain encasement free of groundwater for a period of 3 hours or until initial set has taken place.

J. Type VII - Geotextile Fabric Foundation - When specifically called for on the Drawings, or when ordered by the Engineer, the pipe foundation shall be supported on a geotextile fabric foundation. The fabric to be placed on the bottom of the excavated foundation and extended upwards to the top of the Type I pipe foundation where it can then be placed flat with a minimum overlap of 6 inches. Longitudinal overlaps to be a minimum of 2 feet. Fabrics to be installed and stretched tight, have no wrinkles so that the fabric will be in tension when placing the pipe foundation material. Geotextile material to be Trevia Type S 1127 by Hoechat Corporation; Mirafi Type 500X by Celanese Corporation; or equal.

K. Type VIII - Pressure Pipe Foundation

1. Pipe and fittings shall be laid on stable foundations, free from standing water, and trimmed to shape. Type A-2 material as described above in PART 2 shall be used for pipe foundation unless otherwise shown on the Drawings. In particular, stones 2 inches or larger shall be removed from the bearing surface of the pipe foundation. At the joints, enough depth and width shall be provided to permit the pipe layer to reach entirely around the pipe so that the joints may be made in a proper manner. Pipes shall have full bearing throughout their entire length, which shall be accomplished by shaping the bottom of the ditch or adequately tamping the backfill under the pipe in accordance with Minimum Compaction Requirements, of Section 02228. When laid in tunnels, pipes shall be blocked in such a manner as to take the weight off the bells. Pipe laid in normal trench excavation shall not be laid on wood blocking. Mechanical type joints shall be tightened within the AWWA recommended torque range.

2. The following sources shall be reviewed by the Contractor for installation guidelines and requirements:

PIPE MATERIAL	SOURCES
Ductile Iron	AWWA Standard C600; Project Drawings; manufacturer's recommendations.
Gray Cast Iron	AWWA Standard C600; Project Drawings; manufacturer's recommendations.
PVC Pipe	ASTM Standard D2321; Project Drawings; manufacturer's recommendations.
PE Pipe	AWWA Standard C901, including Appendix A; ASTM D2774; Project Drawings; manufacturer's recommendations.

3. Unless otherwise shown on the Drawings, as a minimum, all pipe shall be backfilled to the springline, including hand tamping with T-bars, shovel slicing, and flatheads, and mechanically compacted and the remaining backfill placed in 12-inch lifts to 1 foot above the crown of the pipe in accordance with Minimum Compaction Requirements, of Section 02228. Backfill material within 12 inches of the pipe shall be free of stones greater than 2 inches in any dimension. Unless otherwise shown on the Drawings, the minimum total finished cover over the top of the pipe barrel of all pressure pipe shall be 5 feet.

3.08 GENERAL BACKFILLING REQUIREMENTS

A. Backfilling shall be started as soon as practicable and after structures or pipe installations have been completed and inspected, concrete has acquired a suitable degree of strength, and subgrade waterproofing materials have been in place for at least 48 hours. Backfilling shall be carried on expeditiously thereafter. Backfill shall be started at the lowest section of the area to be backfilled. Natural drainage shall not be obstructed at any time.

B. Backfill spaces shall be inspected prior to backfilling operations and all unsuitable materials, including sheeting, bracing forms and debris, shall be removed. No backfill shall be placed against foundation walls on structural members unless they are properly shored and braced or of sufficient strengths to withstand lateral soil pressures.

C. Backfill material shall be inspected prior to placement and all roots, vegetation, organic matter, or other foreign debris shall be removed. Stones larger than 12 inches in any

dimension shall be removed or broken. Stones shall not be allowed to form clusters with voids.

D. Backfill material shall not be placed when moisture content is more than 2 percent above optimum or is otherwise too high to allow proper compaction. When material is too dry for adequate compaction, water shall be added to the extent necessary.

E. No backfill material shall be placed on frozen ground nor shall the material itself be frozen or contain frozen soil fragments when placed. No calcium chloride or other chemicals shall be added to prevent freezing. Material incorporated in the backfilling operation which is not in satisfactory condition shall be subject to rejection and removal at the Contractor's expense.

F. If the Contractor fails to stockpile and protect on-site excavated material acceptable for backfill, then the Contractor shall provide an equal quantity of acceptable off-site material at no expense to the Owner.

G. Remove surplus backfill material from site.

3.09 PIPE TRENCH BACKFILL

A. Pipe foundations, to a depth of 1 foot above the pipe, shall be placed in 12-inch layers and thoroughly compacted by approved mechanical methods to ensure firm bedding and side support. Refer to Section 02228 for density requirements. For plastic or polyethylene pipe materials, do not compact directly over pipe until the 2 feet of cover has been installed. Pipe foundations are specified in the appropriate sections covering underground piping. The remainder of the trench shall be backfilled and consolidated in accordance with Section 02228 and by one of the following methods, depending on the nature of backfill material and location of trench.

B. Procedure I - For cross-country pipelines under uncultivated areas where subsequent settlement can be tolerated:

1. Backfill material shall be placed in the trench and consolidated by packing with the backhoe bucket or other means to prevent voids. Refer to Section 02228 for density requirements. The top layer shall be thoroughly compacted mechanically and slightly mounded to allow for subsequent settlement. Maintain trench surface until completion of contract and regrade as necessary within guarantee period.

C. Procedure II - For lawns, cultivated fields, gardens and non-paved areas where minimum subsequent settlement is required: Same as for Procedure I, refer to Section 02228 for density requirements. Top of back fill shall be compacted by mechanical means and surface maintained prior to topsoil installation, fine grading, and seeding.

D. Procedure III - For streets, driveways, parking areas, highways, shoulder areas, miscellaneous type pavements, walks, curbs, gutters and other specified areas:

1. Backfill material shall be placed in layers not exceeding 18 inches thick and each layer thoroughly compacted by a backhoe mounted hydraulic or vibratory tamper, up to 4 feet under pavement (below top of subgrade). The upper 4 feet shall be compacted using hand-guided or small self-propelled vibratory or static rollers or pads in layers not exceeding 12 inches in thickness. Refer to Section 02228 for density requirements.

2. For pipelines in or across State Highways, backfill material and compaction shall conform with the Standard Specifications or specific requirements of the State in which the project is located.

3. Where a gravel-cement mixture (Type F) backfill is specified, the dry gravel and cement mixture shall be placed in the trench, in 6-inch layers and thoroughly tamped using mechanical or vibratory tampers. Water shall not be introduced to the gravel-cement mixture during placing and compacting thereof.

3.10 PERIODIC CLEAN-UP; BASIC RESTORATION

A. When work involves installation of sewers, drains, water mains, manholes, underground structures, or other disturbances of existing features in or across streets, rights-of-way, easements or private property, the Contractor shall (as the work progresses) promptly backfill, compact, grade and otherwise restore the disturbed area to a basic condition which will permit resumption of pedestrian or vehicular traffic and any other critical activity or function consistent with the original use of the land. The requirements for temporary paving of streets, walks, and driveways are specified elsewhere. Unsightly mounds of earth, large stones, boulders, and debris shall be removed so that the site presents a neat appearance.

B. The Contractor shall perform the clean-up work on a regular basis and as frequently as required. Basic site restoration in a particular area shall be accomplished immediately following the installation or completion of the required facilities in that area. Furthermore, such work shall also be accomplished if partially completed facilities must remain incomplete for some time period due to unforeseen circumstances.

C. Upon failure of the Contractor to perform periodic clean-up and basic restoration of the site to the Engineer's satisfaction, the Owner may, upon five days prior written notice to the Contractor, without prejudice to any other rights to remedies of the Owner, cause such work for which the Contractor is responsible to be accomplished to the extent deemed necessary by the Engineer, and all costs resulting therefrom shall be charged to the Contractor and deducted from the amounts of money that may be due him.

3.11 TOLERANCES

A. Top Surface of Backfilling - Under Paved Areas - +1/2 -inch from required elevations.

B. Top Surface of General Backfilling - +1 -inch from required elevations.

3.12 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01400.

B. The Contractor shall designate an experienced person who shall be responsible for inspection of excavations on a daily basis, document, and maintain daily trenching and excavation logs per OSHA 29 CFR 1926.

C. Tests and analysis of fill material will be performed in accordance with ASTM D1557 and with Section 02228.

D. Compaction testing will be performed in accordance with ASTM D1556, ASTM D2922, and with Section 02228.

E. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest at no cost to Owner.

3.13 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01500.

B. Regrade and recompact fills subjected to vehicular traffic.

END OF SECTION

SECTION 02228

COMPACTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Compaction requirements and test methods.

B. Compact all subgrades, foundations, embankments, trench backfills, filled, and backfilled material as specified.

1.02 RELATED SECTIONS

A. Section 02225 - TRENCHING

1.03 REFERENCES

ASTM D698	Laboratory Compaction of Soil Using Standard Effort
ASTM D1556	Density of Soil in Place by the Sand-Cone Method
ASTM D1557	Laboratory Compaction of Soil Using Modified Effort
ASTM D2922	Density of Soil in Place by Nuclear Methods
ASTM D3017	Water Content of Soil in Place by Nuclear Methods

1.04 SUBMITTAL

A. Submit in writing a description of the equipment and methods proposed to be used for compaction.

1.05 QUALITY ASSURANCE

A. The Contractor shall adopt compaction methods which will produce the degree of compaction specified herein, prevent subsequent settlement, and provide adequate support for the surface treatment, pavement, structure, and piping to be placed thereon, or therein, without damage to the new or existing facilities.

B. The natural subgrade for all footing, mats, slabs-on-grade for structures or pipes shall consist of firm undisturbed natural soil, at the grades shown on the Drawings.

C. After excavation to subgrade is completed, the subgrade shall be compacted if it consists of loose granular soil or if its surface is disturbed by the teeth of excavating equipment.

1. This compaction shall be limited to that required to compact loose surface material and shall be terminated in the event that it causes disturbance to underlying fine-grained soils, as revealed by weaving or deflection of the subgrade under the compaction equipment.

2. If the subgrade soils consist of saturated fine or silty sands, silts, or clay or varved clays, no compaction shall be applied.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials to be compacted shall be as specified in Section 02225.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine spaces to be filled beforehand and remove all unsuitable materials and debris including sheeting, forms, trash, stumps, plant life, etc.

B. Inspect backfill and fill materials beforehand and remove all roots, vegetation, organic matter, or other foreign debris. Stones larger than 12 inches in any dimension shall also be removed or broken into smaller pieces.

C. No backfill or fill material shall be placed on frozen ground, nor shall the material itself be frozen or contain frozen soil fragments.

D. Spaces to be filled shall be free from standing water so that placement and compaction of the fill materials can be accomplished in “dry” conditions.

3.02 PREPARATION

A. Brace walls and slabs of structures to support surcharge loads and construction loads imposed by compaction operations.

B. Proof-roll all subgrade surfaces to accept fill material in accordance with Section 02229.

C. Each layer of fill shall be compacted to the specified density the same day it is placed.

1. The moisture content of backfill or fill material shall be adjusted, if necessary to achieve the required degree of compaction.

D. Compact each lift in accordance with Table 1.

E. Match compaction equipment and methods to the material and location being compacted in order to obtain specified compaction, with consideration of the following guidelines:

1. Rubber-tired rollers are preferred for most areas to prevent bridging of softer materials.

2. Double smooth drum rollers may be used provided that careful inspection can prevent bridging.

3. Compaction roller for standard asphalt should be lighter in weight than proof-rolling equipment, with a minimum compaction force of 350 pounds per linear inch (PLI). Compaction roller for porous pavement shall be capable of providing a minimum compactive effort of 250 pounds per inch of width of the drive roll.

4. Vibratory compaction is preferred for dry, granular materials. Vibratory compaction for porous pavement sub-base shall be performed with equipment capable of providing a minimum compactive effort of 250 pounds per inch of width of the drive roll.

5. Hand compaction equipment such as impact rammers, plate or small drum vibrators, or pneumatic buttonhead compactors should be used in confined areas.

6. Hydraulic compaction by ponding or jetting will not be permitted except in unusual conditions, and then only upon written approval by the Engineer and after a demonstration of effectiveness.

7. Backhoe mounted hydraulic or vibratory tampers are preferred for compaction of backfill in trenches under pavements over 4 feet in depth. The upper 4 feet shall be compacted as detailed above or with hand-guided or self-propelled vibratory compactors or static roller.

8. For plastic pipelines (PVC, PE, or PB) do not compact directly over center of pipe until backfill has reached 2 feet above top of pipe.

TABLE 1

COMPACTION REQUIREMENTS

CONSTRUCTION ELEMENT	MAXIMUM COMPACTION LAYER THICKNESS (INCHES)	ASTM	MINIMUM COMPACTION
I. STRUCTURES*			
a. Fill beneath foundation elements and under slabs-on-grade - hand-guided compaction	6	D1557	95%
Fill beneath foundation elements and under slabs-on-grade - self-propelled or tractor-drawn compaction	8	D1557	95%
b. Fill around structures and above footings	8	D1557	95%
II. TRENCHES**			
a. Fill under pipelines and pipe bedding	8	D1557	95%
b. Pipe sidefills and top 4 feet of pipe backfill under pavements	12	D1557	93%
c. Backfill below 4 feet under pavement	18	D1557	90%
d. Backfill under lawns, gardens and cultivated fields	24	D1557	90%
e. All other trenches***	36	D698	85%
III. EMBANKMENTS AND FILLS			
a. Fill under streets, parking lots, and other paved areas	12	D1557	92%
b. Embankments not supporting pavement or structures	18	D1557	90%
c. Rough site grading	24	D698	85%

* Where structural loads are carried by piles, caissons or other deep foundations, minimum compaction may be reduced to 92 percent.

** The first 1 foot above pipelines shall have a compacted thickness of 12 inches.

*** For cross-country pipelines, lifts may be compacted with a backhoe bucket or other means, and slightly mounded at the surface provided that regrading is performed within the guarantee period.

3.03 FIELD QUALITY CONTROL

A. Material Testing

1. The Engineer reserves the right to order testing of materials at any time during the work.

2. Testing will be done by a qualified, independent testing laboratory in accordance with this Section.

3. The Contractor shall aid the Engineer in obtaining representative material samples to be used in testing.

4. For each material which does not meet specifications, the Contractor shall reimburse the Owner for the cost of the test and shall supply an equal quantity of acceptable material, at no additional compensation.

5. The Contractor shall anticipate these tests and incorporate the time and effort into procedure.

B. Compaction Testing

1. The Engineer reserves the right to order the qualified independent testing laboratory to conduct in-place density tests of compacted lifts.

2. Testing may be conducted for every 200 cubic yards of fill or backfill, or every 200 linear feet of trench backfill placed.

3. The Contractor shall dig test holes and provide access to all backfill areas at no additional compensation when requested by the Engineer.

4. For each test which does not meet specifications, the Contractor shall retest at his cost. If the retest does not meet specifications, the Contractor shall replace and recompact material to the specifications at no additional cost to the Owner.

5. The Contractor shall anticipate these tests and incorporate the time and effort into procedures.

6. Nuclear moisture density testing by “probe” methods will be acceptable for compacted layers not exceeding 8 inches in thickness.

   a. Nuclear “backscatter” methods will be acceptable only for testing asphalt paving layers not in excess of 3 inches in thickness.

   b. Only certified personnel will conduct nuclear testing.

   c. If the nuclear method is utilized, the results shall be checked by at least one in-place density test method described above.

C. Unacceptable Stockpiled Material - Stockpiled material may be tested according to Material Testing Materials.

D. Alternate Methods of Compaction - The Contractor may employ alternate methods of compaction if the desired degree of compaction can be successfully demonstrated to the Engineer’s satisfaction.

E. Select Material - On-Site

1. Any on-site material may be used for select fill material provided it meets all the requirements of the equivalent off-site material.

2. No on-site material shall be used without prior approval of the Engineer.

F. Systematic Compaction - Compaction shall be done systematically, and no consideration shall be given to incidental coverage due to construction vehicle traffic.

3.04 PROTECTION

A. Prior to terminating work for the day, the final layer of compacted fill, after compaction, shall be rolled with a smooth-wheel roller if necessary to eliminate ridges of soil left by tractors or equipment used for compaction or installing the material.

B. As backfill progresses, the surface shall be graded so as to drain off during incidence of rain such that no ponding of water shall occur on the surface of the fill.

C. The Contractor shall not place a layer of fill on snow, ice, or soil that was permitted to freeze prior to compaction.

1. These unsatisfactory materials shall be removed prior to fill placement.

END OF SECTION

SECTION 02229

PAVEMENT SUBGRADE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Subgrade preparation.

B. Furnishing natural soils.

C. Furnishing select borrow material.

D. Temporary drainage.

E. Compaction.

F. Proof rolling.

G. Removal and replacement of unacceptable materials.

H. Grading.

1.02 RELATED SECTIONS

A. Section 01010 – SUMMARY OF WORK

B. Section 01500 - TEMPORARY FACILITIES

C. Section 01026 – LUMP SUM ITEMS

D. Section 02110 - SITE CLEARING

E. Section 02205 - PROTECTION OF EXISTING FACILITIES

F. Section 02225 - TRENCHING

G. Section 02228 - COMPACTION

1.03 REFERENCES

ASTM D698	Moisture/Density Relations of Soil/Aggregate Mixtures Using 5.5 Lb. Rammer and 12 In. Drop
ASTM D1557	Moisture/Density Relations of Soils and Soil/Aggregate Mixtures Using 10 Lb. Rammer and 18 In. Drop

1.04 DEFINITIONS

A. “Subgrade” refers to existing materials upon which constructed subbase will be placed.

1.05 PERFORMANCE REQUIREMENTS

A. Compaction of subgrade shall meet the requirements for compaction as stated in Section 02228, Table 1.

1. Compaction curves shall be developed for each type of subgrade material when “in-place density” tests are required by the Engineer.

2. The cost of failed compaction tests will be reimbursed by the Contractor.

B. Proof-rolling with 8- to 10-ton pneumatic tire compactors to locate areas of inadequate compaction, soft or rutting areas, or other defects in the subgrade surface.

1.06 SUBMITTALS

A. Submit under Provisions of Section 01300.

B. Select Borrow Material - Refer to Section 02225.

C. Granular Materials - Refer to Section 02225.

1.07 PROJECT RECORD DOCUMENTS

A. See Section 01380.

1.08 REGULATORY REQUIREMENTS

A. Conform to permit requirements obtained by Owner and attached to these Specifications.

B. Conform to regulatory agencies having jurisdiction over the work.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Provide erosion and sediment controls (refer to Section 01500) to prevent debris, stones and silt from entering drainage systems.

1.10 FIELD MEASUREMENTS

A. Prior to start of construction, verify by field measurements that existing conditions are as shown on Drawings, notify Engineer of specific differences.

B. Prior to start of construction, where ordered, verify by exploratory excavations that existing underground utility locations and elevations are as shown on the Drawings or to confirm marked location and elevation of underground utilities by the organization identified in Section 02205.

1.11 COORDINATION

A. Coordinate field work under provisions of Section 01500, including maintenance of traffic, access to private driveways, and emergency vehicle access.

B. Coordinate work with local utility companies (private and municipal) including the appropriate organization identified in Section 02205.

C. Coordinate shutdown of existing utility systems, including streets and/or driveways with local authorities. Notify affected property owners and industries at least 24 hours prior to shutdown including duration of shutdown if so approved by local authorities. Maintain one travel lane at all times.

D. Contractor must maintain one lane of traffic at all times unless approved by Owner and local police and fire departments. Sufficient notice shall be provided prior to any change in traffic pattern.

1.12 TEST REQUIREMENTS

A. Refer to Article 1.05 above.

PART 2 PRODUCTS

2.01 MATERIALS

A. Natural on-site soils, if suitable, shall be utilized.

B. Borrow materials, if required, shall be Type E-2 as specified in Section 02225.

C. Granular materials, if required, shall be as specified in Section 02225. The type, size and quantity of granular material shall be that required to prepare a compacted subgrade approved by the Engineer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine spaces to be filled beforehand and remove all unsuitable materials and debris including sheeting, forms, trash, stumps, plant life, etc.

B. Inspect backfill and fill materials beforehand and remove all roots, vegetation, organic matter, or other foreign debris. Stones larger than 12 inches in any dimension shall also be removed or broken into smaller pieces.

C. No backfill or fill material shall be placed on frozen ground nor shall the material itself be frozen or contain frozen soil fragments.

D. Spaces to be filled shall be free from standing water so that placement and compaction of the fill materials can be accomplished in “dry” conditions.

E. All underground utility installations, including culverts, shall be completed, backfilled and compacted prior to completion of subgrade.

F. Verify that traffic controls and erosion and sediment controls are in place.

3.02 PREPARATION

A. Temporary erosion and sediment controls shall be installed prior to construction of subgrade. See Section 01500.

B. Temporary drains and ditches shall be constructed as necessary to remove water from the subgrade area.

1. Temporary drainage openings in existing catch basins may be made in a manner acceptable to the Engineer. Such openings to be repaired to the satisfaction of the Engineer.

2. Contractor to prevent the entrance of debris, stones and silt from entering drainage systems, including the use of bales of hay, screens, and other desilting methods.

C. Backfilled areas shall be retested at the discretion of the Engineer.

D. Minimize traffic and compaction upon subgrade.

E. In most instances travel upon subgrade is unavoidable, and a careful assessment of degree of subgrade compaction is needed. Tilling and or removal of compacted subgrade may be needed.

F. Subgrade compacted during excavation or where erosion has caused accumulation of fine materials, this material shall be removed and/or scarified to a minimum depth of 6 inches.

G. Prior to placement of the aggregate reservoir (aggregate base course), the infiltration rate of the subgrade shall be determined by ASTM D3385 or approved alternate at the discretion of the supervising engineer. The infiltration rate shall be no less 5-30 ft/day or 50% of the hydraulic conductivity (D2434) at 95% standard proctor compaction.

H. The density of subgrade courses shall be determined by AASHTO T 191 (Sand-Cone Method), AASHTO T 204 (Drive Cylinder Method), or AASHTO T 238 (Nuclear Methods), or other approved methods at the discretion of the supervising engineer.

I. Upon completion of subgrade work, the Engineer shall be notified and shall inspect at his/her discretion before proceeding with the porous media bed installation.

3.03 INSTALLATION

A. Construct the subgrade by cutting or filling with natural on-site soils or borrow material.

1. The final subgrade surface shall be fine graded, rolled, and compacted to form a smooth, even surface.

B. The subgrade in fill section shall be placed in maximum 6-inch layers before compaction and compacted before the next layer is spread.

C. The subgrade surface shall drain to the road edges, be free of holes, bumps, wheel ruts and standing water, snow, frozen material, and organic materials prior to the placement of the next course.

1. Soft or otherwise unacceptable subgrade materials shall be removed and replaced with select on-site material acceptable to the Engineer.

2. Where no suitable on-site is available, granular materials shall be installed and compacted.

3.04 FIELD QUALITY CONTROL

A. For compaction requirements, refer to Article 1.05 and Section 02228, Table 1.

B. Tolerances - The final subgrade surface shall not vary more than ±1/2 inch from the design grade elevation at any location, parallel to the final road surface as defined by the total roadway thickness.

C. Proof Rolled - Prior to the placement of the next pavement course, the subgrade surface shall be proof rolled to locate areas of inadequate compaction or defections or soft or rutting areas requiring undercutting, with 8- to 10-ton pneumatic tire compactors.

1. Areas of inadequate compaction to be recompacted.

2. If additional rolling does not correct an area of unstable condition, then this area and soft or rutted areas shall be removed and replaced with select on-site material and compacted.

3. Where no suitable on-site material is available, granular materials shall be installed and compacted; areas inaccessible to rollers to be compacted by mechanical methods.

3.05 DUST CONTROL

A. Dust control shall be accomplished by using water, brooming, and cleaning methods.

1. Dust control shall be carried out on a daily basis including weekends and holidays. Refer to Section 01500.

END OF SECTION

SECTION 02231

AGGREGATE BASE COURSE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aggregate base course driveways and parking areas.

B. Compaction.

C. Fine grading.

D. Testing.

E. Tolerances.

1.02 RELATED SECTIONS

A. Section 01010 – SUMMARY OF WORK

B. Section 01500 - TEMPORARY FACILITIES

C. Section 01026 – LUMP SUM ITEMS

D. Section 02225 - TRENCHING

E. Section 02228 - COMPACTION

F. Section 02229 - PAVEMENT SUBGRADE

G. Section 02510 - ASPHALT CONCRETE PAVING

1.03 REFERENCES

ANSI/ASTM D1557	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb Rammer and 18 inch Drop
ANSI/ASTM D1556	Density of Soil in Place by the Sand Cone Method
ASTM D4318	Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils

1.04 DEFINITIONS

A. “Aggregate base course” or “subbase” refers to constructed materials below pavement surface and above native subgrade.

1.05 PERFORMANCE REQUIREMENTS

A. Compaction of aggregate base course shall meet the requirements of Section 02228, including Contractor’s responsibility for failed tests.

1. Compaction curves shall be developed for each type of aggregate base course material when “in-place” density tests are required by the Engineer.

1.06 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Submit aggregate base course materials.

1. Certified sieve analysis with the following quality tests:

a. Soundness.

b. Plasticity Index.

c. Elongated Particle.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Provide erosion and sediment controls. Refer to Sections 01500 and 02229.

1.08 COORDINATION

A. Coordinate field work under provisions of Section 01500, including maintenance of traffic, access to private driveways, and emergency vehicle access.

B. Coordinate work with local utility companies (private and municipal) including owners of other existing utilities for location and protection thereof.

C. Coordinate shutdown of streets and/or driveways with local authorities. Notify affected property owners and industries at least 24 hours prior to shutdown including duration of shutdown if so approved by local authorities.

D. Traffic on affected roads shall be managed in accordance with the approved traffic control plan and requirements of local and state authorities.

E. Contractor must maintain one lane of traffic at all times unless approved by MassDOT, Town, and local police and fire departments. Sufficient notice shall be provided prior to any change in traffic pattern.

PART 2 PRODUCTS

2.01 OFF-SITE MATERIALS

A. Aggregate Base Course - As described in Section 02225.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify pavement subgrade has been accepted for placement of aggregate base course.

1. Gradients, crowns, and elevations are correct.

2. Subgrade is dry.

B. Verify that traffic controls are in place.

3.02 INSTALLATION

A. Spread aggregate over prepared subgrade to a total compacted thickness as shown on the Drawings.

B. Place aggregate in 6 inch maximum layers and compact.

C. Level and contour surfaces to elevations and gradients shown.

D. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

E. Compact placed aggregate materials to achieve compaction to 95 percent of its maximum dry density in accordance with ASTM D1557.

F. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

G. Use mechanical vibrating tamping in areas inaccessible to compaction equipment.

3.03 TOLERANCES

A. Flatness - Maximum variation of 1/4-inch measured with 10-foot straight edge.

B. Scheduled Compacted Thickness - Within 1/4-inch.

C. The final base course surface shall be free from holes, bumps, waves, and corrugations.

1. Surface shall be parallel to the final surface course and have a tolerance of $\pm$3/8-inch of its design gradient and elevation.

3.04 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01039 and 01400.

3.05 PROTECTION

A. In the event the subbase is used for maintenance of traffic or is disturbed or loosened by any cause, then prior to placing of the next paving course, the subbase shall be regraded and recompacted to its finished grade and specified density.

3.06 DUST CONTROL

A. Dust control shall be accomplished by using water, brooming, and cleaning methods. Dust control shall be carried out on a daily basis including weekends and holidays. See Section 01500.

END OF SECTION

SECTION 02510

ASPHALT CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Asphalt concrete paving; top course or base course.

B. Driveways and parking areas.

C. Road shoulders.

D. Compaction.

E. Tolerances.

F. Field quality control.

G. Pavement marking.

1.02 RELATED SECTIONS

A. Section 01010 – SUMMARY OF WORK

B. Section 01026 – LUMP SUM ITEMS

C. Section 02225 - TRENCHING

D. Section 02228 - COMPACTION

E. Section 02229 - PAVEMENT SUBGRADE

F. Section 02231 - AGGREGATE BASE COURSE

1.03 REFERENCES

A. MassDOT Standard Specifications for Highways and Bridges, as amended.

B. Massachusetts Manual of Uniform Traffic Control Devices.

1.04 PERFORMANCE REQUIREMENTS

A. Paving and repaving accomplished under this contract shall meet the finished grades, elevations, and profiles shown on the Drawings.

1. Where pavement replacement is being accomplished, match the sectional profiles of the existing pavement unless otherwise stated herein or shown on the Drawings.

B. All thicknesses of pavement courses described herein or shown on the Drawings are after completion of compaction.

1.05 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Traffic control plan in accordance with the Manual of Uniform Traffic Control.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with the MassDOT Standard Specifications for Highways and Bridges, as amended to date and as they apply to the following:

1. Materials and batch plant requirements.

2. Construction procedures except as modified herein.

3. Weather and seasonal limitations except as modified herein.

B. Paving work shall be performed by a qualified paving contractor or subcontractor acceptable to the Owner and Engineer.

C. Obtain asphalt concrete materials from same source throughout project.

1.07 ENVIRONMENTAL LIMITATIONS

A. Weather and Seasonal Limitations – Asphalt concrete and bituminous surface treatments shall not be placed on wet surfaces or when it is raining or when conditions prevent the proper handling, compacting or finishing of the asphalt concrete or when the surface temperature is less than specified in the MassDOT Specifications and by the Owner.

1.08 COORDINATION

A. Coordinate field work under provision of Section 01500 including maintenance of traffic, access to private driveways, and emergency vehicle access.

1.09 SCHEDULING

A. Schedule the paving operations such that all paving necessary to provide safe and adequate maintenance and protection of traffic or for protection of previously laid courses is completed within the weather and seasonal limitations.

1. Such scheduling shall include expediting construction operations to permit paving before the seasonal limitations or by limiting the length of work to that which can be completed before the seasonal shutdown.

2. The cost of scheduling and sequencing of work to conform to the seasonal limitations shall be reflected in the bid prices for the related contract items.

1.10 MAINTENANCE

A. The Contractor shall maintain driving surfaces, free of ruts and potholes, for maintenance of traffic until temporary paving or permanent paving is installed.

1. All temporary paving and pavement replacement shall be maintained in a safe, drivable condition until the pavement wearing course is installed.

2. All subgrade, subbase, and base courses shall also be maintained in their specific finish condition prior to placement of the next course.

B. If the Contractor fails to complete the necessary paving operations prior to weather and seasonal limitations, all temporary materials and work which become necessary as a result of such failure, such as the lowering or shimming of castings and protrusions, drainage of the roadway, providing acceptable rideability, and other work needed for the adequate maintenance and protection of traffic until paving operations can be completed the following paving season, shall be at the Contractor's expense.

C. For a period of one year after issuance of the Certificate of Substantial Completion, the Contractor shall promptly patch, maintain, repair, and/or replace any pavement that settles or becomes damaged due to settlement or defective materials or workmanship.

1. Areas to be repaired shall be cut out in a square or rectangular shape to the depth matching the top course.

2. The vertical face of asphalt to be painted with asphalt emulsion prior to placing the asphalt concrete.

3. If more than top course depth of 1-1/2 inch settlement has occurred, the pavement shall be removed to the subbase and subbase and/or binder and base course restored to proper grade before restoration of the wearing course.

4. The centerline finished grade, in any case, shall be as shown on the Contract Drawings.

PART 2 PRODUCTS

2.01 ASPHALT CONCRETE

A. Base Course – Materials shall be Class I Bituminous Concrete Base Course as specified in the MassDOT Standard Specifications for Highways and Bridges latest edition as amended, Section 420.40.

B. Binder Course - The pavement binder course shall be constructed of the following type and to the widths and depths as shown on the Drawings.

1. This binder course shall be MassDOT Specification Type I-1, in accordance with Section 460, and materials M3.11.00 Class I Bituminous Concrete.

C. Pavement Wearing Course (Surface Course) - Pavement wearing course shall be constructed of the following type and to the width and depth as shown on the Drawings.

1. This wearing course shall be MassDOT Specification Type I-1, in accordance with Section 460, and materials M3.11.00 Class I Bituminous Concrete.

D. Painted Traffic Markings - Contractor shall replace all markings in accordance with local, county, or state specifications (depending on jurisdiction).

2.02 SOURCE QUALITY CONTROL

A. Provide certification of state approved job mix formulas for types to be used on this project.

2.03 PAVEMENT MARKINGS

A. Pavement markings shall be in accordance with MassDOT Standard Specifications for Highways and Bridges, as amended, Sections 860 and M7.01 Pavement Marking.

2.04 TACK COAT

A. Bituminous material for the tack coat shall be emulsified asphalt, grade RS-1 conforming to MassDOT Specification Section M3.03.0.

2.05 SEAL COAT

A. Seal coat shall be as specified in MassDOT Specification Section M3.03.3.

PART 3 EXECUTION

3.01 EXAMINATION

A. Permanent restoration of pavements shall not begin until after trench or structure backfill has been completed in accordance with the applicable specifications or until testing of the installed utility has been completed in accordance with the specifications (whichever is the longest period of time after completion of trench or structural backfill).

1. Completion of backfill shall include compaction tests to ascertain compliance with degree of compaction required as described in Section 02228.

B. If painted traffic markings on the pavement are to be interrupted by the new pavement replacement, they are to be restored using an approved traffic paint in accordance with MassDOT Standard Specifications.

C. Driveway and Parking Areas

1. Driveways and parking areas that are disturbed or damaged by the Contractor’s operations shall be restored equal to a new condition.

2. Driveway or parking area aprons which do not meet the elevation of the edge of new road pavement installed under this project shall be adjusted to meet the new pavement at a slope not to exceed 1 inch per foot with top course material of the new pavement, so that the apron conforms to the elevation of the road pavement at each location.

3. New driveways or parking areas shall be constructed as described herein and as shown on the Drawings.

4. Contractor shall completely replace driveway apron from trench to the road edge of pavement if trench is within 10 feet of road edge.

D. Road shoulders to be constructed or reconstructed as described herein and as shown on the Drawings.

1. Road shoulders that are disturbed or damaged by the Contractor's operations shall be restored equal to, or to conditions superior to that which existed prior to construction.

2. Road shoulders that do not meet the elevation of the edge of new road pavement installed under this project shall be adjusted to meet the new pavement at a slope not to exceed 1-1/2 inches per foot. Paving materials shall match existing unless otherwise shown on the Drawings.

3.02 PREPARATION

A. Where project consists of reconstructing existing streets, lower valve boxes and existing manholes to subgrade level by removing frame and cover and brick masonry.

1. Cover valve boxes and manholes with steel plates and locate with measured ties.

2. After constructing the subbases and pavement courses, and prior to placing the final top course, recover valve boxes and manholes and raise to finished grade.

B. All existing and new manholes, frames and covers, valve boxes, curb boxes, etc., shall be raised or lowered to be 1/2 inch below the new pavement grade.

1. No manhole covers or valve box covers shall be covered with paving material, or be exposed in a depression in the pavement greater than 1/2 inch.

C. Catch basin frames and grates shall be raised or lowered to be 1 inch below the new pavement finished grade.

D. Pavement Cuts

1. Pavement cuts shall be made parallel to the centerline of the trench, shall be located a minimum of 12 inches outside the backfilled trench on undisturbed subgrade and shall be in a straight line for minimum length of 100 feet between manholes or between those stations where changes in direction of the installed piping were made.

2. Where a full street width overlay is to be installed the cutbacks may follow the backfilled trench alignment.

3. Loose, torn, cut, marked up, or damaged pavement outside the cutback areas shall be removed and replaced at the Contractor’s expense and match the proposed permanent paving.

4. Pavement cuts in driveways shall be cut back 12 inches and made in a straight alignment perpendicular or parallel to the driveway and for its full width.

5. Pavement cuts in parking areas shall be cut back 12 inches and made in a straight alignment parallel to the centerline of trench.

6. Temporary pavement shall not be removed by a machine bucket with teeth so as not to destabilize base material.

E. Removal of Existing Pavement

1. Prior to placement of permanent pavement, the Contractor shall remove the temporary pavement to 12 inches beyond the edge of the trench by milling or planing methods.

2. This process shall yield a base upon which a final pavement course will be applied.

3. The Contractor shall employ equipment especially designed and manufactured for the milling or planing of pavements.

F. The resulting ground, milled or planed surface shall be thoroughly cleaned and free from dust, loose pavement material, or other material.

1. The surface shall be free from gouges, large cracks, and unsound, soft, or broken-up areas.

2. Gouges shall be made level and true by the use of a trueing and leveling course of asphalt concrete if allowed by the Engineer.

3. Cracks greater than 1/4-inch shall be cleaned and filled in accordance with this Article.

4. Unsound, soft, or broken-up areas shall be excavated and repaired in accordance with these Specifications.

5. Asphalt concrete removed by these processes shall be removed and disposed of by the Contractor.

G. Preparation of Existing Surfaces

1. Prior to placing of asphalt concrete, the existing pavement surfaces shall be cleaned including brooming, mechanical sweeping, and flushing with water such that no dust or foreign material remains on the existing surface and in accordance with MassDOT Specifications.

2. After cleaning of surface, all unsealed or inadequately sealed cracks and joints shall be cleaned with compressed air and then sealed as required under MassDOT Specifications.

3. Prior to placing of asphalt concrete, vertical faces of existing pavement, structures, curbs and gutters shall receive a tack coat as described in MassDOT Standard Specifications.

H. All new pavement where meeting existing pavement shall be butted up against a vertical face in the existing pavement.

1. This vertical face to be cut to the depth of the new pavement.

2. Where the new pavement is an overlay, the beginning and end of the top course shall be similarly butted against a vertical face.

3. The existing pavement shall be removed for a minimum length of 2 feet, as measured parallel to the direction of paving, or greater if required to eliminate any noticeable bump or to provide adequate drainage away from structures, and to the width of new pavement.

3.03 PREPARATION - RESET MANHOLE FRAMES

A. Prior to placing wearing (top) course, make final adjustments of manhole frames, catch basin frames, valve boxes and any other utility structures located in the pavement in relation to finished grade.

1. Manhole frames, valve boxes, etc. to set 1/2 inch below finished grade and parallel to finished crown.

2. Catch basin frames to set 1 inch below finished grade and parallel to finished crown.

    a. Bevel slope of wearing course (for 6-inch width) around catch basin frame.

3.04 INSTALLATION

A. Final paving of Town roads shall be installed at least 90 days but not more than 4 months after installation of temporary pavement. Permanent pavement on Town roads shall be a minimum of 3 inches of asphalt concrete in layers of 1-1/2 inches.

B. Install Work in accordance with MassDOT standards.

C. Final paving of State roads shall consist of a 1-1/2" thick overlay of the milled trench area.

D. Compact pavement by rolling. Do not displace or extrude pavement from position. Hand compact with vibratory pans and hand tamps in area inaccessible to rolling equipment.

E. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.05 PLACING AND COMPACTING

A. Placing mix in an appropriate ambient temperature and on a surface sufficiently warm to minimize the risk of excessive cooling before completion of rolling is of paramount importance. Holding the aggregate particles in place is solely the function of the film of asphalt. The asphalt cannot perform this function properly if the mix is too cool when rolled.

1. A thin course compresses very little under the roller and, as it cools quickly, it must be rolled as soon as possible.

2. The Contractor shall supply sufficient number of rollers to perform the required compaction while asphalt concrete is still hot and in a workable condition and coordinate speed of paver with rollers such that the degree of compaction required is obtained.

3. A high degree of densification is not the goal with this type of mix; the aim is firm seating and contact of the aggregate particles.

4. One or two coverages (see Table 1) with a steel-wheeled roller weighing 8 to 10 tons are sufficient. Additional rolling may be excessive, causing a break in the bond of asphalt between aggregate particles, particularly after the mix has cooled.

5. When overtaken by sudden storms, the Engineer may permit work to continue up to the amount which may be in transit from the plant at the time, provided the mixture is within temperature limits specified.

B. Paving – Placement of the surface course shall be carefully planned to assure that the longitudinal joints in the surface course will correspond with the edges of the proposed traffic lanes. They shall not be located within the normal wheel path of vehicular traffic.

1. When paving adjoining lanes, the asphalt concrete shall be laid such that it uniformly overlaps the adjacent lane 2 inches to 3 inches. The thickness of the overlap material

shall be approximately 1/4 the compacted thickness of the course, so as to result in a smooth and well compacted joint after rolling. The overlapped material shall be broomed or raked back onto the adjacent hot lane so that the roller operator can crowd the small excess into the hot side of the joint. If the overlap is excessive, the excess material shall be trimmed off so that the material along the joint is uniform. The coarse particles of aggregate in the overlap material shall be removed and wasted if deemed necessary by the Engineer.

2. Transverse joints shall be staggered a minimum of 10 feet from adjacent lanes.

C. Compaction - Asphalt concrete shall be compacted in accordance with MassDOT Specification "460.64 Compaction".

D. The required number of passes for either vibratory or static rollers, listed in Table 1, are minimum and may be increased by the Engineer. One pass shall be defined as one movement of the roller over any point of the pavement in either direction. Static roller passes shall continue until all ruts, ridges, roller marks or other irregularities are removed from the surface. The Engineer may alter the compaction procedures for small areas where the specified procedures are not practical.

TABLE 1

REQUIRED NUMBER OF PASSES (MINIMUM)

PAVEMENT COURSES	VIBRATORY ROLLER		STEEL-WHEEL TANDEM FINISH ROLLER
	VIBRATING PASSES (1)	STATIC PASSES (2)	STATIC PASSES
Base (Open graded each lift)	4	2	5
Base (Dense graded)	4	2	5
Binder (Dense graded)	4	Not required	5
Top (Dense graded all types)	2	Not required	2

(1) The required number of vibrating passes shall be reduced by one-half (1/2) for dual vibrating drum rollers when the drums are tandem and are both in the vibrating mode.

(2) The required number of static passes may be completed by the vibratory roller operating in the static mode.

E. Unless otherwise directed by the Engineer, vibratory rollers having pneumatic drive wheels shall compact the longitudinal joint by using one of the pneumatic drive wheels to overlap the joint in two passes with the drum operating static. Unless otherwise directed by the Engineer, dual vibrating drum rollers shall compact the joint by overlapping the joints in two passes with both drums operating static.

F. To prevent adhesion of the mixture to the drum(s), the drum(s) shall be kept properly moistened with water, or water mixed with small quantities of detergent or other Department approved materials. If required to prevent pneumatic tire pickup, the pneumatic drive wheels may be coated with a fine mist spray of fuel oil or other similar material. In all instances, the surface of the pavement shall be protected from drippings of fuel oil or any other solvents used in pavings, compaction, or cleaning operations.

G. If the Engineer determines that unsatisfactory compaction is being obtained or damage to highway components and/or adjacent property is occurring using vibratory compaction equipment, the Contractor shall immediately cease using this equipment and proceed with the work in accordance with the conventional static compaction procedures at no additional cost.

The Contractor should note that if he elects to use vibratory compaction equipment, he assumes full responsibility for the cost of repairing all damage that may occur to highway components and adjacent property or underground utilities.

H. Areas inaccessible to rollers shall be compacted using vibratory pans, making a minimum of two passes on each course. Hand tamps shall be used for small areas not otherwise compacted.

I. At the end of each work day, when placing top course material, the face of each paving lane shall be ended by the placing of a 2-inch x 4-inch or suitable sized board perpendicular to the pavement and shimmed with asphalt concrete to provide a driving surface such that the board and shim material can be easily removed and a vertical face retained for butting the start of the new pavement on the following work day.

3.06 DRIVEWAYS AND PARKING AREAS

A. Paving materials, type of paving, depth of various courses, etc., shall be as shown on the Drawings.

1. The driveways and parking areas shall be cut back 12 inches from outside disturbed or damaged areas as described above.

2. The minimum depth of subbase shall be 12 inches of gravel per Section 02231 and Section M2.01.7 of the MassDOT Standard Specifications.

3. The work shall include proper compaction of any necessary subbase, base course, and paving courses, in accordance with Section 02228.

B. Bituminous surfaces shall be restored with asphalt concrete matching existing, but in no case shall be less than 2 inches of binder and 1 inch of top course as specified in the applicable Articles of this Section.

C. Non-Bituminous Surfaces - Where shown on the Drawings, construct new driveways and parking areas or restore existing driveways and parking areas as follows:

1. Gravel surfaces shall be restored using screened gravel per Section 02231 of Specifications, matching existing, but in no case shall be less than 6 inches thick. The gravel shall be graded, shaped, and compacted. Loose stones shall be removed.

2. Crushed stone surfaces shall be restored matching existing stone, but in no case shall be less than 1 inch thickness of stone. Stone shall be compacted with a roller.

3.07 SEAL COAT

A. Apply seal coat to surface course and asphalt curbs in accordance with MassDOT Standard Specifications.

3.08 TOLERANCES

A. Surface Tolerance - The pavement surface shall be constructed to a 1/4-inch tolerance. If, in the opinion of the Engineer, the pavement surface is not being constructed or has not been constructed to this tolerance based upon visual observation or upon riding quality, he may test the surface with a 16-foot straight edge (furnished by the Contractor) or string line placed parallel to the centerline of the pavement and with a 10-foot straight edge or string line placed transversely to the centerline of the pavement on any portion of the pavement.

1. Variations exceeding 1/4-inch shall be satisfactorily corrected or the pavement relayed at no additional cost as ordered by the Engineer.

B. Thickness Tolerance - The thickness indicated for each of the various courses of bituminous pavement is the nominal thickness. The pavement shall be so constructed that the final compacted thickness is as near to the nominal thickness as is practical, and within the tolerances specified below.

1. Material which is part of a truing or leveling course or shim course will not be considered in pavement thickness determinations.

2. A tolerance not to exceed 1/4-inch from the nominal thickness required for the course specified under one pay item will be acceptable where the required nominal thickness is 4 inches or less. A tolerance not to exceed 1/2-inch from the nominal thickness required for the course or courses specified under one pay item will be acceptable where the required nominal thickness is over 4 inches. In addition, the sum total thickness of all bituminous mixture courses shall not vary from the total of the nominal thickness indicated on the plans by more than 1/4-inch where the total nominal thickness is 4 inches or less; or more than 1/2-inch where the total nominal thickness is over 4 inches but not more than 8 inches; and by not more than 5/8-inch where the total nominal thickness is more than 8 inches.

3.09 FIELD QUALITY CONTROL

A. The required degree of compaction for wearing or top courses is a finished product having not more than 7 percent air voids.

3.10 PROTECTION

A. Any pavement, constructed or reconstructed, which is subsequently damaged due to activity of work under this contract, shall be removed and replaced by the Contractor at no additional cost to the Owner.

B. Protect pavement from vehicular traffic until compaction is completed.

3.11 PAVEMENT MARKING

A. Pavement marking shall be in accordance with MassDOT Standard Specification 860 and M7.00, as amended. White reflectorized markings shall be type M7.01.03; yellow reflectorized markings shall be type M7.01.04.

B. Raised pavement markers shall be installed to match existing markings. Markers shall be in accordance with MassDOT Standard Detail TR.6.2. Manufacturer of markers shall be identified on MassDOT's list of qualified construction materials. Markers shall be placed no greater than 12 meters apart on either side.

END OF SECTION

SECTION 02723

STORM SEWER PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Gravity flow storm sewer, fittings and accessories, materials, and installation.

B. Connection of storm sewers to manholes, catch basins and existing storm sewers.

1.02 RELATED SECTIONS

A. Section 01010 – SUMMARY OF WORK

B. Section 01500 – TEMPORARY FACILITIES

C. Section 02205 - PROTECTION OF EXISTING FACILITIES

D. Section 02225 – TRENCHING

E. Section 02228 – COMPACTION

1.03 REFERENCES

A. Plastic Pipe

ASTM D3034	Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM F789	Type PS-46 Poly (Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings
ASTM F679	Type Poly (Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM F794	Poly (Vinyl Chloride) (PVC) Large Diameter Ribbed Gravity Sewer Pipe and Fittings
ASTM F894	Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
ANSI/ASTM D1248	High Density Black Polyethylene Pipe
ASTM D2657 and D3261	Black Polyethylene Fittings
ASTM F477	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM D3212	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D2412	External loading Properties of Plastic Pipe by Parallel - Plate Loading

B. MassDOT Standard Specifications for Highways and Bridges, latest edition (including most recent Supplement).

1.04 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data - Provide data indicating conformance to ASTM/AWWA codes, pipe material, sizes, class, dimensions, joint type, and pipe accessories.

C. Manufacturer's Installation Instructions - Indicate special procedures required to install products specified.

1.05 PROJECT RECORD DOCUMENTS

A. Submit documents under provisions of Section 01500.

B. Submit marked up record plans including record location if different from plan and actual measured length of pipe runs, connections, manholes, catch basins, rim and pipe invert elevations. Invert elevations to be the pipe invert at a point where the pipe enters or outlets a manhole or catch basin.

C. Identify and locate on record drawings unmapped utilities or services exposed during construction.

1.06 REGULATORY REQUIREMENTS

A. Conform to requirements of regulatory agencies having jurisdiction over the work.

B. Conform with permit requirements obtained by Owner.

C. Conform to applicable codes for material and installation of the work of this Section.

1.07 FIELD MEASUREMENTS

A. Prior to start of construction verify by field measurements and elevations that existing conditions are as shown on Drawings. Notify Engineer of specific differences.

B. Prior to start of construction verify by exploratory excavations that existing underground utility locations and elevations are as shown on Drawings or to confirm locating and elevation of uncharted utilities. Notify Engineer of location and elevation.

C. Prior to installation of crossing connections from catch basin confirm location and elevation of existing utilities. If required, adjust grade of pipe connection as approved by Engineer.

1.08 COORDINATION

A. Coordinate field work under provisions of Division 1, including field engineering, maintenance of traffic, access to private driveways, and emergency vehicle access.

B. Coordinate the work with local utility companies (private and municipal), including the organization identified in Section 02205 for locating existing utilities and protection thereof.

PART 2 PRODUCTS

2.01 STORM SEWER PIPE MATERIALS

A. High Density Black Polyethylene Pipe – ANSI/ASTM D1248, Grade P34, Type III, Class C and ASTM D3035; butt heat fusion type joint. Fittings shall conform to ASTM D2657 and D3261.

B. Drainage piping inside diameters shall be in accordance with the Contract Drawings and shall be corrugated high density polyethylene (HDPE) pipe, Type N-12 manufactured by ADS or equivalent as shown on the Contract Drawings. All HDPE pipe shall be suitable for H-20 loading at minimum buried depths of 24 inches.

1. Materials incorporated in the pipe shall be those which meet the requirements of MassDOT Specifications both as to quality, source of supply and manufacturer.

2. Minimum laying length shall be 5 feet for sizes 12 inches and 15 inches and 7.5 feet for sizes 18 inches and above.

2.02 PIPE ACCESSORIES

A. Fittings - Same material and class as pipe, molded or formed to suit pipe size and end design, in required tee, bends, elbows, couplings, adapters, and other configurations required in accordance with the Contract Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that trench cut, excavated base, and pipe bedding are ready to receive pipe and excavations, and pipe bedding dimensions and elevations are as shown on the Drawings.

B. All pipe, fittings and specials shall be carefully inspected in the field before lowering into the trench. Cracked, broken, warped, out-of-round, damaged joints including damaged pipe linings or coatings, or otherwise defective pipe, fittings, or specials as determined by the Engineer, shall be culled out and not installed. Such rejected pipe shall be clearly tagged in such manner as not to deface or damage it, and the pipe shall then be removed from the job site by the Contractor at his own expense.

C. Any pipe showing a distinct crack with no evidence of incipient fracture beyond the limits of the visible crack, if approved, may have the cracked portion cut off by, and at the expense of, the Contractor before the pipe is laid so that the pipe used is perfectly sound and will form an approved joint. The cut shall be made in the sound barrel at a point at least 12 inches from the visible limits of the crack.

D. If authorized, cutting of the pipe shall be done in a neat and workmanlike manner without damage to the pipe lining. All pipe cutting shall be done by means of an approved type of power cutter and in accordance with manufacturer's instructions. The use of hammer and chisel, or any other method which results in rough edges, chipped or damaged pipe, is prohibited.

3.02 PREPARATION

A. The Contractor shall have on the job site with each pipe laying crew, all the proper tools, gauges, pipe cutters, lubricants, etc. to handle, cut, and join the pipe.

B. Prior to installing the foundation, trenches shall have all water removed and all work performed in a dry trench.

C. All pipes, fittings or specials which are to be installed in the open trench excavation shall be properly bedded in and uniformly supported on pipe foundation of the various types specified in Section 02225 and shown on the Contract Drawings.

D. Flat-bottom trenches of required width shall be excavated to the necessary depth as required and maintained in accordance with Section 02225.

E. Bedding material shall be spread in maximum of 8-inch layers for the pipe foundation and each layer shall be compacted until the required total depth of bedding has been built up.

F. Suitable holes or depressions shall be provided in the pipe bedding to permit adequate bedding of bells, couplings, or similar pipe projections.

G. Compaction methods include hand tamping with T-bars, flat heads, shovel slicing, as well as mechanical compactors.

H. The Contractor shall perform his bedding operations with care to maintain line and grade.

3.03 CATCH BASIN CONNECTIONS

A. When shown on the Contract Drawings, or ordered by the Engineer, catch basin pipe connections shall be furnished and installed directly to the storm sewer pipe instead of a manhole connection.

3.04 LINES AND GRADES

A. The Contractor shall furnish all labor, materials, surveying instruments, and tools to establish and maintain all lines and grades. The Contractor shall have personnel on duty or on standby call, at all times, who are qualified to set and check grades of storm sewers and manholes as they are installed.

B. Control lines necessary for locating the work are shown on the Drawings.

C. The Contractor shall use this information to set line and use laser equipment to set line and grade. The Contractor shall check the grade of pipe by use of level instrument and rod at not more than 50-foot intervals.

D. The use of string levels, hand levels, carpenter’s levels or other crude devices for transferring grade or setting pipe are not permitted.

E. During construction, the Contractor shall provide the Engineer, at his request, all reasonable and necessary materials, opportunities, and assistance for setting stakes and taking measurements, including the furnishing of one or two rodmen or chainmen as needed at intermittent times.

F. The Contractor shall carefully preserve bench marks, reference points and stakes established by the Engineer or Owner, and in case of willful or careless destruction by his own operations he will be charged with the resulting expense to re-establish such destroyed control data and shall be responsible for any mistakes or delay that may be caused by the unnecessary loss or disturbance of such control data.

3.05 TOLERANCES

A. Pipes shall be laid to the lines and grades shown on the Drawings or as presently exists in the field.

B. Pipes shall be straight between manholes or between points of connection to structures or existing pipes.

C. The grade of the sewer between manholes and pipe length to pipe length shall not vary from the existing or design grade shown on the Contract Drawings by more than 0.15 times the grade in question, unless a change in grade has been ordered by the Engineer, in which case the same tolerance shall apply.

D. Invert elevations at any location shall not vary from the design elevations by more than 0.05 feet, unless a change in invert elevation has been ordered by the Engineer, in which case the same tolerance shall apply.

E. Any sewer grade or invert elevation which exceeds these tolerances shall be corrected by the Contractor at his own expense in a manner prescribed, and to the extent ordered, by the Engineer.

3.06 INSTALLATION

A. The Contractor shall furnish slings, straps and/or approved devices to provide satisfactory support of the pipe when it is lifted. Transportation from storage areas to the trench shall be restricted to operations which can cause no damage to the pipe or lining or coatings.

B. The pipe shall not be dropped from trucks onto the ground or into the trench.

C. Pipe laying shall proceed upgrade with spigot ends pointing in the direction of flow.

D. Each pipe section shall be placed into position in the trench on the pipe bedding in such manner and by such means required to cause no injury to the pipe, persons, or to any property.

E. Pipe shall be installed so that a pipe joint occurs not more than 2 feet from the outside face of the wall manholes or structures to which the pipe connects.

F. The pipe fittings and specials shall be firmly bedded in the pipe foundation so that the pipe barrel is uniformly supported and cradled throughout its length.

G. Blocking will not be permitted under the pipe, except where the pipe is to be installed in concrete encasement or concrete cradle.

H. Holes and depressions in the pipe foundation shall be provide to receive bells, couplings, or similar projections to assure proper bedding of the pipe barrel.

I. When the pipe is in proper position it shall be joined or coupled to the mating end of the previously laid pipe, using the required joint and using the manufacturer’s recommended assembly procedure.

J. After the pipe had been joined the pipe bedding material to be placed and spread in maximum 8-inch layers to the midpoint of the pipe.

K. Each layer compacted using mechanical compactors and hand tamping with T-bars or shovel slicing so the pipe barrel is firmly embedded in the pipe bedding material.

L. If inspection of the pipe indicates that the pipe has been properly installed as determined by the Engineer, the Contractor may then continue to spread the pipe foundation material to 12 inches over the top of pipe.

M. After completing the pipe foundation to 12 inches above the top of pipe the Contractor may then backfill the remainder of the trench in accordance with Sections 02225 and 02228 and the typical trench details shown on the Drawings.

N. The completed assembly of pipe sections shall form a storm sewer with uniform slope.

O. Live storm sewers shall be reconnected by the conclusion of the day's work so that service to the storm sewer is not interrupted.

P. At the end of each day's work or at intervals of length at the option of the Engineer, the Engineer, with the Contractor, will check the grade and inspect the pipe for alignment with lamps or mirrors. Defective work shall be dug up and reinstalled to the satisfaction of the Engineer.

3.07 CONNECTION TO EXISTING STRUCTURES

A. Where sewers are to be connected to existing manholes or other structures, and where no stub or opening has been provided for the connection, the Contractor shall cut an opening of minimum diameter through the side wall of the structure for inserting the pipe, at the required location and elevation.

B. After inserting the pipe, the annular space remaining outside the pipe shall be completely filled with an expanding joint sealer (activated oakum or compressed foam) and covered with non-shrinking watertight mortar and such joint made watertight so that leakage of water into the structure is prevented.

C. The pipe shall be positioned so that the finished or trimmed end of the pipe is flush with the inside wall surface of the structure. The mortar filler shall be struck off neatly to form a smooth, dense surface flush with inside wall surface of the structure.

D. In making connections to existing manholes or structures, care shall be taken to avoid damage to the manhole or structure or allowing debris to enter the pipelines. Any damage resulting from the Contractor's operations shall be repaired and made good by the Contractor at his own expense.

3.08 FINAL INSPECTION

A. Each section of installed storm sewer between manholes catch basins or structures will be inspected by the Engineer before final acceptance. Such inspection will be visual by sighting through the line from manhole to manhole with the aid of artificial light when the pipe is too small to be entered.

B. Any section of sewer or drain, or portions thereof, which do not comply with the inspection criteria defined above, shall be promptly corrected or repaired by the Contractor at his own expense.

C. Pipe which is cracked or collapsed shall be dug up and replaced with new pipe; pipe which is out of line or grade shall be dug up and relayed to the correct line and grade.

D. Connecting pipes which protrude into the line shall be dug up and the connection remade, or the protruding portion of the connecting pipe shall be trimmed back flush with the wall of the main sewer, if the main line can be entered.

E. Deposits of dirt and debris shall be flushed with water through to the downstream manhole and removed.

F. At points of leakage, the pipe shall be dug up and replaced or repaired with approved repair clamp couplings (stainless steel Type 304 with stainless steel bolts and nuts or cast iron coupling with stainless steel bolts and nuts) so as to permanently stop the leak in a manner which shall receive the prior approval of the Engineer.

G. All manholes shall be watertight. All joints between precast wall sections, between cast iron frame and brick, and between brick units themselves shall be neat, continuous, and flush with the adjacent surfaces. Dirt and debris shall be removed from all manholes.

END OF SECTION

SECTION 02724

CATCH BASINS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory design and manufacture of catch basin sections, frames, and grates.

B. Quality assurance and control.

C. Field installation of catch basins.

D. Connection to sewer piping.

E. Installation of frames and grates.

1.02 RELATED SECTIONS

A. Section 02225 – TRENCHING

B. Section 02723 - STORM SEWER PIPING

1.03 REFERENCES

A. Catch Basin Materials

ASTM A36	Structural Steel
ASTM A48	Gray Iron Castings
ASTM A123	Zinc (Hot-Dipped Galvanized) Coating on Iron and Steel Products
ASTM A496	Deformed Steel Wire Fabric for Concrete Reinforcement
ASTM A536	Ductile Iron Castings
ASTM A615	Deformed and Plain Billet Steel Bars for Concrete Reinforcement
ASTM C62	Building Brick
ASTM C90	Hollow Load Bearing Concrete Masonry Units
ASTM C144	Aggregate for Masonry Mortar
ASTM C150	Portland Cement
ASTM C207	Hydrated Lime for Masonry Purposes
ASTM C443	Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gaskets
ASTM C478	Precast Reinforced Concrete Manhole Sections

B. MassDOT Standard Specifications for Highways and Bridges, latest edition (including most recent Supplement).

1.04 SUBMITTALS

A. Submit shop drawings of typical manufactured wall sections and bases proposed for this project, including joint design and related details for field assembly. Include certification of conformance with Contract Documents and appropriate ASTM Specification.

B. Submit shop drawings of typical frames and grates proposed for this project.

C. Submit copy of calculations by a Massachusetts licensed professional engineer for design of square and/or rectangular-shaped wall sections and bases proposed for this project.

1.05 QUALITY ASSURANCE

A. Precast reinforced concrete wall sections and bases for catch basins shall be manufactured in a plant approved by Engineer and the MassDOT for manufacture of concrete pipe and other precast concrete products.

B. Aggregates used in producing concrete shall be from MassDOT approved sources.

1.06 QUALITY CONTROL INSPECTION

A. The quality of all materials, the process of manufacture and the finished sections shall be subject to inspection by the Engineer. Such inspection may be made at the place of manufacture, and/or at the work site after delivery. Sections shall be subject to rejection at any time on account of failure to meet the Specification requirements, even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the site shall be tagged and removed from the job site immediately. All sections which have been damaged after delivery will be rejected, or if already installed, shall be repaired or removed and replaced entirely at the Contractor's expense as directed by the Engineer.

B. All sections shall be inspected for general appearance, dimensions, soundness, etc. The surface shall be dense, close-textured and free of blisters, cracks, roughness, exposure of reinforcement, damaged joints, and dimensional distortions or other irregularities.

C. Cast iron frames and grates shall be manufactured true to pattern and shall be of uniform quality, free from blowholes, porosity, hard spots, shrinkage distortion, or other defects. Grates shall seat uniformly in any position in the frame without rocking.

D. Fabricated steel frames and grates shall be free from warping or other dimensional distortions. All exposed surfaces shall be free from blowholes, blisters, or holidays.

PART 2 PRODUCTS

2.01 CIRCULAR CONCRETE BASES

A. Design and manufacture of precast concrete bases shall conform to the requirements of this Section and ASTM Specification C478. Bases shall conform to the dimensions indicated on the Drawings, and the horizontal joint at the top of the base shall be compatible with that of the precast wall section.

B. Precast bases shall be manufactured to contain openings in the wall of minimum size, to receive the ends of the installed sewer pipe. Openings shall be accurately positioned to conform with line and grade of the connecting sewer.

2.02 CIRCULAR CONCRETE WALLS AND CATCH BASIN TOPS

A. Design and manufacture of precast concrete walls shall conform to the requirements of this Section and ASTM Specification C478.

B. Precast concrete walls shall be made up using circular pipe sections and eccentric cone sections if manhole steps are required and concentric cone sections where steps are not required. The total height of precast wall required for each catch basin shall be determined in the field, and shall be such that the vertical distance between the top of the assembled precast units and the bottom of the installed frame is a minimum of 4 inches and a maximum of 12 inches, to allow for masonry work or precast concrete grade rings.

C. If required, manhole steps shall be cast integrally with or grout solid into the precast wall units as specified in a later article. No lifting holes are permitted in the precast units.

D. Unless shown otherwise on the Drawings, all tongue-and-groove (or male and female) joints in the precast wall, including the joint at the top of the base, shall be made up of using the "Snap-On" type O-ring gasket, and shall conform to ASTM Specification C443; except that joint taper shall not exceed 3-1/2 degrees. The precast sections shall be provided with a special groove (cast into the male end) to receive and hold the gasket in position during joint assembly. After joint assembly, the gap between sections shall be packed on the inside and outside with Anti-Hydro "Axpandcretes," Masterflow 713 by Master Builder; or Five Star Grout by U.S. Grout Corp., and shall be troweled smooth so that no projections remain on the inside. There shall be concrete to concrete bearing between the various sections, and the gasket shall not support the weight of the section. Joints may also be made up using Butyl joint sealant rope material in lieu of the O-ring gasket.

E. If required, precast reinforced concrete slab tops for catch basins shall be manufactured in accordance with ASTM Specification C478, except that thickness and reinforcing shall be as shown on the Drawings. Openings shall be of the proper diameter to receive the frame specified. Slab tops shall be set in a full bed of mortar.

2.03 SQUARE OR RECTANGULAR CONCRETE BASES AND WALL SECTIONS

A. Design and manufacture of precast concrete bases and wall sections shall conform to requirements MassDOT Specifications Section 201.

B. Concrete shall conform to the following mix design:

28-day compressive strength, psi	4000 (minimum)
Maximum aggregate size, per ASTM C33	#57
Minimum cement content, lbs/cy	606
Maximum water/cement ratio, by weight	0.46
Entrained air content, by volume	6% ($\pm$1%)
Slump, adjust as necessary, but not exceeding	3 inches

C. Portland cement shall be Type I or II, conforming to ASTM Specification C150 and be free from deterioration or contamination.

D. Aggregates shall conform to ASTM Specification C33, be properly graded to meet Mix "A" requirements, and be free from deleterious substances.

E. Reinforcing steel shall conform to ASTM Specification A496 (Grade 60) for wire fabric, and to ASTM Specification A615 (Grade 60) for deformed bars.

F. Forms shall be of accurate and rigid construction so as to yield units with uniformly smooth and dense finish, free from honeycombing and other deformities.

G. Measuring, mixing, placing, vibrating, and curing of concrete for precast units shall be accomplished in suitable enclosed facilities to provide quality control throughout the entire process.

H. The manufacturer shall provide adequate testing facilities at his plant to make, cure and break compression test cylinders in accordance with ASTM C31 and ASTM C39. Records of these tests shall be made available to the Engineer upon request.

I. Commence stripping of forms only after average concrete strength has reach 2,500 psi. Handle units in manner consistent with design loadings to avoid structural cracks, rupture, or other damage.

J. If permitted, minor chips, cracks, spalls, or honeycombs incurred in storage, shipment, and/or erection shall be patched only by the manufacturer to the Engineer's satisfaction.

2.04 FRAMES AND GRATES (CAST IRON)

A. Frames and grates shall be of the make, style, opening, height, weight, and other designation specified herein and shown on the Drawings.

B. Material shall be gray cast iron conforming to ASTM Specification A48, Class 30; or shall be ductile cast iron conforming to ASTM Specification A536, Grade 60-40-18.

C. Unless otherwise scheduled, frames and grates shall be heavy duty design, and contain machined bearing surfaces to prevent rocking and rattling under traffic loads.

D. Surface finish shall be smooth and well-cleaned by shot-blasting or by some other approved method.

2.05 FRAMES AND GRATES (FABRICATED STEEL)

A. Frames and Grates shall be of the make, style, opening, height and other designation specified herein and shown on the Drawings.

B. Frames, grates and appurtenant parts shall be fabricated from steel conforming to ASTM Specification A36. Galvanizing shall be in accordance with ASTM Specification A123, Type I.

C. Unless otherwise scheduled, frames and grates shall be of heavy duty design, and be non-rocking or rattling under traffic loads.

D. Frames shall be of welded fabrication utilizing minimum 3/8-inch thick steel. Grates shall be recticuline pattern made of alternate straight (or carrying) bars and shallower crimped (or bracing) bars, riveted or welded together with all top edges of bars flush. Edges of grates shall be bonded with bars welded to ends of bearing at every bar.

E. After fabrication, frames, grates and appurtenant parts shall be hot-dipped galvanized. Frames and grates shall lie in a flat plane after galvanizing without warping or other dimensional distortions.

2.06 MASONRY WORK AND GRADE RINGS

A. Where necessary or indicated on the Drawings, catch basin frames shall be supported by and adjusted to finished grade using solid brick masonry or precast concrete grade rings. Grade rings shall conform to ASTM Specification C478 and be set in a full bed of mortar.

B. Masonry - in accordance with the following ASTM specifications:

BRICK	C62; Grade “SW”
CONCRETE BLOCK	C90; Grade “U-I”
PORTLAND CEMENT	C150; Type I or III
SAND	C144
LIME	C207; Type “N”
WATER	Clear and free from all deleterious materials
MORTAR MIX	C207; Type “M” (min. 2500 psi strength) 1 part cement; 1/4 part hydrated lime; 3 parts sand

2.07 MANHOLE STEPS

A. No manhole steps are to be provided.

2.08 PIPE CONNECTIONS

A. Sewer connections between catch basins and pipes shall be made by inserting the ends of the pipe through the precast opening of the base or wall section, as indicated on the drawings. Provide an elastomeric waterstop gasket around the exterior of all plastic, polyethylene, or PVC pipe to aid in confining the mortar in the annular space.

B. The ends of the pipe shall be accurately positioned in the openings, properly secured against movement, and the remaining annular space between the pipe wall and the base completely packed with Anti-Hydro “Axpandcretes,” Masterflow 713 by Master Builders, or Five Star Grout by U.S. Grout Corp.; or equal. Before the grout has set, the Contractor shall recheck invert elevations of the ends of the pipe, and perform any adjustments which are necessary to establish the required line and grade of the sewer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subgrade elevations for catch basin bases are correct and excavation is dewatered.

B. Verify that rejected (tagged) units have been removed from site.

3.02 PREPARATION

A. Provide foundation mat of Type D-3 run-of-crusher stone (3/4-inch crushed stone) per Section 02225 to support catch basin base. Mat shall be 6 inches minimum depth and shall bear on sound undisturbed earth; excavate and remove subgrade material as necessary to reach sound stratum.

B. Mat size shall be a minimum of 2 feet greater than outside dimensions of base, and shall be compacted to a uniform, level surface.

3.03 INSTALLATION

A. Precast bases shall be accurately located and uniformly supported on the foundation mat in a level position.

B. Install subsequent wall sections, as required, in their properly oriented position. Join together each section in conformance with manufacturer's instructions, using prescribed joint gaskets or joint materials. There shall be concrete-to-concrete bearing between the various sections, and gasket material shall not support the weight of the section.

C. Precast units shall be laid-up plumb and level to form a vertical catch basin structure at each location.

D. After joint assembly, pack the gap between sections on inside and outside with grout using Anti-Hydro "Axpandcretes," Masterflow 713 by Master Builders, or Five Star Grout by U.S. Grout Corp. Trowel grout flush with adjacent surfaces on the inside.

E. Perform masonry work to support frames at top of catch basin structures as follows:

1. Perform masonry work in accordance with Article 2.06.

2. Brick shall be wetted just prior to being laid. Brick shall be laid in full mortar bed, and mortar for the bed shall be spread to a uniform thickness (not furrowed). All interior joints shall be filled solidly before laying the next course, and all vertical joints shall be shoved tight. All brick is to be laid true to lines, with both sides plumb. Bed joints shall be 3/8-inch to 1/2-inch thick. Mortar on inside and outside joints shall be struck off flush with wall surface and joints shall be so planned that sources will come level with and conform to the overall dimensions required. The interior and exterior face of the brick to be finished smooth with non-shrink grout. No masonry work shall be done when temperature is below 40 degrees F. Protect work with coverings, plastic envelopes, etc. Maintain temperature inside such coverings at minimum 45 degrees F for three consecutive days.

F. Frames shall be firmly seated in full bed of mortar and be positioned to conform to the adjacent finished grade or to the specific elevation shown on the Drawings. Frames to be set parallel to surface slopes. Grates shall seat uniformly in any position in the frame without rocking. In pavements and shoulder areas, set frame 1-inch below finished grade.

3.04 BACKFILLING

A. Carry out backfilling operations in conformance with Section 02225; being careful to provide full support under connecting pipes using compacted bedding material specified for the sewer piping.

B. All visible leaks shall be permanently sealed in an approved manner.

END OF SECTION

SECTION 02980

SITE REHABILITATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Materials and installation requirements and restoration of disturbed site areas.

B. Topsoil, fertilizer, seeding, mulching, and planting.

C. Site rehabilitation of walls, fences, ditches, drains, culverts, drives, posts, small structures, and other artificial features.

D. Site modifications and development to meet new conditions.

E. Removal and disposal of all excess materials, equipment, trash, and debris used for, or resulting from, the work included in this Section.

1.02 RELATED SECTIONS

A. Section 01010 – SUMMARY OF WORK

B. Section 02225 - TRENCHING: Basic site restoration.

1.03 REFERENCES

A. The American Association of Nurserymen Standards.

1. ANSI Z60.1-2004, “American Standard for Nursery Stock.”

B. Soil Conservation District of the Department of Agriculture.

1.04 QUALITY ASSURANCE

A. Areas and Features to be restored

1. All areas, including natural features occurring thereon, which are damaged or disturbed by the Contractor’s operations, shall be restored, repaired or replaced to the same or superior condition which existed prior to construction or as modified herein or as shown on the Drawings.

2. Artificial features shall be restored equal to a new condition or as modified herein or as shown on the Drawings.

1.05 SUBMITTALS

A. Submit under provisions of Section 01010.

B. Submit the source nursery for all plantings.

C. Topsoil - Submit sieve analysis and characteristics of topsoil as listed in Part 2.

D. Submit seed mixture data.

1.06 QUALIFICATIONS

A. All planting material to be furnished from a nursery which meets the requirements of the American Association of Nurserymen and or an accredited grower of wetland plants.

1.07 PACKING AND SHIPPING

A. All seed furnished for this project shall be delivered in standard size unopened bags of the vendor, showing weight, mixture, vendor's name, and guaranteed analysis.

1.08 STORAGE

A. Seed shall be properly stored in dry conditions at the site of the work.

1. Any seed damaged or spoiled during storage shall be replaced by the Contractor.

1.09 ENVIRONMENTAL CONDITIONS

A. Topsoil shall not be delivered or placed in a frozen or muddy condition.

B. Seeding is to be done on dry or moderately dry soil in upland areas and on exposed mud surfaces or moderately dry soil in created wetland biofilter areas.

1. Seeding is to be done when the wind velocity does not exceed 5 miles per hour.

1.10 SCHEDULE

A. The Contractor shall do all seeding during the periods of May 1st to June 15th, or August 15th to October 1st.

1. Seeding may be conducted under unseasonable conditions without additional compensation, and at the option and full responsibility of the Contractor.

1.11 GUARANTEE

A. Any new, reestablished, replaced or disturbed plant material that fails to respond properly within the one-year guarantee period shall be replaced at the Contractor's expense.

B. Any new, reestablished, replaced, or disturbed surface treatment (paving and asphalt) that cracks, deforms, or deviates from the installed grade within one year of the installation shall be replaced at the Contractor's expense.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil

1. Topsoil shall be naturally occurring, fertile, friable agricultural soil capable of sustaining vigorous vegetative growth.

2. Topsoil shall have at least 3 percent by weight of fine textured stable organic material, and no greater than 6 percent organic material, unless accepted as an alternative material by the Engineer. Muck soil shall not be considered topsoil.

3. Topsoil shall have not less than 20 percent fine textured material (passing the No. 200 sieve) and not more than 15 percent clay. Topsoil shall be free of stones over 2 inches in diameter, large roots, sticks, trash, noxious weeds such as nut sedge and quack grass, and other foreign substances. Topsoil shall contain less than 52 percent sand.

4. The pH of topsoil shall be between 6.0 and 7.0.

5. Topsoil shall not contain any wood chips or other processed wood products, nor shall topsoil have been treated with soil sterilants or herbicides, or contain soluble salts greater than 500 ppm.

6. Topsoil may be from previously excavated, stockpiled, and protected materials, provided the materials meet the requirements for topsoil.

B. Stone Riprap

1. Bedding stone shall be 3/4- to 1-inch size clean crushed or washed stone material from an approved quarry source.

2. Stone material shall be 4- to 6-inch size washed gravel cobbles or blocky broken/crushed stone material. Only material from a single source shall be supplied for the work of the project.

3. Filter fabric shall be a roll geotextile that will pass water but retain sediments and silt material. Submit manufacturer's specifications for Engineer's approval of material proposed for use.

C. Fertilizer

1. General Fertilizer

a. Fertilizer shall be a complete, partially organic, commercial 10-6-4 fertilizer.

b. All fertilizer shall contain a minimum of 10 percent nitrogen, 6 percent available phosphorous and 4 percent potash.

c. Other commercially available fertilizers, such as 20-10-10 and 12-6-6, may be utilized provided that spreading rates are adjusted to provide the aforementioned minimum requirements for nitrogen.

2. Plant Fertilizer - As recommended by local Soil Conservation District of the Department of Agriculture for the type(s) of soil(s) and plant(s).

D. Seed

1. All seed shall be fresh, recleaned, and of the latest crop year.

2. Each component shall meet or exceed the minimum State and Federal requirements for purity and germination for that component.

3. The weed content of each component shall not exceed 0.1 percent.

4. The following seed mixtures shall be used:

For Sunny Areas: 40 percent triplex Kentucky Blue, 20 percent Creeping Red Fescue, 20 percent triplex Rye, and 20 percent Annual Rye.

For Shady Areas: 25 percent Hard Fescue, 20 percent Creeping Red Fescue, 25 percent triplex Rye, 10 percent Rough Bluegrass, and 20 percent Annual Rye.

a. The previous blends are for spring and fall, over bare ground. Any overseeding either in the sun or shade will have the annual rye replaced with chewings or creeping red fescue.

b. Variations may be recommended by qualified personnel, but shall not be used without approval by the Engineer.

E. Mulch for Seeded Areas - Mulch shall be oat, wheat or rye straw, free from noxious weeds and other materials which may interfere with the establishment of a healthy stand of grass.

F. Mulch for Tree or Shrub Plantings - Mulch shall consist of dry, clean, shredded hardwood bark.

G. Plantings - Trees, shrubs, vines, ground cover, and other vegetation to be replaced or installed new as specified shall meet the requirements of the American Association of Nurserymen.

1. Classifications of plants, dimensions, planting procedures, etc., shall conform to ANSI Z60.1, 1-2004 “American Standard for Nursery Stock.”

H. Tree wrapping shall be 8 ounce first quality burlap.

I. All disturbed existing pavement markings and striping shall be replaced to original or better condition at the expense of the Contractor.

J. Curbing and Berms – All disturbed existing curbing and berms, including Cape Cod berms, shall be replaced to original or better condition and material at the expense of the Contractor.

PART 3 EXECUTION

3.01 EXAMINATION

A. Determine that surface areas are ready for finish grading and/or to receive topsoil and seeding or plantings.

1. Remove trash, debris, large stones, and other foreign materials from surface areas to be restored or rehabilitated.

2. Topsoil shall be free of frozen fragments, debris, large stones, and other foreign materials.

3.02 PREPARATION

A. Finish Grading

Areas requiring topsoil shall be rough graded to within 4 inches of finished grade to provide a minimum thickness after normal compaction of 4 inches of topsoil at all locations.

1. All such areas, whether in cut or fill, shall be loosened to a depth of 12 inches, be parallel to finished grade as shown or required and shall be free of all stones larger than 4 inches, large roots, rubbish, and other deleterious material.

3.03 INSTALLATION

A. Areas to be Developed and or Restored

1. The Contractor shall perform all required grading, topsoiling, fertilizing, seeding, planting, mulching, and maintenance of areas, all in accordance with the Drawings and as specified herein.

2. Unless shown otherwise on the Drawings, the entire unpaved area within the grading limits and within the overall areas excavated and backfilled shall be seeded in accordance with this section.

3. New landscaping work and artificial features, if any, are shown on the Drawings and specified elsewhere.

4. All seeding shall be done by hydroseeding only.

B. Existing trees, plants, shrubs, saplings, ground cover, vines, etc., which are disturbed or damaged by the Contractor’s operations shall be replaced with new seeding and/or plant materials.

3.04 RIPRAP

A. Grade and prepare rough grade for riprap slopes and water flow areas.

B. Install filter fabric over rough graded surfaces.

C. Install bedding stone in one lift on filter fabric and level and compact layer. Install riprap stone over bedding stone in one lift so that it shall be at least 12 inches in depth. Take precautions to not break through bedding stone or displace fabric material.

D. Finished surface of riprap stone shall be roughly leveled to follow the finished slope by machine or hand work.

3.05 TOPSOILING

A. Topsoil shall be furnished and spread across the required areas to a loose depth of approximately 4 to 6 inches.

1. Stockpiled topsoil may be used if it is acceptable to the Engineer.

2. In the event this topsoil is not satisfactory, or is inadequate to cover the required areas, the Contractor shall furnish the required amount of satisfactory topsoil from approved sources off the site.

B. The loose topsoil shall be uniformly compacted with a light hand roller so that it shall have a final depth of not less than 4 inches.

1. When finished, the topsoiled surface shall conform to the finished grades and shall have a generally smooth surface at the time of seeding.

2. Any irregularities shall be corrected before the fertilizer and seed are placed.

3. Any subsequent settlement or displacement of the topsoil shall be restored to an acceptable condition at the Contractor's expense.

3.06 FERTILIZING

A. The fertilizer shall be uniformly spread over area that will be mowed by a mechanical spreader at the rate of 25 lbs. per 1,000 square feet. Created wetland biofilter areas that will be allowed to grow in a natural condition will not be fertilized.

1. The fertilizer shall be incorporated into the upper 2 inches of topsoil immediately after spreading.

2. Other commercial fertilizers, such as 20-10-10 or 12-6-6 may be used at rates adjusted to provide the same quantity of nitrogen per 1,000 square feet.

3.07 SEEDING

A. The process of spraying grass seeds, water, fertilizer, and mulch known as hydro-seeding or hydro-mulching shall be utilized provided that water hazards are minimized.

1. Presoaking, the spraying of the materials and watering after spraying shall be in strict accordance with the manufacturer's instructions.

2. All materials, protection, maintenance, etc., shall be in conformance with this specification.

3. The mulch may be a wood fiber material compatible with the spray equipment.

4. Watering - Daily for two weeks, then weekly for six weeks.

3.08 PLANTING

A. New plant materials shall be as listed and displayed on the Drawings. Plant materials that are to replace existing plant materials shall be of the same genus and species as the original, and shall be placed in the same location as the item being replaced.

B. Plants shall be set plumb and true.

1. Shape planting area to form a shallow saucer around new shrubs and trees.

C. For all trees of 2-inch caliper or larger, wrap with tree wrap.

1. Begin at base of tree and work upward to the first branches.

2. Tie the burlap wrap with cord (no synthetic cord or wire) at 2-foot intervals and at the bottom and top.

3.09 MULCHING AND PROTECTION

A. The Contractor shall protect and maintain seeded areas to assure a full even stand of grass.

1. Immediately after seeding and rolling, the Contractor shall apply oat, wheat, or rye straw, free from noxious weeds, as mulch, to a loose depth of about 1 inch.

2. The Contractor shall perform all watering and reseeding as necessary for a minimum of 30 days and until final acceptance of the Contract, to ensure the establishment of a uniform stand of specified grasses.

3.10 MAINTENANCE AND GUARANTEE

A. Any portion of seeded areas failing to produce a full uniform stand of grass from any cause shall be reseeded at full rate and refertilized at one-half rate and protected and maintained until such a full stand has been obtained.

B. Plantings shall be maintained by the Contractor for one year. Maintenance shall include watering during dry periods, pruning of broken or dead branches, and weeding of noxious and invasive weed growth impacting plant establishment.

C. New plantings shall be guaranteed for one year from the date of planting completion and acceptance of the completed work. At the completion of the guarantee period the Contractor shall replace all dead, dying, or disfigured plants with new plants of the size and species as originally specified for the project and shall then request an inspection and acceptance of the work.

D. New paving shall be guaranteed for one year from the date of final paving completion and acceptance of the completed work. At the completion of the guarantee period the Contractor shall replace all cracked, deformed, or paving that has deviated from the installed grade as originally specified for the project and shall then request an inspection and acceptance of the work.

3.11 SPECIAL CONDITIONS

A. Damaged Trees - Vegetation which has been damaged by construction activities and deemed non-functional by the Owner or engineer, shall be replaced by the Contractor with vegetation of the same caliper, genus, and species at no additional compensation to the Contractor.

B. Damaged Pavement and Non-Paved Driving Surfaces - Pavement and unpaved driving surfaces which have been damaged by construction activities and deemed non-functional by the Owner or engineer, shall be replaced by the Contractor with pavement or similar damaged material of the same caliper, at no additional compensation to the Contractor.

C. Damaged Curbing and Berms – Curbing and berms, including Cape Cod berms, which have been damaged by construction activities and deemed non-functional by the Owner or engineer, shall be replaced by the Contractor with curbing and/or berms of the same material at no additional compensation to the Contractor.

D. Damaged Pavement Markings – Pavement lines and striping which have been damaged by construction activities and deemed non-functional by the Owner or Engineer shall be replaced by the Contractor with striping and or markings of the same color, size, type, and thickness as the existing markings and striping at no additional compensation to the Contractor.

E. Damaged Miscellaneous Items – Mailboxes, signs, other landscaping items, patios, walkways and all other site features within the project limits shall be replaced by the Contractor at no additional compensation to the Contractor.

END OF SECTION

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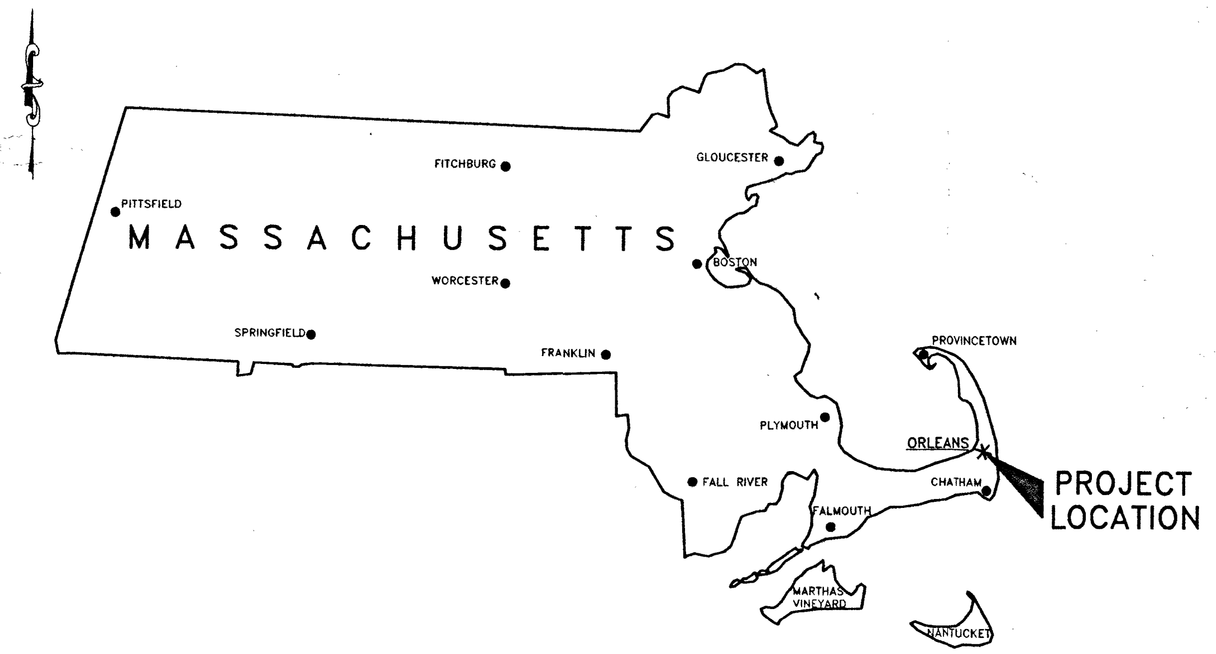
ATTACHMENT C

The Stop & Shop Supermarket Company, Cranberry Cove Plaza, Store No. 026, Orleans, MA
Septic System Upgrade Bioclere System Addition, by Woodard & Curran, Inc., September 1995

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THE STOP & SHOP SUPERMARKET COMPANY
CRANBERRY COVE PLAZA STORE No. 026
ORLEANS, MASSACHUSETTS

SEPTIC SYSTEM UPGRADE
BIOCLERE SYSTEM ADDITION



DRAWING INDEX

1 – SITE PLAN

2 – SITE LAYOUT DETAIL

3 – BIOCLERE SYSTEM DETAIL

4 – COFFERDAM DESIGN

SEPTEMBER 1995

WOODARD & CURRAN INC.

ENVIRONMENTAL SERVICES

PORTLAND, ME • BANGOR, ME • DEDHAM, MA

BRADLEES
DEPARTMENT STORE
FIN. FLR. ELEV. 12.2'

STOP & SHOP
SUPERMARKET

DRAINAGE POND

POND

PAPA
GINO'S

ROUTE 6A

TO ELECTRIC SERVCE/
CONTROL AREA DESIGNATED
BY OWNER (ADJACENT TO
EXISTING PUMP PANEL).

SANITARY

MH

EXIST. ELEC.
PULL BOX

6" PVC

NEW ELEC. PULL
BOX (POWER)

NEW ELECTRIC PULL BOX
(INTRINSICALLY SAFE WIRES)

LIGHT POST
(TYP.)

13,000 GAL.
GREASE TRAP

INLET

18" CMP

CB

24" CMP

30" CMP

20" CMP

CURBING (TYP.)

FIELD LOCATE CONDUITS WITH
MINIMUM NUMBER OF OFFSETS.
FOR WIRING SEE SHEET 2.

EDGE OF
PAVEMENT

8,000 GAL.
SEPTIC TANK

SMH

21,000 GAL.
SEPTIC TANK

NEW ELECTRIC PULL BOX
(INTRINSICALLY SAFE WIRES)

NEW ELEC. PULL
BOX (POWER)

FOR CONT.
SEE SHT. 2

PROVIDE 25' X 100'
GROUNDWATER RECHARGE
AREA. SEE SHT. 2 FOR DTL.

NEW 1-1/4" DIA.
RECYCLE FORCE
MAIN TO SMH

VALVE
CHAMBER

PUMP
CHAMBER

NEW 2" PVC
FORCE MAIN

NEW 4" PERF. SCH 80
PVC DISTRIBUTION LINES
(TYP. OF SEVEN EACH BED)

NEW 4" SCH 80
PVC VENT PIPE

(4) NEW 4"SCH 80
PVC FORCE MAINS

LEACHING
FIELD No.1

LEACHING
FIELD No.2

LEACHING
FIELD No.3

LEACHING
FIELD No.4

NEW 6' HIGH CHAIN LINK FENCE

NEW BIOCLERE SECONDARY TREATMENT UNIT
UNIT No.1
UNIT No.2

NEW SAMPLING MANHOLE

NEW ELEC. JUNC. BOX

NEW 6"PVC
TREATED
EFFLUENT

NEW
4" SCH 80
PVC VENT

NEW DISTRIBUTION
BOX (TYP. OF 4)

NEW 4" SCH 80 PVC
PIPE (TYP. OF SEVEN
FOR EACH BED)

EDGE OF
LEACHING
FIELD (TYP.)

100 FT. BUFFER ZONE

BORDERING VEGETATED WETLANDS

STREAM

REMOVE & REPLACE LIGHT
POLE & POWER CABLE TO IT.

SUBSURFACE DISPOSAL SYSTEM
DESIGN CRITERIA

1. WATER USE : AVERAGE ANNUAL FOR 1991–1994 = 5,000 GPD
2. DESIGN FLOW : 2X ANNUAL AVG. = 2 X 5,000 GPD = 10,000 GPD
3. TOTAL SEPTIC TANK VOLUME REQUIRED : 1.5 X 10,000 = 15,000 GALLONS
4. EXISTING SEPTIC TANK VOLUME = 28,000 GALLONS
5. PERCOLATION RATE :
   PERCOLATION TESTS DONE 4/11/88 1.67MIN./IN. USE 2 MIN./IN.
6. EFFLUENT LOADING RATE :
   A.) ALLOWABLE LOADING RATE = 0.74 GPD/S.F.
7. LEACHING AREAS :
   A.) PROVIDE (4) FOUR SEPARATE BEDS
   EACH 42' X 88' LONG OR 3,696 S.F. IN AREA.
   B.) TOTAL LEACHING AREA PROVIDED = 4 X 3,696 =14,784 S.F.
8. EFFLUENT LOADING RATE :
   A.) DESIGN FLOW = 10,000 GPD
   B.) LEACHING AREA = 14,784 S.F.
   C.) LOADING RATE = 0.68 GPD/S.F.
9. PUMPING CAPACITY :
   A.) PROVIDE (2) TWO SETS OF DUPLEX PUMPS.
   ONE PUMP DEDICATED TO ONE FIELD.
   B.) DOSAGE REQUIRED = 1' IN 15 MINUTES OVER LEACHING AREA
   OF EACH FIELD.
   C.) DOSING VOLUME = AREA OF EACH FIELD X 1" PER DOSE =
   3,696 S.F. X 1/12 X 7.48 = 2,304 GALLONS.
   D.) PUMPING RATE = 2,304 / 15MIN. = 154 GPM.
   E.) EXISTING PUMPING CHAMBER VOLUME BETWEEN OFF FLOAT
   AND INLET TO CHAMBER = 7,500 GALLONS.
10. PROVIDE TWO (2) – 15 GPM PUMPS AT 20 FT. TDH.
    FOR BIOCLERE FEED.

LEGEND

18" CMP	EXISTING PIPING WITH PIPE IDENTIFICATION
	NEW PIPING
-E-	EXIST. UNDERGROUND ELECTRIC CONDUIT
-E-	NEW UNDERGROUND ELECTRIC CONDUIT
	LIQUID FLOW DIRECTION ARROW
	PROPERTY LINE
	WATER FEATURES
	BUILDING

NOTE: REVISED LEA DRAWING No.1

9/95	BIOCLERE SYSTEM ADDITION
DATE	ADDITION OR REVISION

DES.BY: OK	DR.BY: RDC	CK.BY: OK

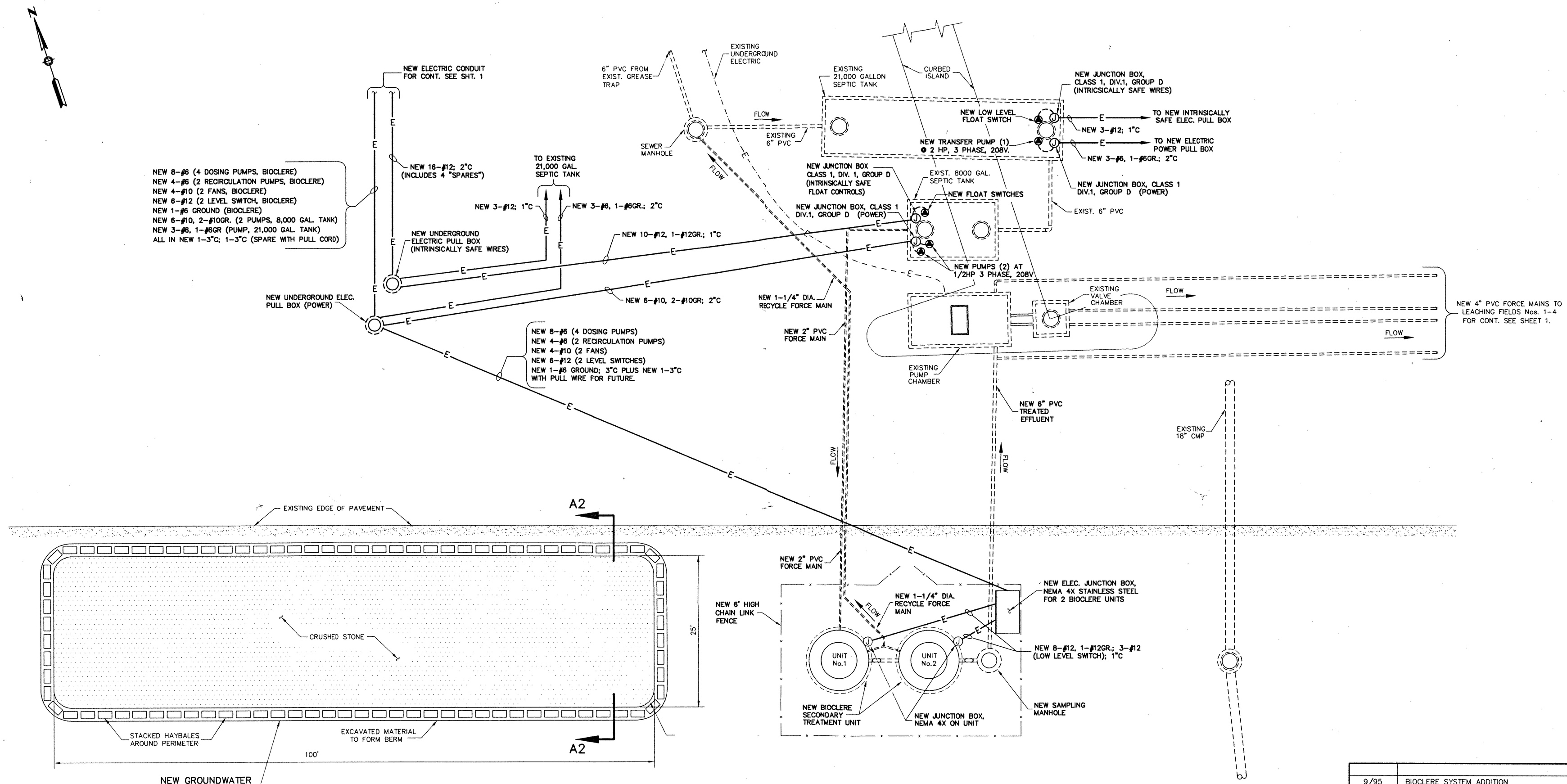
THE STOP & SHOP SUPERMARKET COMPANY
CRANBERRY COVE PLAZA STORE No. 026
ORLEANS, MASSACHUSETTS

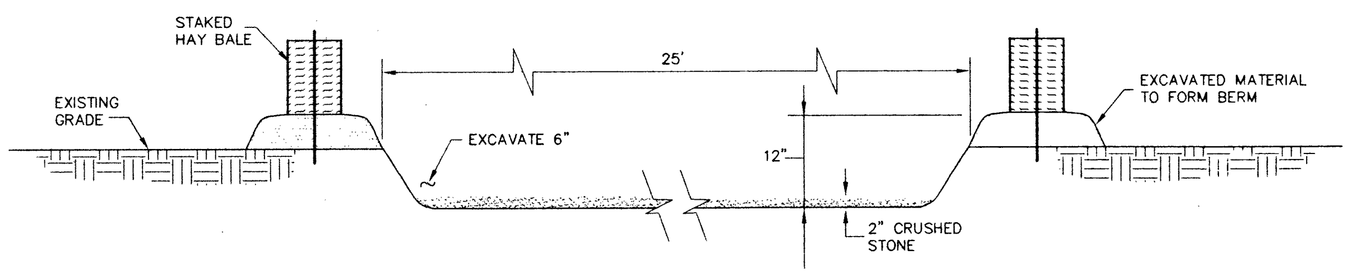
SEPTIC SYSTEM UPGRADE

SITE PLAN

SCALE: 1"=40'	JOB NO.: 90473.5	
DATE: NOVEMBER 1994	SHEET: 1 OF 4	ORLEANS1.DWG

WOODARD & CURRAN INC.
ENVIRONMENTAL SERVICES
PORTLAND, ME • BANGOR, ME • DEDHAM, MA





SECTION – A2
NOT TO SCALE

9/95	BIOCLERE SYSTEM ADDITION
DATE	ADDITION OR REVISION

DES.BY: OK	DR.BY: RDC	CK.BY: OK

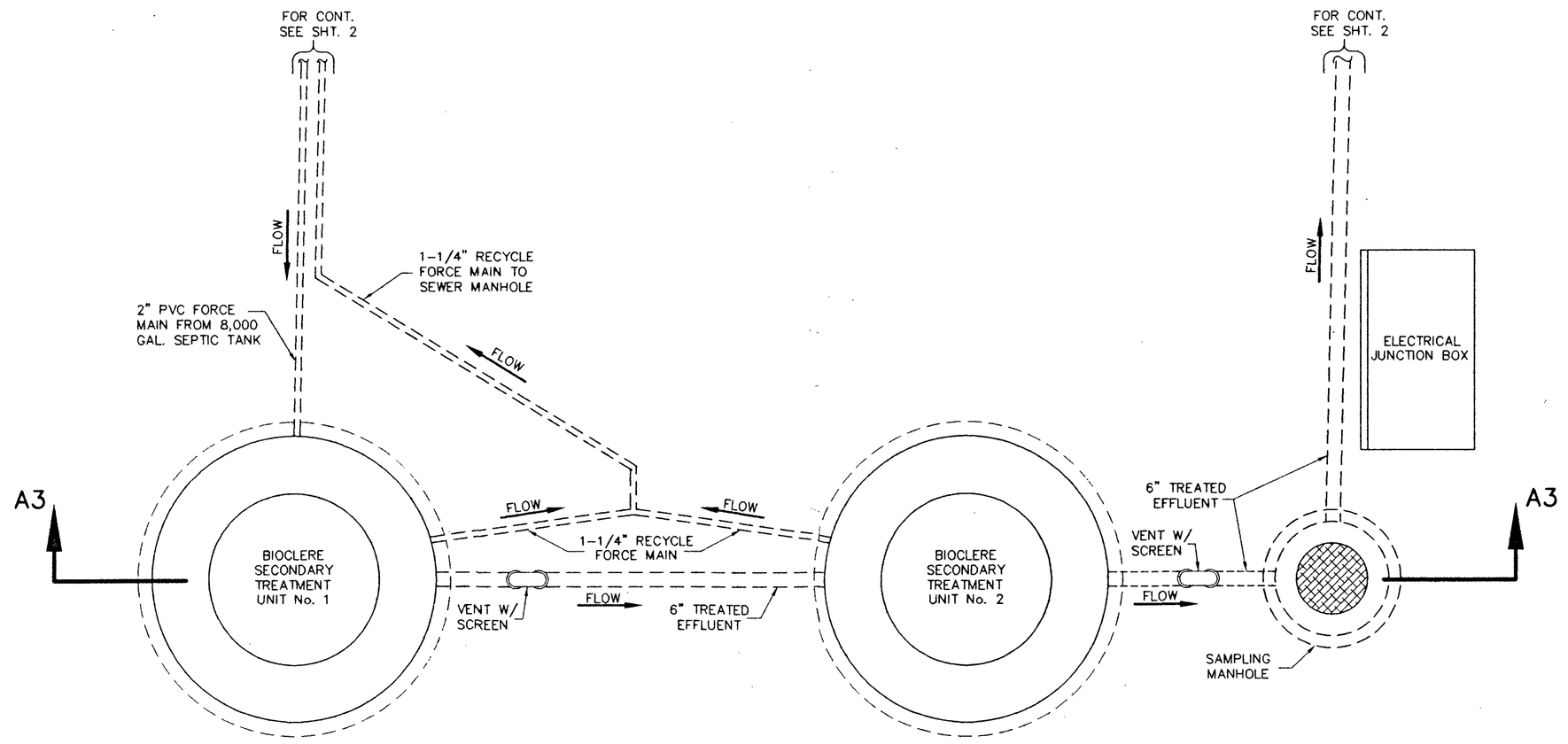
THE STOP & SHOP SUPERMARKET COMPANY
CRANBERRY COVE PLAZA
ORLEANS, MASSACHUSETTS

SEPTIC SYSTEM UPGRADE

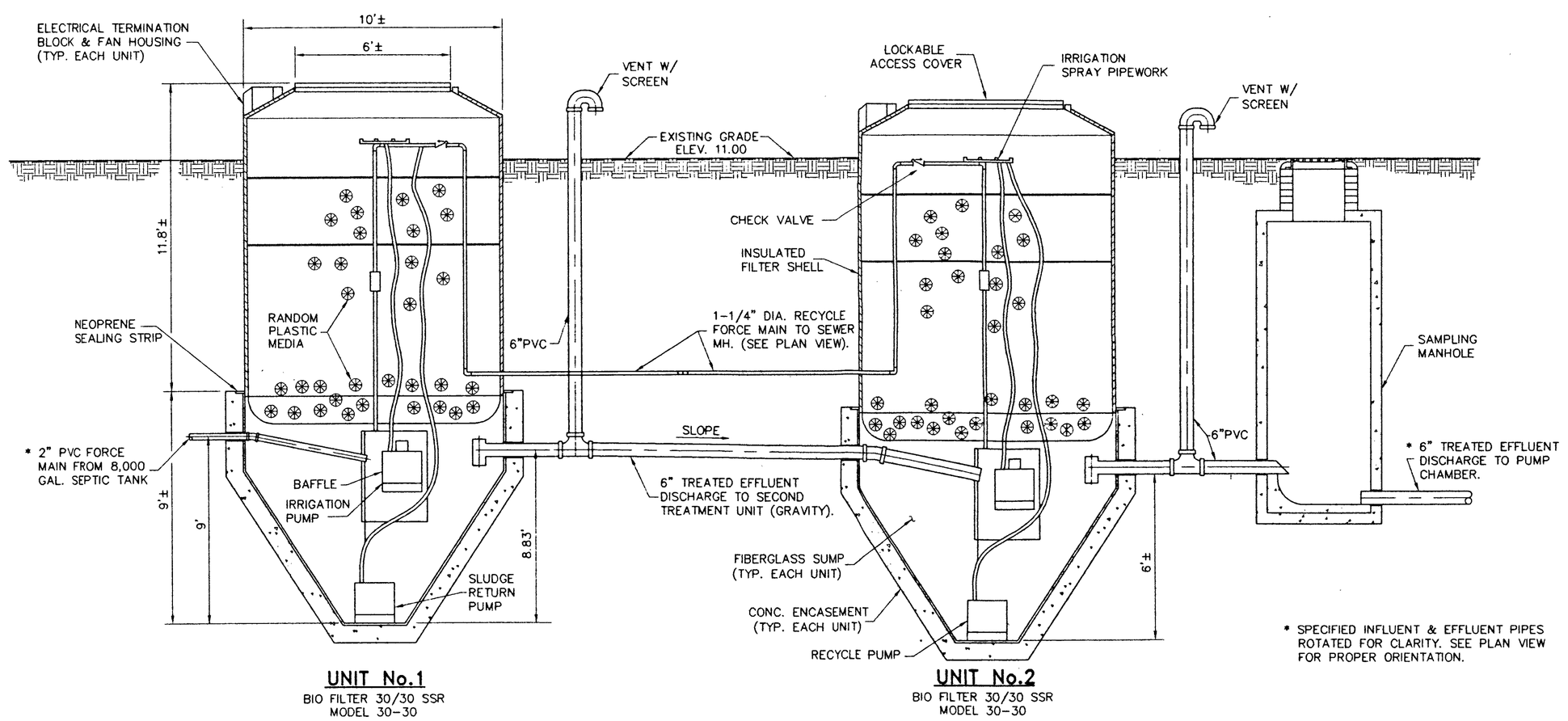
SITE LAYOUT DETAIL

SCALE: 1/8"=1'–0"	JOB NO.: 90473.5	
DATE: NOVEMBER 1994	SHEET: 2 OF 4	LAYOUT.DWG

WOODARD & CURRAN INC.
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PLAN VIEW
NOT TO SCALE



UNIT No.1
BIO FILTER 30/30 SSR
MODEL 30-30

UNIT No.2
BIO FILTER 30/30 SSR
MODEL 30-30

SECTION – A3
NOT TO SCALE

9/95	BIOCLERE SYSTEM ADDITION
DATE	ADDITION OR REVISION

DES.BY: OK	DR.BY: RDC	CK.BY: OK

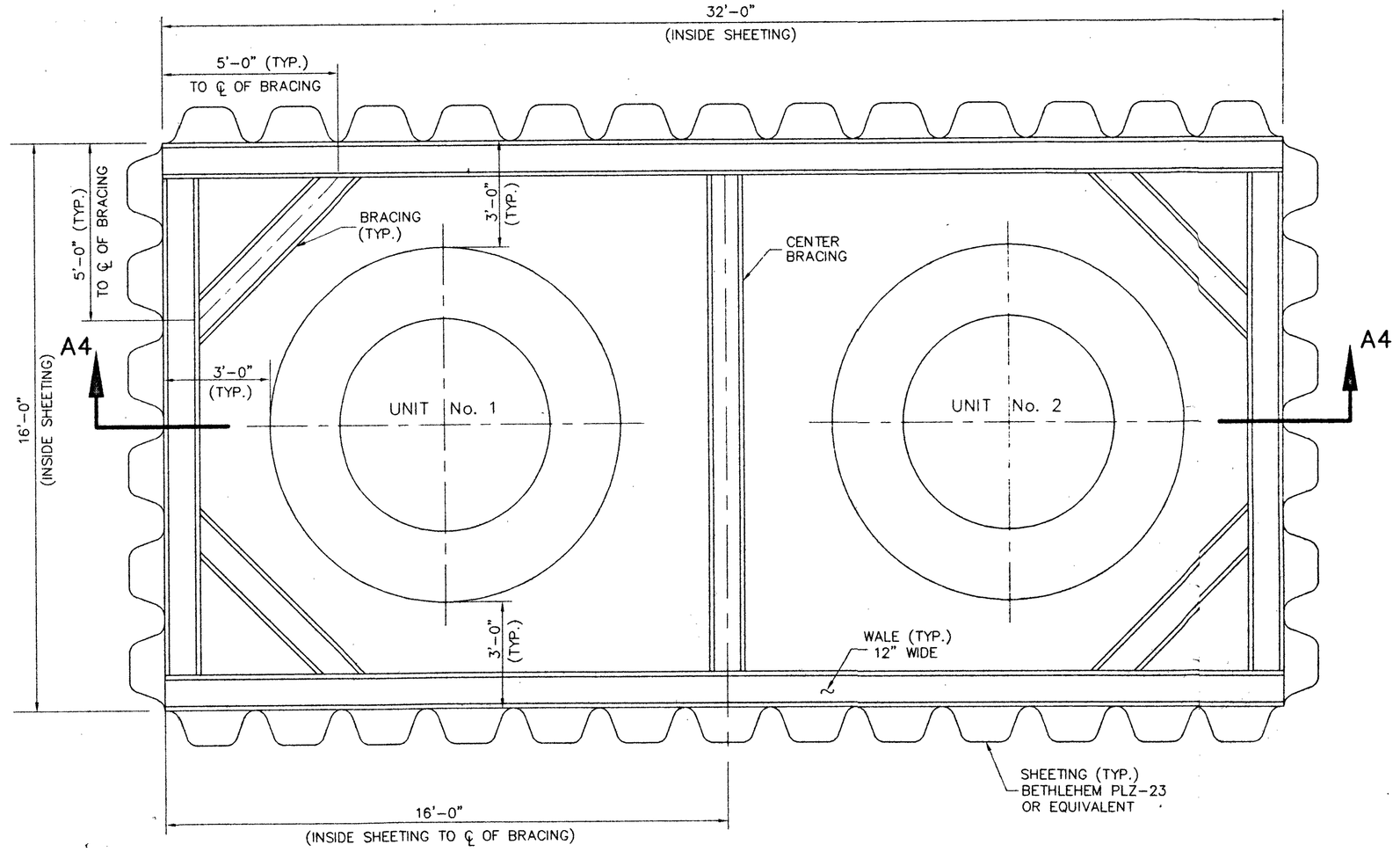
THE STOP & SHOP SUPERMARKET COMPANY
CRANBERRY COVE PLAZA STORE No. 026
ORLEANS, MASSACHUSETTS

SEPTIC SYSTEM UPGRADE

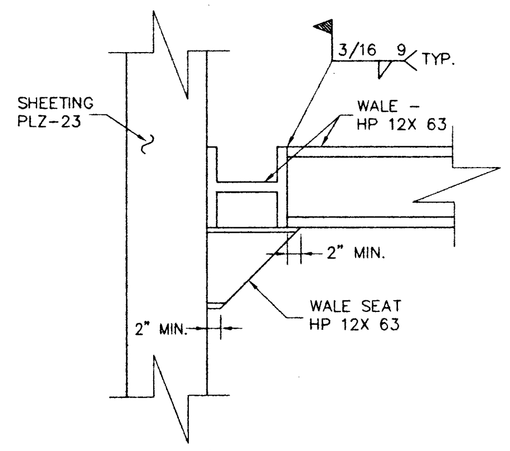
BIOCLERE SYSTEM DETAIL

SCALE: AS NOTED	JOB NO.: 90473.5	
DATE: NOVEMBER 1994	SHEET: 3 OF 4	BIOCLERE.DWG

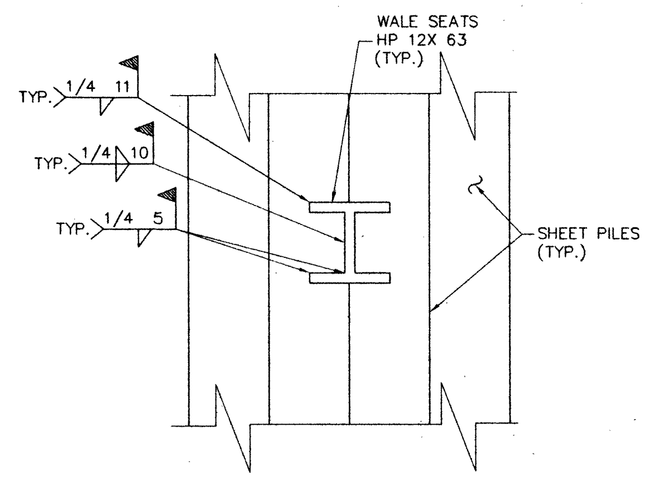
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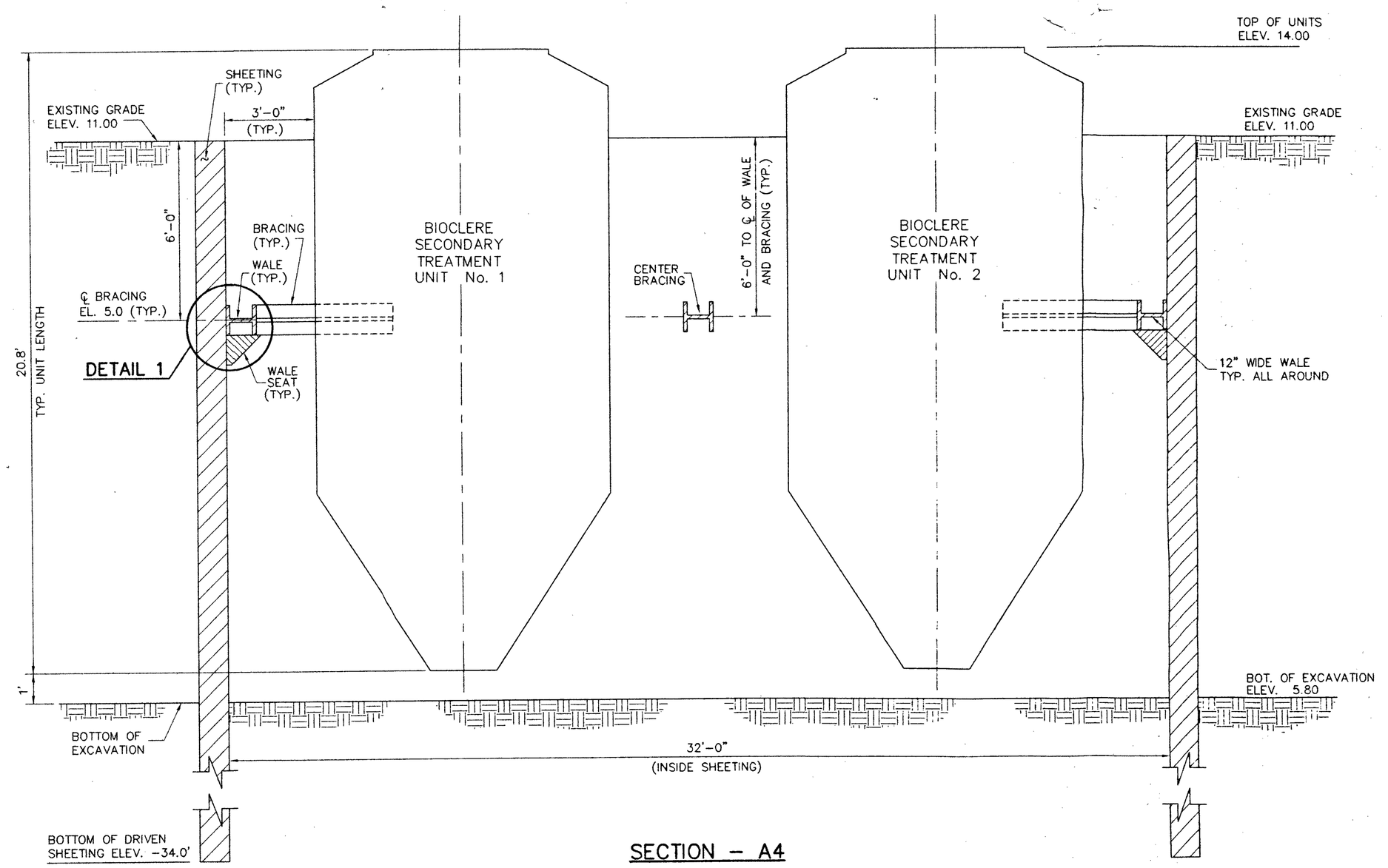
PLAN VIEW
SCALE: 3/8"=1'-0"



DETAIL 1
SCALE: 3/4"=1'-0"



WALE SEAT DETAIL
SCALE: 3/4"=1'-0"



SECTION – A4
SCALE: 3/8"=1'-0"

DESIGN NOTES:

1. LOCATE ALL UTILITIES PRIOR TO EXCAVATING OR DRIVING SHEETING.
2. STEEL SHEET PILE SHALL BE STANDARD BETHLEHEM SECTIONS & CORNERS AS REQUIRED TO CONSTRUCT THE COFFERDAM TO THE DIMENSIONS SHOWN ON THE DRAWINGS. STEEL FOR THE SHEETING SHALL CONFORM TO ASTM A328.
3. ALL STRUCTURAL STEEL SHALL BE SIZED AND LOCATED AS SHOWN ON THE DRAWINGS.
4. ALL WELDING SHALL CONFORM TO THE AMERICAN WELDING SOCIETY AWS D1.1-88. WELDING ELECTRODES SHALL BE E70XX. MINIMUM WELD LENGTH IS 3 INCHES. MINIMUM WELD SIZE IS 1.4 INCH.
5. WALE SEATS SHALL BE PLACED DIRECTLY UNDER EACH BRACE WITH ADDITIONAL SEATS PLACED IN CORNERS WHERE SEATS CANNOT BE PLACED DIRECTLY BELOW A BRACE, A SEAT SHALL BE PLACED ON EITHER SIDE OF THE BRACE. A WALE SEAT SHALL ALSO BE PLACED AT THE MID SPAN BETWEEN ADJACENT BRACES.

CONSTRUCTION SEQUENCE

1. INSTALL AND CONNECT SHEETING IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDED PROCEDURE TO A MAXIMUM TIP ELEVATION OF –34 FEET. INSTALL DEWATERING SYSTEM AND BEGIN DEWATERING THE AREA.
2. THE AREA WITHIN THE COFFERDAM WILL BE EXCAVATED TO APPROXIMATELY ELEVATION +5.8'.
3. THE WALE SEATS, WALES, AND BRACING SHALL BE INSTALLED.
4. DURING THE EXCAVATION DIRECT ALL SURFACE WATER AWAY FROM THE EXCAVATION.
5. THE TOP OF WALL SHOULD BE MONITORED FOR HORIZONTAL DEFLECTION AT TWO LOCATIONS PER SIDE OF THE EXCAVATION ON A CONTINUOUS BASIS UNTIL THE EXCAVATION HAS BEEN FILLED.

9/95	BIOCLERE SYSTEM ADDITION
DATE	ADDITION OR REVISION

DES.BY: OK	DR.BY: RDC	CK.BY: OK

THE STOP & SHOP SUPERMARKET COMPANY
CRANBERRY COVE PLAZA
ORLEANS, MASSACHUSETTS

SEPTIC SYSTEM UPGRADE

COFFERDAM DESIGN

SCALE: AS NOTED		JOB NO.: 90473.5	
DATE: NOVEMBER 1994		SHEET: 4 OF 4	COFFER.DWG

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ATTACHMENT D

Preliminary Pumping Station No. 2 Site Planting Plan

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ATTACHMENT E

Miscellaneous Testing and Soil Data: Geotechnical Data Report

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SECTION 01310

MISCELLANEOUS TESTING AND SOIL DATA

PART - GENERAL 1
1.01 - SCOPE 1
1.02 - MEASUREMENT AND PAYMENT 1
1.03 - DEFINITIONS 1
1.04 - SUBMITTALS 2
1.05 - PRODUCT HANDLING – Not Used 2
1.06 - DESIGN CRITERIA 2
PART 2 - PRODUCTS - Not Used 2
PART 3 - EXECUTION - Not Used 2

PART - GENERAL

1.01 - SCOPE

A. The Work of this section includes the furnishing of all labor, materials, tools and equipment required to perform miscellaneous testing as required in the Contract Documents and/or as directed by the Engineer.

B. Existing testing and subsurface soil data, if available, is included in this section.

C. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1, GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 - MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. In addition to the above, measurement and payment shall be in accordance to the following:

1. Payment for testing shall be as specified under the applicable Payment Items included under SECTION 01025, MEASUREMENT AND PAYMENT.

2. Pay all up front costs associated with additional testing. If the testing proves the Work is defective or materials are unsatisfactory then correct all defective Work at no cost to the Owner. If the testing proves the Work and/or materials are satisfactory, then the Owner will pay for costs associated with additional testing.

3. Where the technical section of the Specifications required that a piece of equipment be tested at the manufacturer's facility or at the site, the cost of such tests shall be included in the price of the equipment.

1.03 - DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.
5. "Piping" shall mean, in addition to pipe or tubing all backfilling and bedding, fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.
6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.
7. "Exposed" shall mean not concealed as defined above.
8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.
9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 - SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS.

B. Submittals shall include shop drawings including at least the following:

1. Additional Testing.

1.05 - PRODUCT HANDLING – Not Used

1.06 - DESIGN CRITERIA

A. Subsurface soil data, if included in the Contract Documents, is for general information only. The information pertains to the subsoil conditions in the vicinity of the Work and is given to assist in properly evaluating the amount and character of the Work required hereunder. Such data is represented as being the best factual information available.

1. The Owner and Engineer assume no responsibility for the accuracy thereof or for any conclusions that might draw therefrom.
2. It is understood and agreed that, by careful examination, you have satisfied yourself as to the nature and location of the Work, have examined such logs of test borings and/or records made of underground exploration as may be available, understand the character of equipment and facilities needed for the prosecution of the Work, the general and local conditions, and all other matters which could in any way affect the Work under this Contract.
3. Jar samples, if available, may be examined during normal business hours, at the Owner’s office.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF TEXT

SEE ATTACHMENT - GEOTECHNICAL DATA REPORT

GEOTECHNICAL DATA REPORT

Downtown Area Sewer Collection System and Pumping Stations
Orleans, Massachusetts

August 2019

AECOM Project: Final Design of Downtown Area Sewer Collection System, Treatment Facility and Effluent Disposal Site in Orleans, Massachusetts

AECOM Project No.: 60587515

1.1 PROJECT DESCRIPTION

AECOM is providing engineering services to integrate relevant components of the Comprehensive Wastewater Management Plan (CWMP) developed by the Town in 2011 and all work since, including the 25 percent Downtown Area Collection System design, 25 percent Downtown Area Wastewater Treatment Facility design (29 Oak Ridge Lane) and studies for effluent disposal at 32 Lots Hollow Road in order to permit, final design and bid complete a fully functioning and permitted Downtown Area Sewer System.

1.2 PURPOSE OF REPORT

The purpose of this Geotechnical Data Report (GDR) is to provide supporting data for the design and ultimate construction of sewers and pumping stations (i.e., the collection system) in Orleans, Massachusetts. The data was collected during two separate exploration programs that involved the drilling of test borings and the laboratory testing of select soil samples. The exploration programs conducted are a component of the design.

1.3 EXPLORATION PROGRAMS

The two exploration programs were conducted to evaluate subsurface conditions along proposed sewerage routes and at three planned pumping station sites. The sewerage exploration program was performed on downtown streets from Finlay Road to Canal Road and consisted of the drilling of 111 test borings. The sewerage test borings ranged in depth from 10 to 40 feet and were drilled by New England Geotech of Jamestown, Rhode Island. The collection system test boring locations are shown on Figure 1. The test boring logs are provided in Attachment 1.

The three proposed pump station sites are located on parcels at 84 Old Colony Way, the Stop & Shop supermarket plaza at Cranberry Cove Plaza (24 Rte. 6A), and east of the Snow Library on Main Street. The exploration program for the pump station sites was conducted between April 2, 2019 and May 29, 2019 and consisted of the drilling of two test borings per site. The pumping station test borings ranged from 50 to 60 feet in depth and were drilled by Desmond Well Drilling of Orleans, MA. The test boring locations at the three proposed pump station sites are shown on Figures 2 through 4. The test boring logs are provided in Attachment 1.

Additionally, six test borings (B-130 through B-134 and B-140) for Route 6 pipeline crossing and one boring close to Pump Station 3 (B-112) were drilled by Desmond Well Drilling from March 29, 2019 to May 22, 2019. The Route 6 crossing borings ranged from 35 to 36 feet in depth and B-112 is 40 feet depth. The test boring locations are shown on Figure 1. The test boring logs are provided in Attachment 1.

1.3.1 Drilling and Sampling

Utility locating efforts were implemented prior to the start of borehole drilling. These efforts included a *DigSafe* mark-out and borehole vacuum excavation to 5-feet.

The collection system test borings were mostly advanced below the pre-cleared 5-foot interval using a geoprobe direct push drill rig. Direct push drilling uses hydraulic pressure and percussion to advance drill casing. Direct push drilling methods allow for the continuous

collection of soil cores. Technical personnel from AECOM accompanied the geoprobe and logged the recovered soil cores.

The deeper pump station test borings and Route 6 crossing borings were drilled using 3.25-inch ID hollow stem augers. Standard penetration test (SPT) split-spoon soil sampling was conducted at 5-foot intervals in these borings. The SPT soil samples were logged by an AECOM geologist in accordance with ASTM D2488.

1.3.2 Historic Geotechnical Investigations

Two historic borings MA-4 and MA-7 each 21 feet depth were drilled by New Hampshire Boring Inc. between January 7, 2013 and January 8, 2013 and are provided in Attachment 1 as well.

1.3.3 Groundwater Levels

The groundwater level at each boring location was estimated at the time of drilling and recorded on the boring log. It should be noted that groundwater levels will fluctuate with changes in precipitation, season, construction activities, run-off controls, and other hydraulic factors.

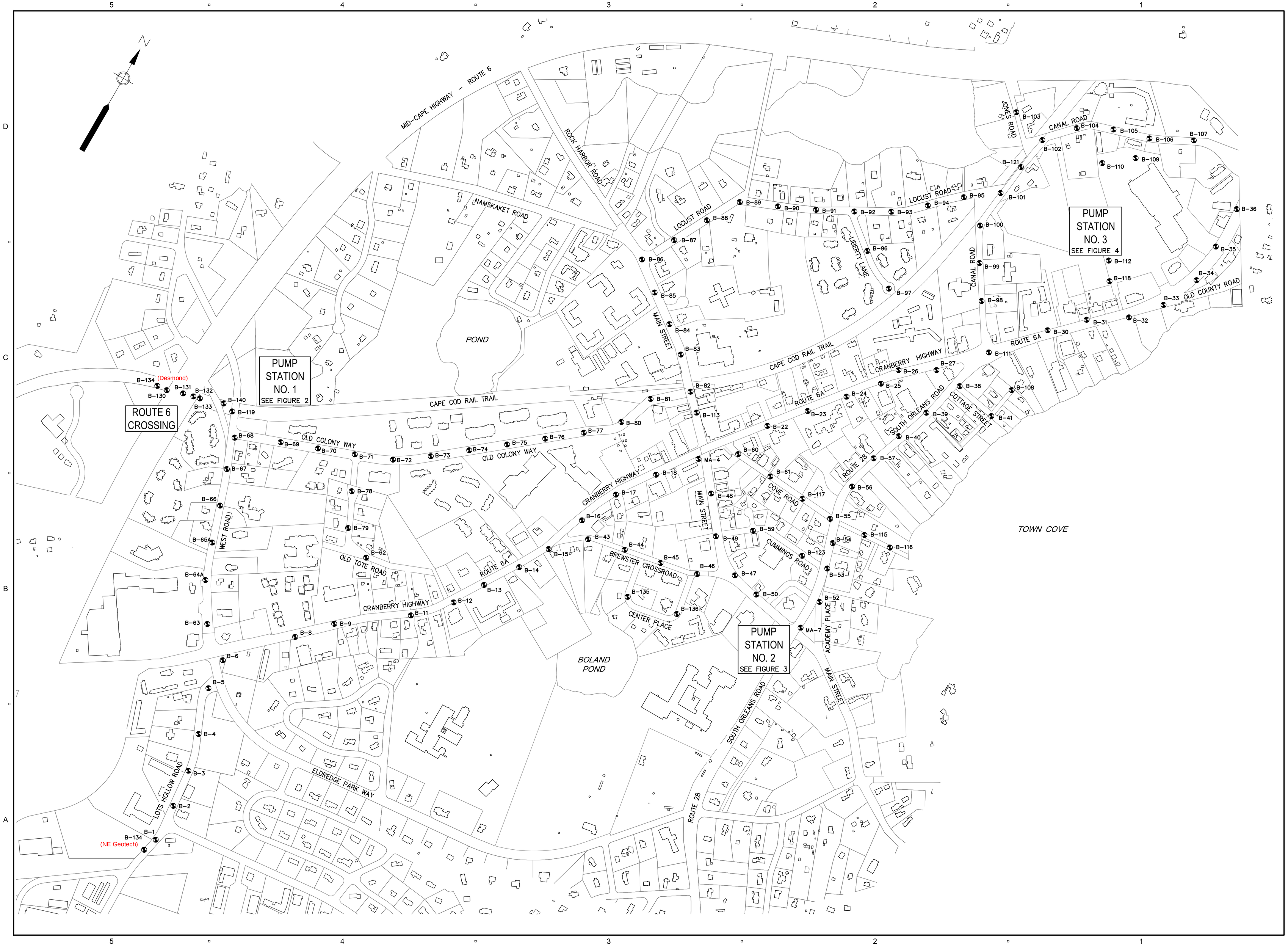
1.3.4 Laboratory Testing

A laboratory testing program was performed to determine the engineering properties of soils at the pump station sites and Route 6 crossing sites. Representative soil samples were selected by AECOM and tested for physical characteristics (*i.e. gradation, moisture content and density)* by GeoTesting Express in Acton, Massachusetts. A summary of the soil laboratory testing is provided in Table 1. The laboratory test results are provided in Attachment 2.

TABLE 1: Summary of Geotechnical Laboratory Testing

Boring ID	Sample ID	Depth (ft)	Sieve (ASTM D6913)	Hydrometer (ASTM D7928)	Moisture Content (ASTM D2216)	Density (ASTM D7263)
B-130	SS-3	14 - 16	X			
B-131	SS-2	8 - 10	X	X		
B-132	SS-2	8 - 10	X			
B-133	SS-3	13 - 15	X			
B-134	SS-2	8 - 10	X		X	
PS1-1	SS-3	13 - 15	X			
PS2-1	SS-2	8 - 10	X	X		X
PS2-1	SS-4	18 - 20	X	X		
PS2-2	SS-1	5-7	X			X
PS2-2	SS-3	13 - 15	X	X		
PS3-1	SS-3	13 - 15	X			
PS3-2	SS-2 (Bottom)	8 - 10	X	X		

FIGURES



Last saved by: CURRANM (2019-07-12) Last Plotted: 2019-07-12
Filename: L:\WORK\60476644 - ORLEANS DOWNTOWN SEWER\SHEETS\GIS\GEOTECH REPORT FIGURE 1 - BORING LOCATIONS CS AND PS.DWG

Project Management Initials: Designer:____ Checked:____ Approved:____

AECOM

PROJECT

Downtown Area Collection System and Pump Stations

Contract No. 2019-02
SRF No. 4486

CLIENT

Town of Orleans, MA
19 SCHOOL ROAD
ORLEANS, MA 02653
(508) 240-3700

ENGINEER

AECOM TECHNICAL SERVICES, INC.
9 JONATHAN BOURNE DRIVE
POCASSET, MA 02559
PHONE: (508) 833-6950
www.aecom.com

CONSULTANTS

REGISTRATION

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NOTE: This document is preliminary only and is not intended for any purpose except review and comment by the owner and its agents.

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60476644

Designed By:	M. CURRAN
Drawn By:	M. CURRAN
Dept Check:	T. PARECE
Proj Check:	M. DONOGHUE
Date:	JULY 2019
Scale:	1" = 300'

DISCIPLINE

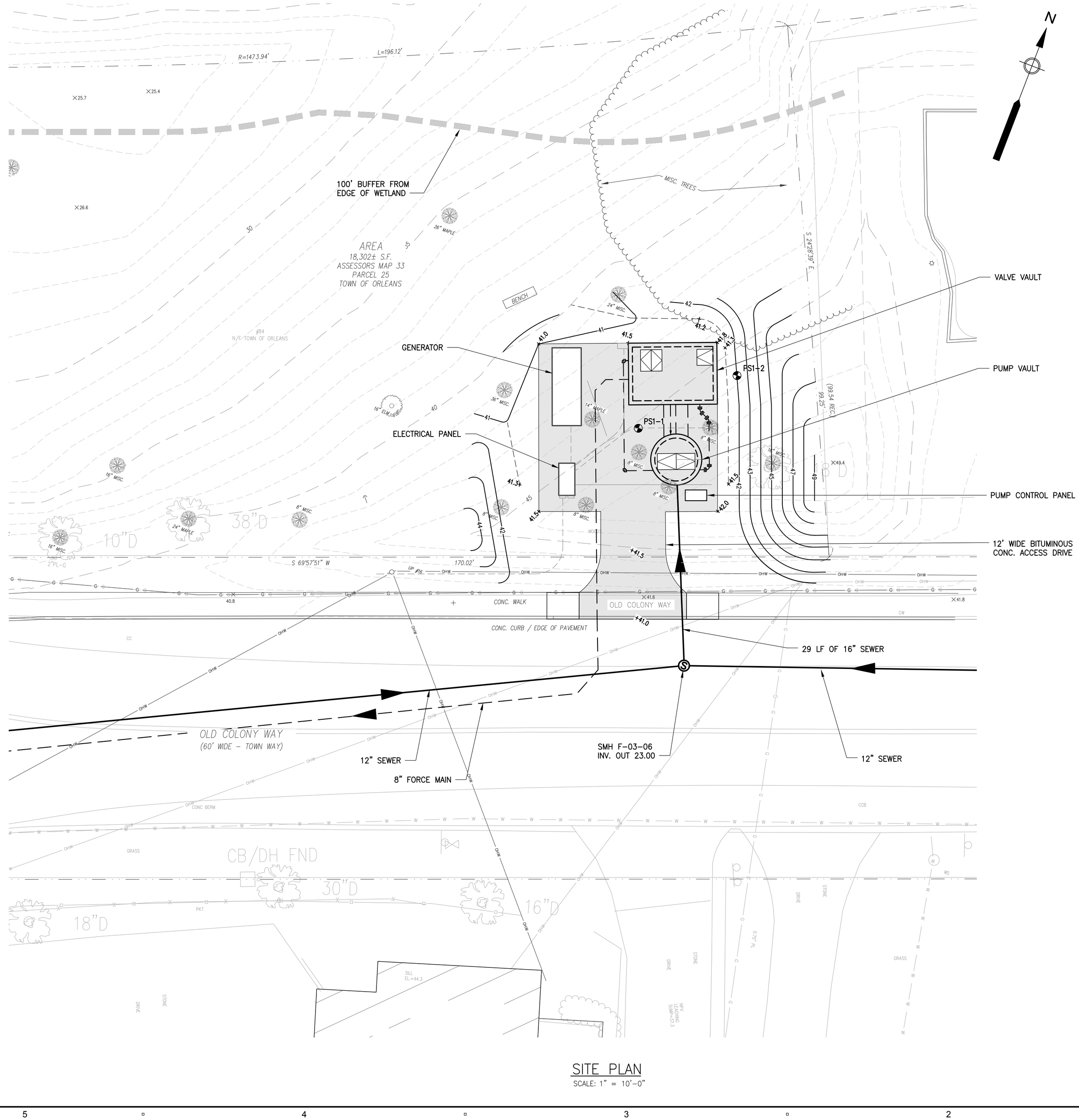
GENERAL

SHEET TITLE

BORING LOCATION PLAN
DOWNTOWN AREA
COLLECTION SYSTEM

SHEET NUMBER

FIGURE 1



SITE PLAN

SCALE: 1" = 10'-0"

REFERENCE

SURVEY FOR THIS SITE PROVIDED BY COASTAL ENGINEERING COMPANY, INC, 260 CRANBERRY HIGHWAY, ORLEANS, MA 02653.

PROJECT	"AECOM – 84 OLD COLONY WAY"
PROJECT NO.	C18686.01
SHEET TITLE	"PLAN SHOWING EXISTING SITE CONDITIONS"
SHEET NO.	C1.2.1

Approved:____ Checked:____ Designer:____ Project Management Initials:

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Filename: P:\60476644 - ORLEANS DOWNTOWN PUMP STATIONS\SHEETS\CIVIL\GEOTECH REPORT FIGURE 2.DWG

AECOM

PROJECT

Downtown Area Collection System and Pump Stations

Contract No. 2019-02
SRF No. 4486

CLIENT

Town of Orleans, MA
19 SCHOOL ROAD
ORLEANS, MA 02653
(508) 240-3700

ENGINEER

AECOM TECHNICAL SERVICES, INC.
9 JONATHAN BOURNE DRIVE
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CONSULTANTS

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ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60476644

Designed By:	M. CURRAN
Drawn By:	M. CURRAN
Dept Check:	T. PARECE
Proj Check:	M. DONOGHUE
Date:	JULY 2019
Scale:	AS NOTED

DISCIPLINE

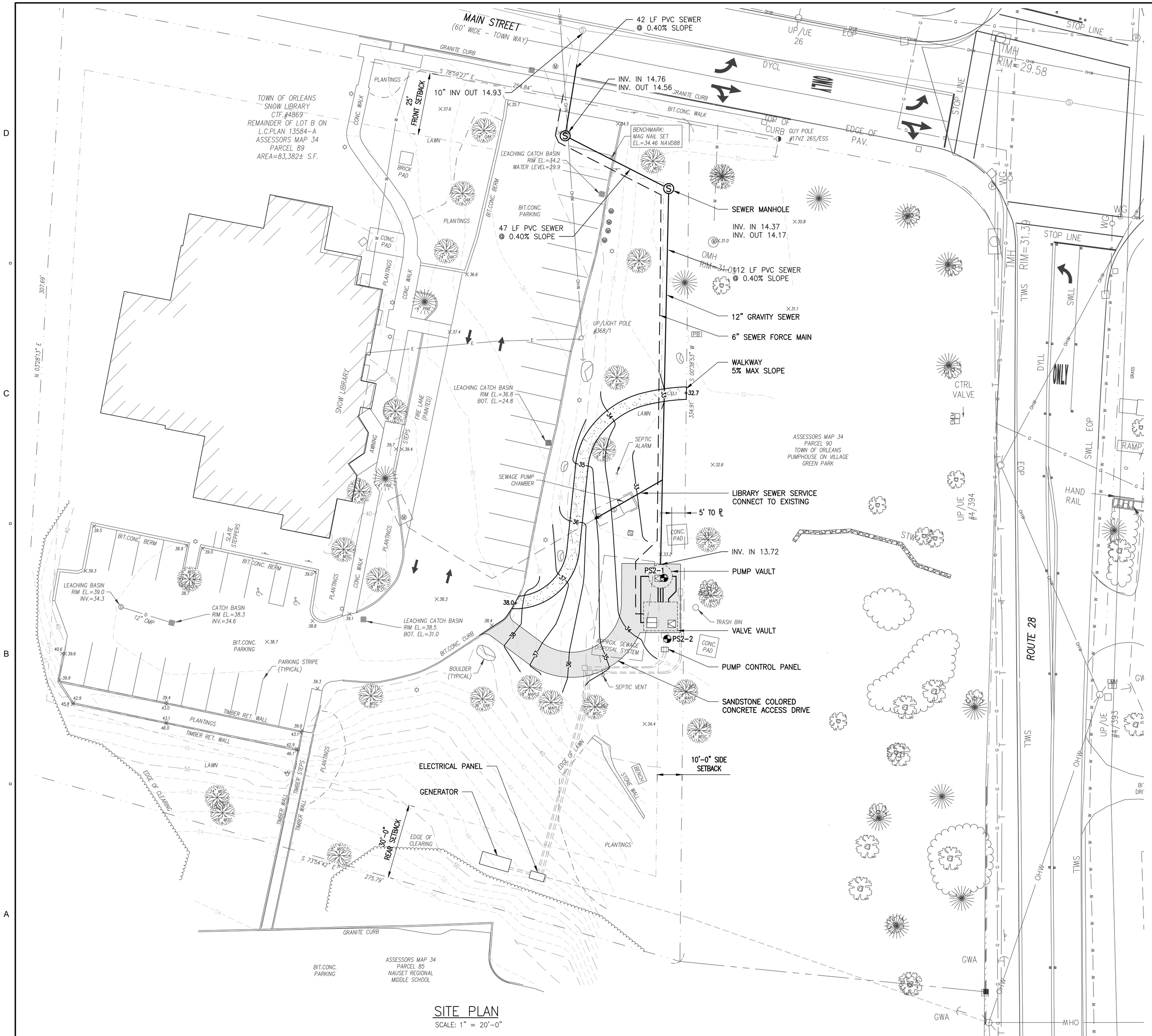
CIVIL

SHEET TITLE

BORING LOCATION PLAN PUMP STATION NO. 1

SHEET NUMBER

FIGURE 2



SITE PLAN

SCALE: 1" = 20'-0"

LEGEND

■	BOUND	▦	CATCH BASIN
—·—·—	PROPERTY LINE	Ⓓ	DRAIN MANHOLE
—o—	MISC. SIGN	—D—	DRAIN LINE
OHW	OVERHEAD UTILITY LINE	—W—	WATER LINE
	UTILITY POLE	Ⓜ	MANHOLE
	GUY POLE	Ⓢ	SEWER MANHOLE
	GUY WIRE		TREE
	LIGHTPOST	40	EXISTING CONTOUR
PB	PULL BOX	X 31.0	EXISTING SPOT GRADE
Ⓦ	MONITORING WELL	40	PROPOSED CONTOUR

REFFERENCE SURVEY

SURVEY FOR THIS SITE PROVIDED BY COASTAL ENGINEERING COMPANY, INC, 260 CRANBERRY HIGHWAY, ORLEANS, MA 02653.

PROJECT	"AECOM – SNOW LIBRARY"
PROJECT NO.	C18686.01
SHEET TITLE	"PLAN SHOWING EXISTING SITE CONDITIONS"
SHEET NO.	C1.2.1 REV 1

N

Approved: ____
Checked: ____
Designer: ____
Project Management Initials: ____

Last saved by: CURRANM(2019-06-27) Last Plotted: 2019-06-28
Filename: P:\60476644 - ORLEANS DOWNTOWN PUMP STATIONS\SHEETS\CIG\GEOTECH REPORT FIGURE 3.DWG

AECOM

PROJECT

Downtown Area Collection System and Pump Stations

Contract No. 2019-02
SRF No. 4486

CLIENT

Town of Orleans, MA
19 SCHOOL ROAD
ORLEANS, MA 02653
(508) 240-3700

ENGINEER

AECOM TECHNICAL SERVICES, INC.
9 JONATHAN BOURNE DRIVE
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ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60476644

Designed By:	M. CURRAN
Drawn By:	M. CURRAN
Dept Check:	T. PARECE
Proj Check:	M. DONOGHUE
Date:	JULY 2019
Scale:	AS NOTED

DISCIPLINE

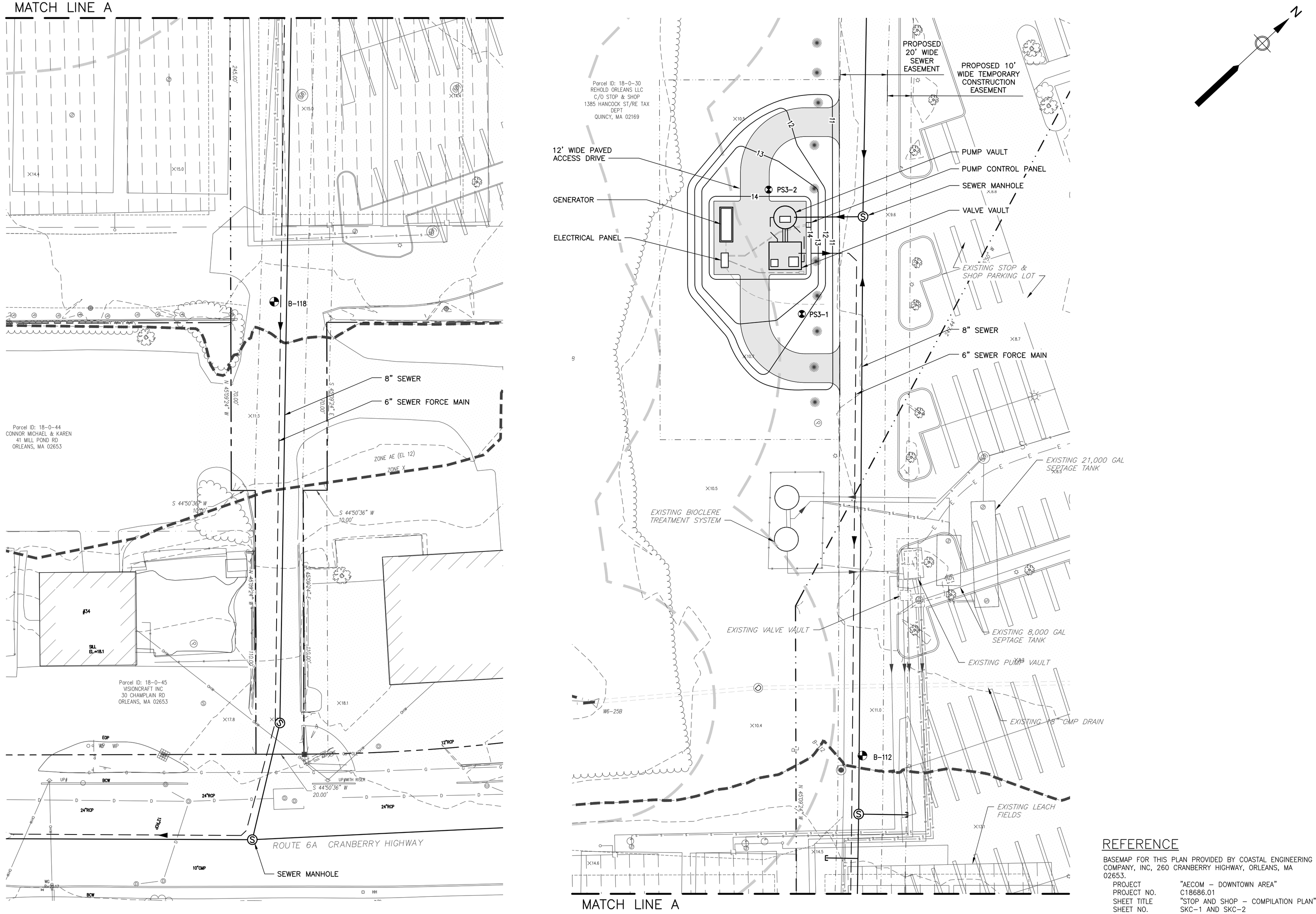
CIVIL

SHEET TITLE

BORING LOCATION PLAN PUMP STATION NO. 2

SHEET NUMBER

FIGURE 3



PLAN
SCALE: 1" = 20'-0"

REFERENCE

BASEMAP FOR THIS PLAN PROVIDED BY COASTAL ENGINEERING COMPANY, INC, 260 CRANBERRY HIGHWAY, ORLEANS, MA 02653.

PROJECT	"AECOM – DOWNTOWN AREA"
PROJECT NO.	C18686.01
SHEET TITLE	"STOP AND SHOP – COMPILATION PLAN"
SHEET NO.	SKC-1 AND SKC-2

1" = 20' SCALE: 0, 20, 40, 60 FEET

Approved: ____ Checked: ____ Designer: ____ Project Management Initials: ____

Last saved by: CURRANM(2019-06-27) Last Plotted: 2019-06-28
Filename: P:\60476644 - ORLEANS DOWNTOWN PUMP STATIONS\SHEETS\CIGEOTECH REPORT FIGURE 4.DWG

AECOM

PROJECT

Downtown Area Collection System and Pump Stations

Contract No. 2019-02
SRF No. 4486

CLIENT

Town of Orleans, MA
19 SCHOOL ROAD
ORLEANS, MA 02653
(508) 240-3700

ENGINEER

AECOM TECHNICAL SERVICES, INC.
9 JONATHAN BOURNE DRIVE
POCASSET, MA 02559
PHONE: (508) 833-6950
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CONSULTANTS

REGISTRATION

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NOTE: This document is preliminary only and is not intended for any purpose except review and comment by the owner and its agents.

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

60476644

Designed By:	M. CURRAN
Drawn By:	M. CURRAN
Dept Check:	T. PARECE
Proj Check:	M. DONOGHUE
Date:	JULY 2019
Scale:	AS NOTED

DISCIPLINE

CIVIL

SHEET TITLE

BORING LOCATION PLAN PUMP STATION NO. 3

SHEET NUMBER

FIGURE 4

ATTACHMENT 1

Test Boring Logs

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Lots Hollow Road
Orleans, MA

Boring: B-1

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: C.Hayden, B.Morrill
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/16/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/22/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 8" : Asphalt					1
2					8" - 10" : Gravel					2
3					10" - 5' : Orange/Brown fine sand					3
4										4
5										5
6	5 ft to 10 ft	3.8 ft	dry		Tan to Light Brown medium sand					6
7										7
8										8
9										9
10					---------- End of Boring at 10' ----------					10
11										11
12										12
13										13
14										14
15										15
16										16
17										17
18										18
19										19
20										20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Lots Hollow Road
Orleans, MA

Boring: B-2

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: C.Hayden, B.Morrill
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/16/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/22/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 8" : Asphalt 8" - 10" : Gravel 10" - 5' : Brown\Orange fine sand					1
2										2
3										3
4										4
5										5
6	5 ft to 10 ft	3.8 ft	dry		5 to 8 ft: Tan fine sand, intermittent Iron-staining 8 to 8.8 ft: Tan fine silty sand					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	3.3 ft	dry		10 to 10.7 ft: Brown silt, trace clay 10.7 to 12.9 ft: Tan fine/very fine sand 12.9 to 13.3 ft: Brown silt					11
12										12
13										13
14										14
15					---------- End of Boring at 13' ----------					15
16										16
17										17
18										18
19										19
20										20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Lots Hollow Road
Orleans, MA

Boring: B-3

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: C.Hayden, B.Morrill
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/16/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/22/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0-10" : Asphalt					1
2					10" - 16" : Gravel road base					2
3					16" - 5' : Orange/Brown fine sands					3
4										4
5										5
6	5 ft to 10 ft	3.7 ft	dry		5 to 5.8 ft: Tan fine sand, little medium sand					6
7					5.8 to 13.9 ft: Tan-Light Brown fine to medium sand, trace coarse sand					7
8										8
9										9
10										10
11	10 ft to 15 ft	3.9 ft	dry							11
12										12
13										13
14										14
15					---------- End of Boring at 14' ----------					15
16										16
17										17
18										18
19										19
20										20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Lots Hollow Road
Orleans, MA

Boring: B-4

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: C.Hayden, B.Morrill
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/16/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/22/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 8" : Asphalt 8" - 16" : Gravel 16" - 5' : Orange/Brown, fine to med sand. Large cobbles encountered					1
2										2
3										3
4										4
5										5
6	5 ft to 10 ft	3.5 ft	dry		Tan fine sand					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	4 ft	dry		Tan fine sand, mottled					11
12										12
13										13
14										14
15					---------- End of Boring at 13' ----------					15
16										16
17										17
18										18
19										19
20										20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Lots Hollow Road
Orleans, MA

Boring: B-5

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: C.Hayden, B.Morrill
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/16/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/22/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 5" : Asphalt 5" - 11" : Gravel 11"-13" : Dark brown soil 13" - 14" : Organic looking material 14" - 5' : Orange\Brown fine sand					1
6	5 ft to 10 ft	3.3 ft	dry		5 to 7.6 ft: Tan medium sand, trace small gravel 7.6 to 8.3 ft: Brown fine sand, little silt					6
11	10 ft to 15 ft	3.5 ft	dry		10 to 12.6 ft: Tan medium sand, trace small gravel 12.6 to 13.5 ft: Tan medium to coarse sand ---------- End of Boring at 13' ----------					11
16										16
21										21
26										26

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Route 6A
Orleans, MA

Boring: B-6

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B. Barra
Pre-Clear Contractor: Strategic
Pre-Clear Date: 5/1/2019
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 5/6/2019

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear 0 ft to 7 ft				0 - 12" : Topsoil 12" - 84" : Medium sand					1
2										2
3										3
4										4
5										5
6	5 ft to 10 ft	5.0	dry		5' - 7' : Light brown fine to medium sand, loose, non-plastic					6
7					7' - 7.5' : Light brown medium sand with some fines, loose, non-plastic					7
8					7.5' - 10' : Light brown fine sand, loose, non-plastic					8
9										9
10										10
11	10 ft to 15 ft	5.0	dry		10' - 12.5' : Light brown fine sand, loose, non-plastic					11
12					12.5' - 15' : Light tan fine sand, trace small subangular gravel, loose, non-pla 2" cobble @ 13'					12
13										13
14										14
15										15
16	15 ft to 20 ft	5.0	sl. moist		15' - 16.5' : Brown fine sand with some meidum sand, loose, non-plastic					16
17			dry		16.5' - 18' : Light tan fine sand with some medium sand and trace small subangular gravel, loose, non-plastic					17
18			dry		18' - 18.4' : Brown fine sand, tightly packed					18
19			dry		18.4' - 20' : Brown fine to medium sand, loose, non-plastic					19
20					some orange mottling, gradually becomes coarser					20
21	20 ft to 25 ft	5.0	dry		20' - 21.5' : Brown fine to medium sand, loose, non-plastic					21
22					21.5 - 22.7 : tan w/ orange fine to medium sand, loose, non-plastic					22
23					22.7' - 25' : Light tan w/ orange fine sand w/ medium sand, loose, non-					23
24					---------- End of Boring at 25' ----------					24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Route 6A
Orleans, MA

Boring: B-8

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: S.Chmiel, B.Morrill
Pre-Clear Contractor: Strategic
Pre-Clear Date: 3/13/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 3/16/2017

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 6" Dark Brown Loamy Sand With Fine Roots (Topsoil)					1
2					6 to 60" Tan Medium to Coarse Sand With Pebbles					2
3										3
4										4
5										5
6	5 ft to 10 ft	3.75			5.00' - 6.25' : Orange\Brown medium - coarse sand					6
7					6.25' - 6.75' : Some cobbles					7
8					6.75' - 7.00' : Medium - coarse sand					8
9					7.00' - 8.25' : Fine sand (bagged)					9
10					8.25' - 8.75' : Very fine w/ some silt					10
11	10 ft to 15 ft	4.0			10.00' - 10.25' : Organic silt and fine sand					11
12					10.25' - Bottom ; Orange\Brown fine to medium sand.					12
13										13
14										14
15					---------- End of Boring @ 15' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Route 6A
Orleans, MA

Boring: B-9

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: S.Chmiel, B.Morrill
Pre-Clear Contractor: Strategic
Pre-Clear Date: 3/13/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 3/16/2017

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 2" Dark Brown Loamy Sand With Fine Roots (Topsoil)					1
2					2 to 24" Light Tan Medium to Fine Sand with Small to Medium Roots					2
3					24 to 60" Tan Fine Sand With Pebbles					3
4										4
5										5
6	5 ft to 10 ft	4			5.00' - 6.00' : Orange\Tan fine to medium sand					6
7					6.00' - 6.75' : Tan medium-coarse sand w/ silt fines					7
8					6.75' - 7.75' : Medium-coarse sand					8
9					7.75' - 8.5': Silt fine layer over medium - coarse sand					9
10					8.50' - 9.00' : Light tan coarse sand					10
11	10 ft to 15 ft	4	Damp		10.00' - 15.00' : Tan coarse sand with medium sand mixed.					11
12										12
13										13
14										14
15										15
16	15 ft to 20 ft	5			15.00' - 16.75' : Light Tan coarse sand					16
17					16.75' - 19.50' : Light Tan fine and medium sand					17
18					19.50' - 20.00' : Orange fine and medium sand					18
19										19
20										20
21	20 ft to 25 ft	5			20.00' - 21.50' : Fine to medium sand. (bagged @ 21.50 and 22.50)					21
22					21.50' - 26.00' : Fine, dense, sand w/ some clay-like materials					22
23										23
24										24
25										25
26	25 ft to 30 ft				---------- End of Boring @ 26' ----------					26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Route 6A
Orleans, MA

Boring: B-11

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: S.Chmiel, B.Morrill
Pre-Clear Contractor: Strategic
Pre-Clear Date: 3/13/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 3/16/2017

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 7" Dark Brown Loamy Sand With Fine Roots (Topsoil)					1
2					7 to 60" Brown Medium Damp Silty Sand With Stones and Cobbles					2
3										3
4										4
5										5
6	5 ft to 10 ft	4			5.00' - 6.00' : Brown fine sand					6
7					6.00' - 9.00' : Brown\Tan, densely packed, fine silty sand					7
8										8
9										9
10										10
11	10 ft to 15 ft	4.5			10.00' - 13.00' : Tan\Orange, densely packed, fine silty sand					11
12					13.00' - 13.50' : Light tan fine sand					12
13					13.50' - 14.00' : Dense silt layer					13
14					14.00' - 14.50' : Light tan fine sand					14
15										15
16	15 ft to 20 ft	4.5			15.00' - 17.25' : Light tan fine sand					16
17					17.25' - 20.00' : Light tan medium - coarse sand					17
18										18
19										19
20										20
21	20 ft to 25 ft	4			20.00' - 25.00' : Light tan fine sand					21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft	5			25.00' - 25.50' : Light tan fine sand					26
27					25.50' - 26.00' : Brown fine to medium sand					27
28					26.00' - 28.00' : light tan fine sand					28
29					28.00' - 28.50' : Silt layer					29
30					28.50' - 29.00' : Tan fine to medium sand 29.00' - 30.00' : Rusty and grey fine sand and silt. Lg rock at 30'					30
31	30 ft to 32 ft	2			30.00' - 30.25' : Rest of rock for previous core					31
32					30.25' - 32.00' : Medium - coarse sand					32
33					---------- End of Boring @ 32' ----------					33
34										34
35										35

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Route 6A
Orleans, MA

Boring: B-12

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: S.Chmiel, B.Morrill
Pre-Clear Contractor: Strategic
Pre-Clear Date: 3/13/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 3/16/2017

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				Roots					1
2					36" to 60" Tan Medium to Course Sand with Stones and Cobbles					2
3										3
4										4
5										5
6	5 ft to 10 ft	3.5			5.00' - 7.25' : Orange fine to medium sand					6
7					7.5' - 7.50' : Brown fine sand					7
8					7.75 : Tree root					8
9					8.00' - 8.50' : Tan fine sand					9
10										10
11	10 ft to 15 ft	4			10.00' - 11.50' : Tan fine sand					11
12					11.50' - 15.00' : Fine to medium sand					12
13										13
14										14
15					---------- End of Boring @ 15' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Route 6A
Orleans, MA

Boring: B-13

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: S.Chmiel, B.Morrill
Pre-Clear Contractor: Strategic
Pre-Clear Date: 3/13/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 3/16/2017

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 3” Dark Brown Loamy Sand With Fine Roots (Topsoil)					1
2					3 to 60” Tan Fine to Medium Silty Sand					2
3										3
4										4
5										5
6	5 ft to 10 ft	5			5.00' - 6.00' : Tan fine to medium sand					6
7					6.00' - 7.00' : Fine sand					7
8					7.00' - 8.00' : Fine to medium sand					8
9					8.00' - 11.00' : Fine silty sand					9
10										10
11	10 ft to 15 ft				---------- End of Boring @ 11' ----------					11
12										12
13										13
14										14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Route 6A
Orleans, MA

Boring: B-14

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: S.Chmiel, B.Morrill
Pre-Clear Contractor: Strategic
Pre-Clear Date: 3/13/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 3/16/2017

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 6" Dark Brown Loamy Sand With Fine Roots (Topsoil)					1
2					6 to 60" Tan Fine to Medium Silty Sand With Pebbles					2
3										3
4										4
5										5
6	5 ft to 10 ft	3.75			5.00' - 6.00' : Brown, dense, silty sand					6
7					6.00' - 7.50' : Brown fine sand					7
8					7.50' - 8.00' : Rust colored, silt material					8
9					8.00' - 10.00' : Grey clay-like material					9
10										10
11	10 ft to 15 ft				10.00' - 13.00' : True clay, grey					11
12										12
13					---------- End of Boring @ 13' ----------					13
14										14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Route 6A
Orleans, MA

Boring: B-15

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: S. Chmiel
Pre-Clear Contractor: Strategic
Pre-Clear Date: 3/13/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 3/22/2017

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 10" Dark Brown Loamy Sand With Landscape Material					1
2					10 to 60" Tan Fine Sand					2
3										3
4										4
5										5
6	5 ft to 10 ft				5 to 7 Ft: Tan Fine to Medium Sand with Stones and Pebbles					6
7					7 to 10 Ft: Light Tan Dense Silty Fine Sand with Stones and Pebbles					7
8										8
9										9
10					10 to 12.2 Ft: Tan Medium Sand with Pebbles					10
11	10 ft to 15 ft									11
12					12.2 to 13.4 Ft: Light Gray Dense Silty Clay Sand					12
13					13.4 to 18 Ft: Light Tan Fine Sand					13
14										14
15										15
16	15 ft to 20 ft									16
17										17
18			Wet		18 to 19.6 Ft: Tan to Brown Dense Damp Silty Sand with Pebbles					18
19					19.6 to 21.3 Ft: Light Tan Fine Sand					19
20										20
21	20 ft to 25 ft				21.3 to 23 Ft: Light Tan to Gray Damp Silty Clay Sand					21
22										22
23					23 to 25 Ft: Tan to Brown Fine to Medium Sand					23
24										24
25					25 to 27 Ft: Dense Damp Tan to Gray Silty Sand					25
26	25 ft to 30 ft									26
27										27
28					---------- End of Boring @ 27' ----------					28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Route 6A
Orleans, MA

Boring: B-16

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: S. Chmiel
Pre-Clear Contractor: Strategic
Pre-Clear Date: 3/13/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 3/22/2017

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 8" Dark Brown Loamy Sand With Landscape Material					1
2					8 to 60" Tan Fine to Medium Sand With Pebbles					2
3										3
4										4
5										5
6	5 ft to 10 ft				5 to 6.5 Ft: Tan Fine Sand					6
7					6.5 to 11 Ft: Gray to Light Brown Dense Silty Fine Sand with Trace Clay and Multiple Fine Sand					7
8										8
9										9
10										10
11	10 ft to 15 ft				---------- End of Boring @ 11' ----------					11
12										12
13										13
14										14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Route 6A
Orleans, MA

Boring: B-17

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: S. Chmiel, B.Morrill
Pre-Clear Contractor: Strategic
Pre-Clear Date: 3/13/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 3/17/2017

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 6" Dark Brown Loamy Sand With Landscape Material					1
2					6 to 60" Tan Medium to Course Sand With Pebbles					2
3										3
4										4
5										5
6	5 ft to 10 ft	3.5			5.00' - 5.75' : Tan fine sand					6
7					5.75' -7.00' : Cobble and gravel layer					7
8					7.00' - 7.50' : Fine sand with small amounts of silty sand					8
9					7.50' - 8.00' : Fine to medium sand					9
10										10
11	10 ft to 15 ft				10.00' - 11.00' : Brown fine to medium sand					11
12					11.00' - 13.00' : Orange coarse sand					12
13					---------- End of Boring @ 12' ----------					13
14										14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: RT 6A
Orleans, MA

Boring: B-18

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: S. Chmiel, B.Morrill
Pre-Clear Contractor: Strategic | Pre-Clear Date: 3/16/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 3/17/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 10" Dark Brown Loamy Sand (Topsoil)					1
2					10 to 60" Light Brown Silty Sand with Pebbles and Stones					2
3										3
4										4
5										5
6	5 ft to 10 ft	4			5.00' - 6.25' : Brown\Orange, silty (50%) fine sand					6
7					6.25' - 7.00' : Orange fine sand					7
8					7.00' - 7.25' : Silt with fine sand					8
9					7.25' - 8.00' : Orange fine to medium sand					9
10					8.00' - 9.00' : Fine silty sand ---------- End of Boring @ 10' ----------					10
11	10 ft to 15 ft									11
12										12
13										13
14										14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: RT 6A
Orleans, MA

Boring: B-22

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: S. Chmiel, B.Morrill
Pre-Clear Contractor: Strategic | Pre-Clear Date: 3/16/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 3/17/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 10" Dark Brown Loamy Sand (Topsoil)					1
2					10 to 60" Light Tan Saturated Silty Sand					2
3										3
4										4
5										5
6	5 ft to 10 ft	3.5			5.00' - 6.50' : Fine medium sand					6
7					6.50' - 6.75' : Silty fine sand					7
8					6.75' - 8.50' : Tan\Orange coarse - medium sand					8
9										9
10										10
11	10 ft to 15 ft	2			10.00' - 12.00' : Orange\Tan coarse sand with some medium material					11
12					---------- End of Boring @ 12' ----------					12
13										13
14										14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: RT 6A
Orleans, MA

Boring: B-23

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: S. Chmiel, B.Morrill
Pre-Clear Contractor: Strategic | Pre-Clear Date: 3/16/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 3/17/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 20" Dark Brown Loamy Sand (Topsoil)					1
2					20 to 60" Tan Fine to Medium Sand					2
3										3
4										4
5										5
6	5 ft to 10 ft	3.5			5.00' - 6.25' : Tan fine to medium sand					6
7					6.25' - 6.50' : Silty fine sand					7
8					6.50' - 7.00' : Orange fine to medium sand					8
9					7.00' - 8.00' : Brown silty fine sand					9
10					8.00' - 8.50' : Orange fine to medium sand ---------- End of Boring @ 10' ----------					10
11	10 ft to 15 ft									11
12										12
13										13
14										14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Route 6A
Orleans, MA

Boring: B-24

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: B. Barra
Pre-Clear Contractor: Strategic | Pre-Clear Date: 5/2/2019
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 5/7/2019

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear				0 - 12" : Topsoil					1
2	0 ft to 8 ft				12" - 96" : Fine sand					2
3										3
4										4
5										5
6	5 ft to 10 ft	5.0	dry		5' - 7.9' : Tan/light orange fine sand, loose and non-plastic					6
7			moist		7.9' - 8.4' : Tan silt with little fine sand, medium dense, non-plastic					7
8			dry		8.4' - 9.6' : Tan fine sand with silt, dense, non-plastic					8
9					9.6' - 10' : Light brown silty fine sand, dense, non-plastic					9
10										10
11	10 ft to 15 ft	5.0	dry		10' - 12.5' : Brown fine to medium sand, loose and non-plastic, some organics at 12'					11
12										12
13					12.5' - 15' : Brown silt with little fine sand, medium dense, non-plastic fine to medium sand lens at 13.7' and 14.5' rock @ 15'					13
14										14
15										15
16	15 ft to 20 ft	5.0	dry		15' - 17.4' : Brown fine to medium sand with some silt, loose and non-plastic					16
17					17.4' - 17.55' : silt with little fine sand, medium dense, non-plastic					17
18					17.55' - 18.7' : Light brown fine sand w/ little silt, claylike inclusion @ 17.7					18
19					18.7' - 19.3' : Tan silt with trace fine sand, medium dense, non-plastic					19
20					19.3' - 20' : Tan fine to medium sand, loose and non-plastic					20
21					---------- End of Boring at 20' ----------					21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Route 6A
Orleans, MA

Boring: B-25

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B. Barra
Pre-Clear Contractor: Strategic
Pre-Clear Date: 5/2/2019
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 5/7/2019

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear				0-4" : Topsoil					1
2	0 ft				4" - 36" : Sandy subsoil					2
3	to 8.5 ft				36" - 102" : Medium sand					3
4										4
5										5
6	5 ft		dry		5' - 9' : Tan fine sand, loose and non-plastic					6
7	to 10 ft	5.0			9' - 10' : Tan silty fine sand, medium dense, non-plastic					7
8										8
9										9
10										10
11	10 ft		dry		10' - 10.6' : Orange fine sand, loose and non-plastic					11
12	to 15 ft	5.0			10.6' -13' : Brown/tan silty sand, medium dense, non-plastic					12
13			moist		13' - 13.3' : Grey w/ orange mottled silt, medium dense, non-plastic					13
14					13.3' - 13.7' : Light tan fine sand, loose and non-plastic					14
15			dry		13.7' - 14.2' : Brown silty sand, medium dense, non-plastic					15
					14.2' - 15' : Light tan fine sand, loose and non-plastic					
16	15 ft		dry		15' - 17.75' : Light tan fine sand, loose and non-plastic					16
17	to 20 ft	5.0			plastic					17
18					18' - 20' : Light tan fine sand, loose and non-plastic					18
19										19
20					---------- End of Boring at 20' ----------					20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: RT 6A
Orleans, MA

Boring: B-26

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: S. Chmiel, B.Morrill
Pre-Clear Contractor: Strategic | Pre-Clear Date: 3/16/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 3/17/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 8" Dark Brown Loamy Sand (Topsoil)					1
2					8 to 60" Tan Fine Sand					2
3										3
4										4
5										5
6	5 ft to 10 ft	4			5.00' - 9.00' : Tan fine sand					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	4			10.00' - 14.00' : Tan fine sand. Silty horizons at 11.5 & 12.0					11
12										12
13										13
14										14
15										15
16	15 ft to 20 ft	3			15.00' - 16.50' : Brown fine sand					16
17					16.50' - 17.50' : Silty clay material					17
18					17.50' - 18.00' : Tan medium sand					18
19					---------- End of Boring @ 18' ----------					19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Lots Hollow Road
Orleans, MA

Boring: B-27

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B. Barra
Pre-Clear Contractor: Strategic
Pre-Clear Date: 5/2/2019
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 5/7/2019

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear				0 - 8" : Topsoil					1
2	0 ft				8" - 12" : Broken pavement					2
3	to 8 ft				12" - 36" : Fine sand					3
4					36" - 96" : Medium sand					4
5										5
6	5 ft		moist		5' - 10' : Light brown fine sand, loose and non-plastic					6
7	to 10 ft	5.0								7
8										8
9										9
10										10
11	10 ft		moist		10' - 13.4' : Light brown/tan fine sand with little silt, medium dense, non-plastic					11
12	to 15 ft	5.0			13.4' - 13.6' : rock					12
13					13.6' - 14.5' : Brown/orange fine to medium sand with little angular gravel,					13
14			dry		14.5' - 14.8' : Brown silt with trace fine sand, medium dense, non-plastic					14
15					14.8' - 15' : Dark orange fine to medium sand, loose and non-plastic					15
16	15 ft		dry		15' - 16.7' : Light brown fine sand with trace angular gravel, loose and non-pla					16
17	to 20 ft	5.0			16.7' - 17' : Dark orange fine to medium sand, loose and non-plastic					17
18					17' - 17.1' - silt lens, dense					18
19					17.1' - 18.7' : Light tan fine sand, loose and non-plastic, some orange					19
20					18.7' - 20' : Brown w/ orange mottled silty fine sand w/ trace small gravel, medium dense, non-plastic					20
21					---------- End of Boring at 20' ----------					21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Route 6A
Orleans, MA

Boring: B-30

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: S. Chmiel
Pre-Clear Contractor: Strategic | Pre-Clear Date: 3/15/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 3/21/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 10" Brown Loamy Sand Landscape Medium					1
2					10 to 60" Tan Course Sand with Pebbles					2
3										3
4										4
5										5
6	5 ft to 10 ft				5 to 9 Ft: Tan to Light Tan Medium to Course Sand					6
7										7
8										8
9					9 to 12 Ft: Tan to Brown Fine to Medium Sand with Stones					9
10										10
11	10 ft to 15 ft									11
12					12 to 15 Ft: Tan Fine Sand with Orange Redox Concentrations					12
13										13
14										14
15										15
16	15 ft to 20 ft				---------- End of Boring @ 15' ----------					16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: RT 6A
Orleans, MA

Boring: B-31

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: S. Chmiel
Pre-Clear Contractor: Strategic | Pre-Clear Date: 3/15/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 3/21/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 6" Dark brown Loamy Sand (Topsoil)					1
2					6 to 60" Tan Course Sand with Pebbles and Stones					2
3										3
4										4
5										5
6	5 ft to 10 ft				5 to 9 Ft: Dark Brown Damp Course Sand with Small Stones or Pebbles					6
7										7
8										8
9					9 to 9.4 Ft: Dark Brown and Gray Damp Clay Sand					9
10					9.4 to 11 Ft: Light Tan Damp Fine Sand					10
11	10 ft to 15 ft				11 to 14 Ft: Light Tan Damp Fine to Medium Sand with Stones and Pebbles					11
12										12
13										13
14										14
15					---------- End of Boring @ 14' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Route 6A
Orleans, MA

Boring: B-32

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B. Barra
Pre-Clear Contractor: Strategic
Drill Contractor: NE Geotech
Driller: Hayes
Pre-Clear Date: 5/3/2019
Drill Date: 5/7/2019

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear				0 - 12" : Topsoil					1
2	0 ft to 6 ft				12" - 36" : Sandy fill					2
3					36 - 72" : Medium sand					3
4										4
5										5
6	5 ft to 10 ft	5.0	moist		5' - 10" : fine to medum sand with trace coarser sand, loose and non plastic 1" rock @ 8.2'					6
7					5'-7.8' - brown					7
8					7.8'-10 - light brown/orange					8
9										9
10										10
11	10 ft to 15 ft	5.0	moist		10' - 14' : Brown to orange to tan fine to medium sand w/ little coarse sand & trace subangular gravel, loose & non-plastic					11
12					14' - 15' : Brown to Grey clay, very stiff, plastic					12
13										13
14										14
15										15
16	15 ft to 20 ft		wet		*Liner crushed 15'-20' : Tan silty sand transitioning into light brown medium sand with little fine sand then to dark orange fine sand					16
17										17
18										18
19										19
20					---------- End of Boring at 20' ----------					20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: RT 6A
Orleans, MA

Boring: B-33

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: S. Chmiel
Pre-Clear Contractor: Strategic | Pre-Clear Date: 3/15/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 3/21/2017

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 20" Dark Brown Loamy Sand (Topsoil)					1
2					20 to 30" Pavement					2
3					30 to 60" Tan Medium to Course Sand with Pebbles					3
4										4
5										5
6	5 ft to 10 ft				5 to 6 Ft. Light Tan Fine Sand					6
7					6 to 7.7 Ft: Tan Medium to Course Sand with Stones 7.7 to 8.5 Ft: Light Tan Fine Sand with Pebbles					7
8					8.5 to 9.3 Ft: Light Tan Medium to Course Sand					8
9					9.3 to 11.9 Ft: Light Tan Fine to Medium Sand					9
10										10
11	10 ft to 15 ft				11.9 to 12.7 Ft: Light Tan Fine Sand					11
12					12.7 to 13.5 Ft: Tan Fine to Medium Sand					12
13										13
14					14.7 to 15.3 Ft: Gray to Blue Dense Damp Clay					14
15					15.3 to 17 Ft: Gray Saturated Medium to Course Sand					15
16	15 ft to 20 ft									16
17					17 to 18.3 Ft: Tan Damp Fine to Medium Sand					17
18					18.3 to 19.5 Ft: Brown to Gray Damp Fine to Medium Sand					18
19					19.5 to 20 Ft: Gray Damp Medium to Course Sand					19
20					20 to 21.4 Ft: Dark Brown Damp Course Sand with Stones and Pebbles					20
21	20 ft to 25 ft				21.4 to 22 Ft: Gray Damp Fine to Medium Silty Sand					21
22					---------- End of Boring @ 22' ----------					22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: RT 6A
Orleans, MA

Boring: B-34

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: S. Chmiel
Pre-Clear Contractor: Strategic | Pre-Clear Date: 3/15/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 3/21/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 12" Dark Brown Loamy Sand (Landscape Medium)					1
2					12 to 14" Pavement					2
3					14 to 36" Tan to Gray Damp Silty Sand					3
4					36 to 60" Gray Silty Clay Sand					4
5										5
6	5 ft to 10 ft				5 to 6 Ft: Tan Fine Sand					6
7					6 to 12 Ft: Tan Fine to Medium Sand with Stones and Pebbles					7
8										8
9										9
10										10
11	10 ft to 15 ft									11
12					12 to 12.3 Ft: Dense Damp Gray Silty Sand with Trace of Clay					12
13					12.3-14 Ft: Gray Damp Fine to Medium Sand with Stones and Pebbles					13
14					14 to 15 Ft: Dark Brown Damp Medium to Course Sand					14
15					---------- End of Boring @ 15' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Route 6A
Orleans, MA

Boring: B-35

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B. Barra
Pre-Clear Contractor: Strategic
Pre-Clear Date: 5/2/2019
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 5/7/2019

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear				0" - 12" : Topsoil					1
2	0 ft to 8 ft				12" - 96" : Fine sand					2
3										3
4										4
5										5
6	5 ft to 10 ft	5.0	moist		5' - 9' : Brown fine to medium sand with trace silt and trace angular gravel, loo					6
7					9' - 9.3' : Brown silt with little fine sand, medium dense, non-plastic					7
8					9.3' - 10' : Brown fine sand, loose and non-plastic					8
9										9
10										10
11	10 ft to 15 ft	5.0	dry		10' - 15' : Light brown to brownish grey fine to medium sand with trace coarse sand and trace subangular gravel, loose and non-plastic					11
12										12
13										13
14										14
15					---------- End of Boring @ 15' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: RT 6A
Orleans, MA

Boring: B-36

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: S. Chmiel
Pre-Clear Contractor: Strategic | Pre-Clear Date: 3/15/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 3/21/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 10" Dark Brown Loamy Sand (Topsoil)					1
2					10 to 18" Pavement					2
3					18 to 30" Tan Course Sand					3
4					30 to 60" Silty Clay Sand					4
5										5
6	5 ft to 10 ft				5 to 9.3 Ft: Tan Medium to Course Sand with Small Stones and Pebbles					6
7										7
8										8
9					9.3 to 10 Ft: Gray Silty Fine Sand					9
10					---------- End of Boring at 10' ----------					10
11	10 ft to 15 ft									11
12										12
13										13
14										14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Cottage Street
Orleans, MA

Boring: B-38

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Drill Contractor: NE Geotech
Driller: Hayes
Pre-Clear Date: 2/21/2017
Drill Date: 2/23/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 6" : Grass, loam					1
2					6" - 5' : Orange\Brown medium sand. Large cobble encountered					2
3										3
4										4
5										5
6	5 ft to 10 ft	4 ft	dry		Tan-Brown fine to medium sand, trace silt					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	4.1 ft	dry		10 to 10.6 ft: Tan-Brown fine to medium sand, trace silt					11
12					10.6 to 12.4 ft: Brown fine sand, little medium silty sand					12
13					12.4 to 14.1 ft: Brown silt, some fine sand fining to clay					13
14										14
15										15
16	15 ft to 20 ft	3.7 ft	dry		Tan fine to medium sand, Iron-staining from 15 to 16.4 ft					16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft	3.4 ft	dry		20 to 28.4 ft: Tan medium sand, little coarse sand					21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft	3.4 ft	dry							26
27										27
28										28
29										29
30					---------- End of Boring at 30' ----------					30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: RT 28
Orleans, MA

Boring: B-39

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: S. Chmiel
Pre-Clear Contractor: Strategic | Pre-Clear Date: 3/15/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 3/21/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 8" Landscape Medium of Mulch and Loamy Sand					1
2					8 to 12" Loamy Sand					2
3					12 to 36" Tan Medium to Course Sand					3
4					36 to 60" Light Tan Fine Silty Damp Sand					4
5										5
6	5 ft to 10 ft				5 to 7 Ft: Tan Fine Silty Sand					6
7					7 to 7.8 Ft: Gray to Brown Damp Fine Silty Sand with Trace of Gray Clay					7
8					7.8 to 11.5 Ft: Light Tan Fine Sand					8
9										9
10										10
11	10 ft to 15 ft				11.5 to 13 Ft: Tan to Light Tan Damp Silty Sand					11
12										12
13					13 to 14 Ft: Tan Medium to Course Sand with Stones					13
14										14
15					---------- End of Boring at 14' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: RT 28
Orleans, MA

Boring: B-40

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: S.Chmiel
Pre-Clear Contractor: Strategic | Pre-Clear Date: 3/15/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 3/21/2017

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 10" Dark Brown Loamy Sand with Small Roots (Topsoil)					1
2					10 to 60" Tan Fine to Medium Sand					2
3										3
4										4
5										5
6	5 ft to 10 ft				5 to 7.5 Ft: Tan Fine Sand					6
7					7.5 to 8.6 Ft: Tan Fine to Medium Sand					7
8					8.6 to 11.2 Ft: Tan Fine Sand					8
9										9
10										10
11	10 ft to 15 ft				11.2 to 13.4 Ft: Light Tan Saturated Fine Silty Sand					11
12										12
13					13.4 to 15 Ft: Light Tan to Gray Damp Sand					13
14					---------- End of Boring at 13' ----------					14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: North Cottage Street
Orleans, MA

Boring: B-41

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/21/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/23/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 4" : Asphalt					1
2					4" - 5" : Gravel					2
3					5" - 5' : Brown medium sand					3
4										4
5										5
6	5 ft to 10 ft	3.7 ft	dry		Tan medium to coarse sand					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	3.6 ft	dry		10 to 10.6 ft: Tan medium to coarse sand					11
12					10.6 to 11.2 ft: Tan-Orange coarse sand, some medium sand					12
13					11.2 18.9 ft: Tan medium to coarse sand, trace fine gravel					13
14										14
15										15
16	15 ft to 20 ft	3.9 ft	dry							16
17										17
18										18
19										19
20					---------- End of Boring 20' ----------					20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Brewster Cross Road
Orleans, MA

Boring: B-43

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 15 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/17/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/23/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 6" : Asphalt					1
2					6" - 12" : Tar gravel					2
3					12" - 5' : Brown fine to medium sand					3
4										4
5										5
6	5 ft to 10 ft	3.6 ft	dry		5 to 6 ft: Tan fine sand, trace medium gravel					6
7					6 to 13.7 ft: Brown-Grey fine sand, trace silt					7
8										8
9										9
10										10
11	10 ft to 15 ft	3.7 ft	dry							11
12										12
13										13
14										14
15					---------- End of Boring 15' ----------					15
16										16
17										17
18										18
19										19
20										20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Brewster Cross Road
Orleans, MA

Boring: B-44

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 10 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date 2/17/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/23/2017

Depth	Sample Identification	Rec (ft)	Moisture		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 6" : Asphalt					1
2					6" - 12" : Tar gravel					2
3					12" - 5' : Brown fine to medium sand					3
4										4
5										5
6	5 ft to 10 ft	4.1 ft	dry		5 to 8.3 ft: Brown fine sand, little silt					6
7					8.3 to 8.8 ft: Tan medium sand, some fine sand					7
8					8.8 to 9.1 ft: Tan fine sand, little silt					8
9										9
10					---------- End of Boring 10' ----------					10
11										11
12										12
13										13
14										14
15										15
16										16
17										17
18										18
19										19
20										20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Brewster Cross Road
Orleans, MA

Boring: B-45

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 25 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/17/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/23/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 6" : Asphalt					1
2					6" - 12" : Tar gravel					2
3					12" - 5' : Brown fine to medium sand					3
4										4
5										5
6	5 ft to 10 ft	2 ft	dry		Brown/Light Brown fine to medium sand					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	4.1 ft	dry		10 to 11.5 ft: Tan medium sand, little coarse sand					11
12					11.5 to 14.1 ft: Brown-Grey, mottled fine sand, some silt					12
13										13
14										14
15										15
16	15 ft to 20 ft	4.4 ft	dry		Brown, Iron-stain-mottled fine to medium sand					16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft	3.5 ft	dry		20 to 22 ft: Tan/Grey fine sand, little silt					21
22					22 to 22.8 ft: Tan fine sand, little medium sand					22
23					22.8 to 23.5 ft: Grey, Iron-stain-mottled fine sand, little silt					23
24										24
25					---------- End of Boring 25' ----------					25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Brewster Cross Road
Orleans, MA

Boring: B-46

Boring Number:
Sheet: 1 of 2
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 40 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/17/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/23/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 8" : Asphalt					1
2					8" - 12" : Gravel					2
3					12" - 5' : Brown fine to medium sand					3
4										4
5										5
6	5 ft to 10 ft	4.2 ft	dry		5 to 7.2 ft: Tan fine to medium sand					6
7					7.2 to 7.4 ft: Broken cobble					7
8					7.4 to 9.2 ft: Brown fine sand, little silt					8
9										9
10										10
11	10 ft to 15 ft	4 ft	dry		Brown silt, some fine sand					11
12										12
13										13
14										14
15										15
16	15 ft to 20 ft	3.1 ft	dry		15 to 16.7 ft: Brown silt, trace fine sand					16
17					16.7 to 17 ft: Grey silt, little clay					17
18					17 to 26.7 ft: Plastic Grey clay					18
19										19
20										20
21	20 ft to 25 ft	4 ft	moist							21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft	4 ft	moist /	wet						26
27					26.7 to 27.5 ft:Grey sandy silt					27
28					27.5 to 28.8 ft: Brown, Iron-stain-mottled fine sand, little silt					28
29					28.8 to 29 ft: Tan medium sand, some fine sand					29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Main Street
Orleans, MA

Boring: B-46, continued

Boring Number:
Sheet: 2 of 2

Surface Elevation (ft-asl): ____

Equipment: Geoprobe 6620
Inside Diameter: 2"

Well Data

Boring Depth: 40 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/17/2017
Drill Contractor: NE Geotech
Drill Date: 2/23/2017

Depth	Sample Identification	Rec (ft)	Moisture		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
31	30 ft to 35 ft	3.5 ft	wet		30 to 30.4 ft: Tan medium to coarse sand					31
32					30.4 to 33 ft: Brown, Iron-stain-mottled fine sand, little silt					32
33					33 to 33.5 ft: Tan medium sand					33
34										34
35										35
36	35 ft to 40 ft	3 ft	wet		Tan medium sand, little coarse sand					36
37										37
38										38
39										39
40					---------- End of Boring 40' ----------					40

Project Number: 60476644
Client: Town of Orleans

Site Location: Main Street
Orleans, MA

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Project Manager: Reggie Donoghue | Field Techs: C.Hayden

Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/20/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/21/2017

Boring: B-47

Boring Number:
Sheet: 1 of 2
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620
Inside Diameter: 2"

Well Data

Boring Depth: 10 ft
Screen Depth:
Screen length:

Depth	Sample Identification	Rec (ft)	Sorting	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1–5	0 ft to 5 ft					Pre-Cleared to 5 ft Brown fine to medium sand					1–5
6–10	5 ft to 10 ft	3.8 ft		dry		5 to 6 ft: Dense, Brown fine sand 6 to 8.6 ft: Loose, Tan fine sand, little medium sand 8.6 to 8.8 ft: Tan/Grey fine sand, little silt					6–10
11–15	10 ft to 15 ft	3.2 ft		dry		10 to 10.7 ft: Tan /Grey silt, trace fine sand 10.7 to 12 ft: Tan fine to medium sand 12 to 13.2 ft: Tan fine to medium sand, little coarse sand, trace fine gravel					11–15
16–20	15 ft to 20 ft	3.8 ft		dry		Tan fine to medium sand, little coarse sand, trace fine gravel					16–20
21–25	20 ft to 25 ft	3.9 ft		dry		Tan fine to medium sand, little coarse sand, trace fine gravel					21–25
26–30	25 ft to 30 ft	3.7 ft		dry		Tan medium sand, little fine sand					26–30

Project Number: 60476644
Client: Town of Orleans

Site Location: Main Street
Orleans, MA

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Boring: B-47, continued

Boring Number:
Sheet: 2 of 2

Surface Elevation (ft-asl): ____

Equipment: Geoprobe 6620
Inside Diameter: 2"

Well Data

Boring Depth: 40 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: C.Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/20/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/21/2017

Depth	Sample Identification	Rec (ft)	Sorting	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
31	30 ft to 35 ft	3.7 ft		wet		Tan medium sand, little fine sand					31
32											32
33											33
34											34
35											35
36	35 ft to 40 ft	3.5 ft		wet		35 to 37.8 ft: Tan medium sand, **wet**					36
37						37.8 to 38.5 ft: Coarse sand, little medium sand					37
38						---Red/Orange Iron staining from 38.2 to 38.5 ft					38
39											39
40						---------- End of Boring at 40' ----------					40

Project Number: 60476644 *Client:* Town of Orleans *Site Location:* Main Street Orleans, MA	AECOM 250 Apollo Drive Chelmsford, Massachusetts (978) 905-2100	***Boring: B-48*** *Boring Number:* *Sheet:* 1 of 1 *Surface Elevation (ft-asl):* ____ *Equipment:* Geoprobe 6620 *Inside Diameter:* 2"

Well Data

Boring Depth: 15 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue *Field Techs:* B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic *Pre-Clear Date:* 2/21/2017
Drill Contractor: NE Geotech *Driller:* Hayes *Drill Date:* 2/21/2017

Depth	Sample Identification	Rec (ft)	Sorting	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1-5	0 ft to 5 ft					0 - 10" : Asphalt 10" - 12" : Gravel 12" - 5' : Orange\Brown fine to medium sand					1-5
6-10	5 ft to 10 ft	4 ft		dry		5 to 7 ft: Tan fine to medium sand ---Brown silt lenses: 5.7 to 5.9 ft and 6.6 to 6.7 ft 7 to 7.5 ft: Mottled, Brown silt 7.5 to 7.7 ft: Loose, Tan fine to medium sand 7.7 to 9 ft: Mottled, Brown silt and fine sand					6-10
11-15	10 ft to 15 ft	2.5 ft		dry		Tan/Brown fine to medium sand, broken cobble/large gravel fragments ---------- End of Boring 15' ----------					11-15
16-30											16-30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Brewster Cross Road
Orleans, MA

Boring: B-49

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/21/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/23/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 5" : Asphalt					1
2					5" - 6" : Gravel					2
3					6" - 5' : Orange\Brown fine to medium sand. Larger cobbles encountered					3
4										4
5										5
6	5 ft to 10 ft	4 ft	dry		10 to 11.8 ft: Tan fine to medium sand					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	4.2 ft	moist		11.8 to 13.5 ft: Brown mottled fine sand					11
12					13.5 to 14.2 ft: Brown medium sand, trace coarse sand					12
13										13
14										14
15										15
16	15 ft to 20 ft	3.3 ft	moist		15 to 16.9 ft: Tan, Iron-stained medium sand					16
17					16.9 to 17.1 ft: Brown, mottled fine sand					17
18					17.1 to 18.3 ft: Tan, Iron-stained medium to coarse sand					18
19										19
20					---------- End of Boring 20' ----------					20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644 *Client: Town of Orleans* *Site Location: Main Street* *Orleans, MA*	AECOM 250 Apollo Drive Chelmsford, Massachusetts (978) 905-2100	***Boring: B-50*** *Boring Number:* *Sheet:* 1 of 2 *Surface Elevation (ft-asl):* ____ *Equipment:* Geoprobe 6620 *Inside Diameter:* 2"

Well Data

Boring Depth: 35 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue *Field Techs: C.Hayden*
Pre-Clear Contractor: Strategic *Pre-Clear Date:*
Drill Contractor: NE Geotech *Driller: Hayes* *Drill Date:* 2/21/2017

Depth	Sample Identification	Rec (ft)	Sorting	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1 2 3 4 5	0 ft to 5 ft					Brown fine to medium sand					1 2 3 4 5
6 7 8 9 10	5 ft to 10 ft	3.5 ft		dry		5 to 5.8 ft: Tight Brown-Orange fine to medium sand, trace coarse sand 5.8 to 7.7 ft: Dense brown silt and fine sand ---medium sand lenses: 6.3 to 6.5 ft and 6.6 to 6.7 ft 7.7 to 8.1 ft: Tan medium sand 8.1 to 8.5 ft: Brown medium sand					6 7 8 9 10
11 12 13 14 15	10 ft to 15 ft	4.2 ft		dry		10 to 11.5 ft: Tan medium sand, little coarse sand, **wet at 11.2 ft** 11.5 to 13.5 ft: Dense, mottled Brown/Tan fine sand, some silt 13.5 to 14.2 ft: Tan/Light brown medium sand, little coarse sand, **dry**					11 12 13 14 15
16 17 18 19 20	15 ft to 20 ft	3.2 ft				15 to 16.5 ft: Tan fine to medium sand, Iron-staining from 15.5 to 15.6 ft 16.5 to 18 ft: Tan fine/very fine sand ---intermittent brown silt lenses, ranging between 1/8" to 1" thick 18 to 18.2 ft: Tan very fine sand, multiple brown silty clay varves					16 17 18 19 20
21 22 23 24 25	20 ft to 25 ft	3.7 ft				20 to 23.3 ft: Tan fine sand ---Brown silt lenses: 22.2 to 22.4 ft and 22.8 to 22.9 ft 23.3 to 23.7 ft: Brown mottled silt					21 22 23 24 25
26 27 28 29 30	25 ft to 30 ft	3.9 ft				Mottled, Tan fine to medium sand					26 27 28 29 30

Project Number: 60476644
Client: Town of Orleans

Site Location: Main Street
Orleans, MA

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Boring: B-50, continued

Boring Number:
Sheet: 2 of 2

Surface Elevation (ft-asl): ____

Equipment: Geoprobe 6620
Inside Diameter: 2"

Well Data

Boring Depth: 35 ft
Screen Depth:
Screen length:

Project Manager: Mark Owen
Field Techs: C.Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date:
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/21/2017

Depth	Sample Identification	Rec (ft)	Sorting	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
31	30 ft to 35 ft	2.3 ft		wet		30 to 30.5 ft: Tan medium sand, moist (large chunk of gravel at 30.5 ft)					31
32						30.6 to 31.1 ft: Brown fine sand, little medium sand, **wet** 31.1 to 32.3 ft: Brown medium sand, little coarse sand, **wet**					32
33						**Note:** 32.3 to 33.3 ft fell out of the liner back into borehole					33
34											34
35						---------- End of Boring 35' ----------					35
36											36
37											37
38											38
39											39
40											40

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Academy Place
Orleans, MA

Boring: B-52

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: S. Chmiel
Pre-Clear Contractor: Strategic
Pre-Clear Date: 3/15/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 3/21/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 13" Pavement					1
2					13 to 18" Gravel					2
3					18 to 60" Light Tan Fine to Medium Sand					3
4										4
5										5
6	5 ft to 10 ft				5 to 6 Ft: Tan Fine to Medium Sand with Stones and Pebbles					6
7					6 to 10 Ft: Light Tan Fine Sand					7
8										8
9										9
10					---------- End of Boring at 10' ----------					10
11	10 ft to 15 ft									11
12										12
13										13
14										14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Academy Place
Orleans, MA

Boring: B-53

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: S. Chmiel
Pre-Clear Contractor: Strategic
Pre-Clear Date: 3/15/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 3/21/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 7" Dark Brown Loamy Sand with Fine roots (Topsoil)					1
2					7 to 60" Tan Fine Sand with Pebbles and Stones					2
3										3
4										4
5										5
6	5 ft to 10 ft				5 to 5.6 Ft: Gray Dense Silty Sand					6
7					5.6 to 6.4 Ft: Tan Fine to Medium Silty Sand with Orange Redox Concentrations 6.4 to 8.5 Ft: Gray Damp Fine Silty Sand					7
8					8.5-9.5 Ft: Brown Fine Silty Sand					8
9					9.5 to 10.5 Ft: Tan Fine Sand					9
10					10.5 to 11.5 Ft: Gray Silty Clay Sand					10
11	10 ft to 15 ft				11.5 to 13 Ft: Tan to Light Tan Medium to Course Sand					11
12										12
13					---------- End of Boring at 13' ----------					13
14										14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Cove Road
Orleans, MA

Boring: B-54

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: S. Chmiel
Pre-Clear Contractor: Strategic
Pre-Clear Date: 3/15/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 3/21/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 8" Pavement					1
2					8 to 12" Gravel					2
3					12 to 60" Tan Fine to Medium Sand with Pebbles and Stones					3
4										4
5										5
6	5 ft to 10 ft				5 to 5.5 Ft: Light Tan Fine Sand					6
7					5.5 to 8.3 Ft: Tan Fine to Medium Sand with Pebbles and Stones					7
8					8.3 to 12.7 Ft. gray Dense Damp Fine Silty Sand					8
9										9
10										10
11	10 ft to 15 ft									11
12					12.7 to 13 Ft. Tan Medium to Course Sand with Pebbles					12
13					---------- End of Boring at 12' ----------					13
14										14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Cove Road
Orleans, MA

Boring: B-55

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: S. Chmiel
Pre-Clear Contractor: Strategic
Pre-Clear Date: 3/15/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 3/21/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft									1
2										2
3										3
4										4
5										5
6	5 ft to 10 ft				5 to 5.6 Ft: Gray Tight Silty Sand					6
7					5.6 to 6.4 Ft: Tan Orange Medium Silty Sand					7
8					6.4 to 8.5 Ft. Gray Fine Silty Sand, Damp					8
9					8.5 to 9.5 Ft. Brown Coarse Silty Sand					9
10					9.5 to 10.5 Ft. Tan Fine Sand					10
					10.5 to 11.5 Ft. Gray Silty Clay Sand					
					11.5 to 13.0 Ft. Tan to Light Tan Medium Coarse Sand					
					---------- End of Boring at 13' ----------					
11	10 ft to 15 ft									11
12										12
13										13
14										14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: RT 28
Orleans, MA

Boring: B-56

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: S. Chmiel
Field Techs: C.Hayden, B.Morrill
Pre-Clear Contractor: Strategic
Pre-Clear Date: 3/15/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 3/21/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 9" Dark Brown Loamy Sand with Fine Roots (Topsoil)					1
2					9 to 60" Tan Fine Silty Sand with Pebbles					2
3										3
4										4
5										5
6	5 ft to 10 ft				5 to 8.3 Ft: Tan Fine to Medium Sand with Pebbles					6
7										7
8					8.3 to 12.7 Ft: Gray to Light Brown Dense Damp Silty Sand					8
9										9
10										10
11	10 ft to 15 ft									11
12					12.7 to 13 Ft: Tan Medium to Course Sand					12
13										13
14					---------- End of Boring at 13' ----------					14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Route 28
Orleans, MA

Boring: B-57

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B. Barra
Pre-Clear Contractor: Strategic
Pre-Clear Date: 5/2/2019
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 5/6/2019

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear				0 - 12" : Topsoil					1
2	0 ft to 8 ft				12" - 24" : Sandy subsoil					2
3					24" - 96" Fine sand					3
4										4
5										5
6	5 ft to 10 ft	5.0	dry		5' - 7.5' : Tan fine sand, loose and non-plastic					6
7					7.5' - 10' : Brown silty fine sand, medium dense, non-plastic					7
8										8
9										9
10										10
11	10 ft to 15 ft	5.0	dry		10' - 11.5' : Light brown silty fine sand, medium dense, non-plastic					11
12			moist		11.5' - 15' : Brown silt with trace fine sand, dense, non-plastic fine sand lens @ 14.5'-14.6					12
13										13
14										14
15										15
16	15 ft to 20 ft	5.0	moist		15' - 17.5' : Tan silt with trace fine sand, medium dense, non-plastic					16
17					17.5' - 19.2' - Tan fine sand with little silt, medium dense, non-plastic silt lens @ 13.7 and 19.1					17
18					19.2' - 20' : Tan/Orange fine to medium sand, loose and non-plastic					18
19										19
20					---------- End of Boring @ 20' ----------					20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Cummings Way
Orleans, MA

Boring: B-59

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B. Barra
Pre-Clear Contractor: Strategic
Pre-Clear Date: 5/2/2019
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 5/6/2019

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear				0" - 6" : Topsoil					1
2	0 ft to 7 ft				6" - 30" : Sandy gravel subsoil					2
3					30" - 84" : Fine sand					3
4										4
5										5
6	5 ft to 10 ft	5.0	dry		5' - 7' : Brown/Orange fine to medium sand, loose and non-plastic					6
7					7' - 8.4' : Tan fine sand, medium dense, non-plastic					7
8					8.4' - 10' : Brown fine to medium sand, non-plastic, loose					8
9										9
10										10
11	10 ft to 15 ft	5.0	dry		10' - 15' : Light tan/orange fine to medium sand, loose and non-plastic					11
12					rock @ 10'					12
13					rock @ 11.4'					13
14					---------- End of Boring @ 15' ----------					14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Cove Road
Orleans, MA

Boring: B-60

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/21/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/23/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 5" : Asphalt					1
2					5" - 5' : Fine to medium sand.					2
3										3
4										4
5										5
6	5 ft to 10 ft	3.6 ft	dry		5 to 5.6 ft: Brown fine to medium sand, trace coarse sand					6
7					5.6 to 7.9 ft: Tan fine sand					7
8			dry		7.9 to 8.4 ft: Tan-Light Brown fine sand, some medium sand					8
9			moist		8.4 to 11 ft: Brown fine to medium sand					9
10										10
11	10 ft to 15 ft	3.7 ft	moist		11 to 13.7 ft: Brown mottled fine sand, little silt					11
12										12
13										13
14										14
15					---------- End of Boring 12' ----------					15
16										16
17										17
18										18
19										19
20										20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Cove Road
Orleans, MA

Boring: B-61

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/21/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/23/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 4" : Asphalt					1
2					4" - 5" : Gravel					2
3					5" - 5' : Brown\Orange fine to medium sand.					3
4										4
5										5
6	5 ft to 10 ft	3.5 ft	dry		5 to 7.7 ft: Tan, Iron-stained medium sand, some fine sand					6
7					7.7 to 8.1 ft: Brown silt					7
8					8.1 to 8.5 ft: Tan, Iron-stained medium sand, some fine sand					8
9										9
10										10
11	10 ft to 15 ft	3.5 ft	dry		10 to 11.8 ft: Brown fine sand, little medium sand					11
12					11.8 to 12.6 ft: Light Orange/Tan medium sand					12
13					12.6 to 13.5 ft: Brown silt					13
14										14
15					---------- End of Boring 12' ----------					15
16										16
17										17
18										18
19										19
20										20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Old Tote Road
Orleans, MA

Boring: B-62

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: C.Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/20/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/22/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft									1
2										2
3										3
4										4
5										5
6	5 ft to 10 ft	3.8 ft	dry		Tan/Brown fine to medium sand, trace coarse sand, coarsening downward					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	3.8 ft	dry		10 to 11.6 ft: Tan-Brown medium to coarse sand, trace fine gravel					11
12					11.6 to 12.7 ft: Tan/Brown fine silty sand, little medium sand, trace gravel					12
13					12.7 to 13.1 ft: Mottled grey/brown silt, little clay					13
14					13.1 to 13.8 ft: Plastic Brown silt and clay					14
15										15
16	15 ft to 20 ft	3.8 ft	dry		15 to 15.9 ft: Plastic Brown silt and clay, trace fine sand					16
17					15.9 to 18.8 ft: Interchanging 4" layers of Brown silty clay and fine sand					17
18										18
19										19
20										20
21	20 ft to 25 ft	UNK	dry		Liner stuck in macro; soil was hammered out by driller: -Dense, mottled Grey/Tan fine sand					21
22										22
23										23
24										24
25					---------- End of Boring at 22' ----------					25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: West Road
Orleans, MA

Boring: B-63

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: C.Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/20/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/22/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1–5	0 ft to 5 ft									1–5
6–10	5 ft to 10 ft	3.7 ft	dry		Brown to Tan fine sand, little medium sand					6–10
11–15	10 ft to 15 ft	3.4 ft	dry		Tan fine sand, trace medium sand					11–15
16–20	15 ft to 20 ft	3.5 ft	dry		15 to 17.7 ft: Tan fine sand, trace medium sand 17.7 to 18.5 ft: Brown-Orange fine sand, trace medium silty sand ---------- End of Boring at 17' ----------					16–20
21–30										21–30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: West Road
Orleans, MA

Boring: B-64A

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: B. Barra
Pre-Clear Contractor: Strategic | Pre-Clear Date: 5/1/2019
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 5/6/2019

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear				0" - 12" : Topsoil					1
2	0 ft to 7 ft				12" - 84" : Medium sand					2
3										3
4										4
5										5
6	5 ft to 10 ft	3.5			6.5' - 8' : Brown fine to medium sand, loose, non-plastic					6
7			dry		8' - 9.5' : Light brown - orange fine sand , loose, non-plastic					7
8			dry		9.5' - 10' : Light brown very fine sand with little silt, loose but slightly denser than above material, non-plastic					8
9										9
10										10
11	10 ft to 15 ft	5.0	dry		10' - 13' : Light tan fine sand with little silt, loose, non-plastic					11
12					13' - 13.3' : Light tan fine-medium sand , loose, non-plastic					12
13					13.3' - 14.8' : Grey w/ orange silt with trace fine sand, clay-like material dense, somewhat plastic					13
14			dry		14.8' - 15' : Light tan fine-medium sand loose, non-plastic					14
15										15
16	15 ft to 20 ft	5.0	dry		15' - 17' : Brown fine sand, loose, non-plastic					16
17					17' - 18.8' : Light tan very fine sand, loose, non-plastic					17
18			dry		18.8' - 19.6 : Tan/grey silt, dense/firm, somewhat plastic, clay-like fine sand lens @ 19.2' -19.3					18
19					19.6' - 20' : Light tan fine sand with little silt, loose, non-plastic					19
20										20
21	20 ft to 25 ft	5.0	dry		20' - 22.5' : Light brown fine sand with little silt, loose, non-plastic					21
22			dry		22.5' - 25' : Light tan fine sand with trace medium sand, loose. non-plastic					22
23										23
24										24
25										25
26	25 ft to 30 ft	5.0	dry		25' - 30' : Light tan to brown fine sand with trace silt and medium sand, loose, non-plastic					26
27										27
28										28
29			sl. moist							29
30										30
31	30 ft to 35 ft	5.0	sl. moist		30' - 33' : Light brown fine to medium sand, loose, non-plastic					31
32			moist		33' - 33.5 : Tan/grey silt (clay-like) dense and firm, slightly plastic					32
33			dry		33.5' - 35' : Light tan fine sand with trace medium sand , loose, non-plastic					33
34					---------- End of Boring @ 35' ----------					34
35										35

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: West Road
Orleans, MA

Boring: B-65A

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B. Barra
Pre-Clear Contractor: Strategic
Pre-Clear Date: 5/1/2019
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 5/6/2019

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear				0" - 6" : Pavement					1
2	0 ft				6" - 18" : Gravel					2
3	to 6.5 ft				18" - 78" : Sandy backfill					3
4										4
5										5
6	5 ft				5' - 8.5' : fall back from preclear					6
7	to 10 ft	5.0	dry		8.5' - 10' : Light tan fine sand, loose, non-plastic					7
8										8
9										9
10										10
11	10 ft		dry		10' - 13' : Light tan fine sand, loose, non-plastic					11
12	to 15 ft	5.0			13' - 15' : Orange/tan fine to medium sand, loose, non-plastic					12
13										13
14										14
15										15
16	15 ft		dry		15' - 16' : Brown fine-medium sand , loose, non-plastic					16
17	to 20 ft	5.0	moist		16' - 16.5 : Dark brown fine sand with little silt, loose, non-plastic					17
18			dry		16.5' - 17.6' : Light tan fine sand, loose, non-plastic					18
19					17.6' - 19.4' : Light tan fine sand with some silt, loose, non-plastic					19
20			moist		19.4' - 19.8' : Greyish silt (claylike), firm/dense, non-plastic					20
			dry		19.8' - 20' : Orange fine sand, loose, non-plastic					
21	20 ft				---------- End of Boring @ 20' ----------					21
22	to 25 ft									22
23										23
24										24
25										25
26	25 ft									26
27	to 30 ft									27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: West Road
Orleans, MA

Boring: B-66

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: C.Hayden
Pre-Clear Contractor: Strategic
Drill Contractor: NE Geotech
Driller: Hayes
Pre-Clear Date: 2/20/2017
Drill Date: 2/22/2017

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1–5	0 ft to 5 ft									1–5
6–10	5 ft to 10 ft	3.5 ft	dry		Tan-Light Brown fine to medium sand, little silt ---------- End of Boring at 10' ----------					6–10
11–30										11–30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: West Road
Orleans, MA

Boring: B-67

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: C.Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/20/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/22/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft									1
2										2
3										3
4										4
5										5
6	5 ft to 10 ft	1 ft	dry		5 to 6 ft: Brown fine sand, root fibers					6
7					6 ft: Broken cobble in tip; cobble likely located at 7 ft due to hard drilling					7
8										8
9										9
10										10
11	10 ft to 15 ft	4 ft	dry		Dense Brown mottled fine sand, some Iron-staining					11
12										12
13										13
14										14
15					---------- End of Boring at 10' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: West Road
Orleans, MA

Boring: B-68

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: C.Hayden
Pre-Clear Contractor: Strategic
Drill Contractor: NE Geotech
Driller: Hayes
Pre-Clear Date: 2/20/2017
Date Completed: 2/22/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft									1
2										2
3										3
4										4
5										5
6	5 ft to 10 ft	2 ft	dry		Brown/Orange fine to medium sand, trace broken cobble at 5.5 ft and in tip of macro (Broken cobble in tip caused reduction in recovery)					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	3 ft	dry		10 to 11 ft: Brown medium sand, some fine sand, trace broken cobble					11
12					11 to 13 ft: Brown/Orange fine sand, trace coarse sand					12
13										13
14										14
15					---------- End of Boring at 11' ----------					15
16										16
17										17
18										18
19										19
20										20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Old Colony Way
Orleans, MA

Boring: B-69

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B. Barra
Pre-Clear Contractor: Strategic
Pre-Clear Date: 5/2/2019
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 5/6/2019

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear				0" - 6" : Topsoil					1
2	0 ft to 6 ft				6" - 72" : Fine cohesive sand					2
3										3
4										4
5										5
6	5 ft to 10 ft	5.0	dry		5' - 8.9' : Brown silty fine sand, non-plastic, firm very dense 0.1 silt lens @ 8ft					6
7					8.9' - 9.5' : Brown silt with trace fine sand, loose, non-plastic					7
8					9.5' - 10' : Light brown fine sand, loose, non-plastic					8
9										9
10										10
11	10 ft to 15 ft	5.0	dry		10' - 15' : Light brown silty sand, somewhat firm, non-plastic					11
12					15' : Rock refusal					12
13										13
14					---------- End of Boring @ 15' ----------					14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Old Colony Way
Orleans, MA

Boring: B-70

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B. Barra
Pre-Clear Contractor: Strategic
Pre-Clear Date: 5/1/2019
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 5/6/2019

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear				0" - 6" : Pavement					1
2	0 ft to 6.5 ft				6" - 78" : Sandy fill					2
3										3
4										4
5										5
6	5 ft to 10 ft	5.0			5' - 7' : Brown silty fine sand, medium dense					6
7					7' - 8.7' : Brown fine sand with trace silt, loose, non-plastic					7
8					8.7' - 10' : Brown silty fine sand, medium dense, non-plastic					8
9										9
10										10
11	10 ft to 15 ft	5.0	dry		10' - 12.7' : Brown silty fine sand, medium dense, non-plastic wet @ 12.2-12.7					11
12					12.7' 12.9' : Orange medium sand, loose, non-plastic					12
13					12.9' - 15' : Brown to orange silty sand, medium dense, non-plastic					13
14										14
15					---------- End of Boring @ 15' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Old Colony Way
Orleans, MA

Boring: B-71

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 15 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/17/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/17/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 8" : Asphalt 8" - 9" : Gravel 9" - 5' : Brown fine to medium sand					1
2										2
3										3
4										4
5										5
6	5 ft to 10 ft	4 ft	dry		5 to 5.1 ft: Brown fine sand 5.1 to 5.5 ft: Tan medium to coarse sand, little fine sand, pulverized cobble/large gravel 5.5 to 9 ft: Tight, Brown mottled fine sand **-->Orange in color from 7.5 to 7.6 ft**					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	4.1	dry		10 to 13.8 ft: Tight, Brown-Grey mottle fine sand **-->pulverized cobble/large gravel from 11.6 to 12 ft** 13.8 to 14.1 ft: Orange coarse sand, some medium sand					11
12										12
13										13
14										14
15					---------- End of Boring at 15' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Old Colony Way
Orleans, MA

Boring: B-72

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 10 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/17/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/17/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 8" : Asphalt					1
2					8" - 9" : Gravel					2
3					9" - 5' : Brown fine to medium sand					3
4										4
5										5
6	5 ft to 10 ft	4 ft	dry		5 to 5.3 ft: Red/Brown coarse sand					6
7					5.3 to 7.1 ft: Brown/Tan medium sand, little fine sand					7
8					7.1 to 7.4 ft: Brown fine sand 7.4 to 8 ft: Tan coarse sand, broken cobble fragments					8
9					8 to 9 ft: Tan brown-mottled fine sand					9
10					---------- End of Boring at 10' ----------					10
11	10 ft to 15 ft									11
12										12
13										13
14										14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Old Colony Way
Orleans, MA

Boring: B-73

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth: 10 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Tech: B.Morrill, C. Hay | Started: 2/17/2017
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/17/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/17/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	i	Description	Fill Mat.	Tube	Fill Mat.	Depth
1-5	0 ft to 5 ft				0 - 6" : Asphalt 6" - 7" : Gravel 7" - 5' : Orange\Brown fine sand					1-5
6-10	5 ft to 10 ft	3.6 ft	dry		Tight, Brown/Tan fine to medium sand ---------- End of Boring at 10' ----------					6-10
11-15	10 ft to 15 ft									11-15
16-20	15 ft to 20 ft									16-20
21-25	20 ft to 25 ft									21-25
26-30	25 ft to 30 ft									26-30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Old Colony Way
Orleans, MA

Boring: B-74

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 10 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Tech: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategoic
Pre-Clear Date: 2/16/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/17/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 8" : Asphalt					1
2					8" - 5' : Orange\Brown\Lt Brown fine to medium sand					2
3										3
4										4
5										5
6	5 ft to 10 ft	3.8 ft	dry		Tan fine to medium sand					6
7					**-->Trace medium gravel from 7.5 to 8.8 ft**					7
8										8
9										9
10					---------- End of Boring at 10' ----------					10
11	10 ft to 15 ft									11
12										12
13										13
14										14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Old Colony Way
Orleans, MA

Boring: B-75

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B. Barra
Pre-Clear Contractor: Strategic
Pre-Clear Date: 5/1/2019
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 5/6/2019

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear				0" - 6" : Pavement					1
2	0 ft				6" - 12" - Gravel					2
3	to 6.5 ft				12" - 78" : Fine sand					3
4										4
5										5
6	5 ft		dry		5' - 8' : Tna fine sand with trace medium sand, loose, non-plastic					6
7	to 10 ft	5.0	dry		8' - 9' : Tan silt with trace fine sand, dense/firm, non-plastic					7
8			dry		9' - 10' : Brown fine sand with some silt, medium dense, non-plastic					8
9										9
10										10
11	10 ft		dry		10' - 12.7' : Tan silty fine sand, medium dense, non-plastic					11
12	to 15 ft	5.0	dry		12.7' - 13' : Orange fine sand, loose and non-plastic					12
13					13' - 13.3' : Shattered rock fragments					13
14			moist		13.3' - 14.5' : Brown silt with little fine sand, medium dense, non-plastic					14
15					14.5' - 15' : Grey with orange mottling silt with trace fine sand, dense, non-					15
16	15 ft		moist		15' - 17.8' : Grey with orange mottling silt with trace fine sand, dense, non-pla					16
17	to 20 ft	5.0			17.8' - lens of orange medium sand					17
18					17.9' - 20' : Brown silty fine sand with trace medium sand, non-plastic, dense					18
19										19
20					---------- End of Boring @ 20' ----------					20
21	20 ft									21
22	to 25 ft									22
23										23
24										24
25										25
26	25 ft									26
27	to 30 ft									27
28										28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Route 6A
Orleans, MA

Boring: B-76

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B. Barra
Pre-Clear Contractor: Strategic
Pre-Clear Date: 5/1/2019
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 5/7/2019

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear				0" - 6" : Pavement					1
2	0 ft to 6 ft				6" - 12" : Gravel					2
3					12" - 72" : Cohesive fine sand					3
4										4
5										5
6	5 ft to 10 ft	5.0	moist		5' - 10' : Light brown silty fine sand, medium dense, non-plastic 1" tan fine sand lens @ 7.5' 0.5" tan fine sand lens @ 7.85'					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	5.0	dry		10' - 13.8' : Light brown silty fine sand, medium dense, non-plastic, orange mottling 12.8-13.3					11
12					13.8' - 14.2' : Light tan fine sand, loose and non-plastic					12
13					14.2' - 15' : Light brown silty fine snad, medium dense, non-plastic orange mottling at 14.5-15'					13
14										14
15										15
16	15 ft to 20 ft	5.0	dry		15' - 17' : Light Brown with orange mottling silt with some fine sand, slightly plastic, medium dense					16
17					17' - 17.3' : Light brown fine to medium sand, loose and non-plastic					17
18					17.3' - 20' : Light brown with orange mottling silty fine sand, medium					18
19					dense, non-plastic					19
20										20
21	20 ft to 25 ft				---------- End of Boring @ 20' ----------					21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Old Colony Way
Orleans, MA

Boring: B-77

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B. Barra
Pre-Clear Contractor: Strategic
Pre-Clear Date: 5/1/2019
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 5/6/2019

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear				0" - 8" : Pavement					1
2	0 ft to 6 ft				8" - 72" : Sandy fill					2
3										3
4										4
5										5
6	5 ft to 10 ft	5.0			5' - 8' : Tan fine sand, loose, non-plastic 7.5' - 8' : little subangular gravel					6
7			dry		8' - 10' : Brown silty fine sand, dense, non-plastic					7
8										8
9										9
10										10
11	10 ft to 15 ft	5.0	dry		10' - 10.9' : Tan fine sand with little medium sand, loose and non-plastic					11
12					10.9' - 11' : Rock					12
13					11' - 15' : Orange/Brown silty fine sand, medium dense, non-plastic					13
14										14
15										15
16	15 ft to 20 ft	5.0	dry		15' - 17' : Tan fine sand, loose, non-plastic					16
17			moist		17' - 20' : Tan with some orange mottling silty sand, dense, non-plastic					17
18										18
19										19
20					---------- End of Boring @ 20' ----------					20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Old Tote Road
Orleans, MA

Boring: B-78

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: C.Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/20/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/22/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1-5	0 ft to 5 ft									1-5
6-10	5 ft to 10 ft	4 ft	dry		5 to 7.3 ft: Tan, Iron-stained fine to medium sand 7.3 to 9 ft: Tan fine sand					6-10
11-15	10 ft to 15 ft	3.9 ft	dry		Tan fine sand with intermittent Iron-staining ---------- End of Boring at 13' ----------					11-15
16-30										16-30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Old Tote Road
Orleans, MA

Boring: B-79

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: C.Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/20/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/22/2017

Depth	Sample Identification	Rec (ft)	Moisture		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1-5	0 ft to 5 ft									1-5
6-10	5 ft to 10 ft	4.4 ft	dry		5 to 7.6 ft: Tan/Orange-mottled fine to medium sand, little coarse sand 7.6 to 9.4 ft: Mottled Tan/Brown fine sand, some silt					6-10
11-15	10 ft to 15 ft	4.1 ft	dry		Brown silt and fine sand, Iron-staining ---------- End of Boring at 14' ----------					11-15
16-20	15 ft to 20 ft									16-20
21-25	20 ft to 25 ft									21-25
26-30	25 ft to 30 ft									26-30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Old Colony Way
Orleans, MA

Boring: B-80

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 11 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Tech: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/16/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/17/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 6" : Asphalt 6" - 7" : Gravel 7" - 4' : Orange\Brown fine sand 4' - 5' : Asphalt Layer - Refusal for pre-clean					1
2										2
3										3
4										4
5										5
6	5 ft to 10 ft	3.6 ft	dry		5 to 7.2 ft: Dense, Brown fine sand, little medium sand 7.2 to 8.6 ft: Brown fine to medium sand, trace medium gravel					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	4 ft	dry		Dense, Brown-Grey mottled fine sand, trace silt					11
12										12
13										13
14										14
15					---------- End of Boring at 15' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Old Colony Way
Orleans, MA

Boring: B-81

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 12 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Tech: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/16/2017
Drill Contractor: NE Geotech
Driller: Hayes
Date Completed: 2/17/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 6" : Asphalt					1
2					6" - 5' : Orange\Brown fine to medium sand with <5% angular gravel. Few cobbles encountered					2
3										3
4										4
5										5
6	5 ft to 10 ft	4.3 ft	dry		5 to 8 ft: Tan brown fine to medium sand, trace fine gravel					6
7					8 to 9.3 ft: Dense Brown fine sand, trace silt					7
8										8
9										9
10										10
11	10 ft to 15 ft	3.6 ft	dry		10 to 10.2 ft: Dense Brown fine sand, trace silt					11
12					10.2 to 13.6 ft: Tan brown-mottled fine to medium sand					12
13										13
14										14
15					---------- End of Boring at 12' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Intersection of Main St. and Old Colony Way
Orleans, MA

Boring: B-82

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/21/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/21/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 6" : Asphalt 6" - 8" : Gravel 8" - 5' : Brown fine to medium sand.					1
6	5 ft to 10 ft	3.5 ft	dry		5 to 7.9 ft: Orange/Tan fine to medium sand 7.9 to 8.5 ft: Tan coarse sand and fine gravel, some medium sand					6
11	10 ft to 15 ft	3.7 ft	dry		10 to 10.3 ft: Tan coarse sand and fine gravel, some medium sand 10.3 to 11 ft: Tan/Orange mottled fine to medium sand 11 to 13.7 ft: Loose, Tan fine sand ---------- End of Boring at 13' ----------					11
16										16
21										21
26										26

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Main Street West
Orleans, MA

Boring: B-83

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/14/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/21/2017

Depth	Sample Identification	Rec (ft)	Moisture		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 10" : Asphalt					1
2					10" - 5' : Orange and brown, fine to medium sand					2
3										3
4										4
5										5
6	5 ft to 10 ft	3.8 ft	dry		5 to 5.3 ft: Brown fine to medium sand					6
7					5.3 to 8.1 ft: Tan fine sand					7
8					8.1 to 8.5 ft: Brown fine sand, trace root fibers					8
9					8.5 to 8.8 ft: Tan fine sand					9
10										10
11	10 ft to 15 ft	4.1 ft	dry		Mottled, Tan fine to medium sand, interlayered brown fine sand and silt					11
12										12
13										13
14										14
15					---------- End of Boring at 12' ----------					15
16										16
17										17
18										18
19										19
20										20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Main Street West
Orleans, MA

Boring: B-84

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/14/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/21/2017

Depth	Sample Identification	Rec (ft)	Moisture		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 10" : Asphalt					1
2					10" - 5' : Orange and brown, fine to medium sand					2
3										3
4										4
5										5
6	5 ft to 10 ft	3.6 ft	dry		5 to 5.5 ft: Tan fine sand, trace medium gravel					6
7					5.5 to 5.7 ft: Brown fine sand, little brown silt lenses					7
8					5.7 to 8.6 ft: Tan fine sand, intermittent brown silt lenses					8
9										9
10										10
11	10 ft to 15 ft	3.7 ft	dry		10 to 13 ft: Tan medium sand, little coarse sand					11
12					---Brown silt lenses at 12 ft and 12.5 ft 13 to 13.4 ft: Mottled, Brown silt and fine sand					12
13					13.4 to 13.7 ft: Tan very fine sand					13
14										14
15					---------- End of Boring at 13' ----------					15
16										16
17										17
18										18
19										19
20										20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Main Street West
Orleans, MA

Boring: B-85

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/14/2017
Drill Contractor: NE Geotech | Driller: Hayes | Date Completed: 2/21/2017

Depth	Sample Identification	Rec (ft)	Moisture		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 10" : Asphalt over gravel					1
2					10" - 5' : Orange/Brown fine sand					2
3										3
4										4
5										5
6	5 ft to 10 ft	3.7 ft	dry		5 to 6 ft: Tan/Orange medium sand					6
7					6 to 6.7 ft: Brown fine sand and silt					7
8					6.7 to 8.7 ft: Brown/Tan fine to medium sand					8
9										9
10										10
11	10 ft to 15 ft	3.5 ft	dry		10 to 11.1 ft: Tan medium sand, little coarse sand					11
					---Thin layer of brown silt and root fibers at 10.9 ft					
12					11.1 to 12.3 ft: Mottled, Tan medium sand					12
					12.3 to 12.5 ft: Orange medium to coarse sand					
13					12.5 to 13.3 ft: Tan fine to medium sand					13
14					13.3 to 13.5 ft: Brown fine sand, little silt					14
15					---------- End of Boring at 11' ----------					15
16										16
17										17
18										18
19										19
20										20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Main St (West)
Orleans, MA

Boring: B-86

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 12 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Tech: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/14/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/17/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 12" : Asphalt 12" - 5' : Orange-brown, fine to medium sand					1
2										2
3										3
4										4
5										5
6	5 ft to 10 ft	3.6 ft			Tan medium sand **-->wet at 6.5 ft**					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	3.9 ft			10 to 10.8 ft: Tan medium sand 10.8 to 12 ft: Brown fine sand, little medium sand					11
12										12
13					12 to 12.6 ft: Brown fine to medium sand 12.6 to 13.4 ft: Brown fine sand	5				13
14					13.4 to 13.9 ft: Dense,Brown silt, trace fine sand					14
15					---------- End of Boring at 12' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Locust Road
Orleans, MA

Boring: B-87

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: R. Donoghue, C.Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/8/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/22/2017

Depth	Sample Identification	Rec (ft)	Moisture		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0” to 8” - Pavement 8” to 10” - Gravel 10” to 60” - Fine Sand					1
2										2
3										3
4										4
5										5
6	5 ft to 10 ft	3.9 ft	dry		5 to 6.1 ft: Tan fine to medium sand 6.1 to 6.5 ft: Brown mottled fine sand and silt 6.5 to 6.7 ft: Tan fine sand lens 6.1 to 6.5 ft: Brown mottled fine sand and silt					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	4.2	dry		10 to 12.5 ft: Dense Brown mottled fine sand and silt 12.5 to 13.2 ft: Mottled Tan fine sand, trace coarse sand 13.2 to 14.2 ft: Dense Brown mottled fine sand and silt					11
12										12
13										13
14										14
15					---------- End of Boring at 15' ----------					15
16										16
17										17
18										18
19										19
20										20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Locust Road
Orleans, MA

Boring: B-88

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 15 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Tech: R. Donoghue, C.Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/8/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/17/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0" to 8" - Pavement 8" to 12" - Gravel 12" to 60" - Silty Fine Sand					1
2										2
3										3
4										4
5										5
6	5 ft to 10 ft	3.3 ft			5 to 5.3 ft: Brown fine sand, root fibers observed 5.3 to 6.9 ft: Tan brown-mottled fine to medium sand 6.9 to 7.4 ft: Mottled, Brown fine sand, little silt, historic root system 7.4 to 8.3 ft: Mottled, Tan medium sand					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	3.5 ft			10 to 12 ft: Tan medium sand, trace fine sand 12 to 12.3 ft: Brown fine to medium sand, little coarse sand 12.3 to 12.7 ft: Brown/Tan fine to medium sand 12.7 to 13.5 ft: Mottled, Brown silt, little fine sand, trace clay 13.5 (tip) ft: Brown/Red medium sand ---------- End of Boring at 12' ----------					11
12										12
13										13
14										14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Locust Road
Orleans, MA

Boring: B-89

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 15 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Tech: R. Donoghue, C.Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/8/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/17/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 8" Pavement					1
2					8 to 10" Gravel					2
3					10 to 60" Tan Medium to Course Sand with Stones					3
4										4
5										5
6	5 ft to 10 ft	3.6 ft			5 to 6.5 ft: Brown, silty fine sand					6
7					6.5 to 8.6 ft: Tan medium sand, little coarse sand					7
8										8
9										9
10										10
11	10 ft to 15 ft	3.4 ft		moist	10 to 10.6 ft: Tan medium sand, little coarse sand					11
12				wet	10.6 to 13.4 ft: Tan coarse sand, some medium sand					12
13										13
14										14
15					---------- End of Boring at 14' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644 *Client:* Town of Orleans	AECOM 250 Apollo Drive Chelmsford, Massachusetts (978) 905-2100	**Boring: B-90**	
Site Location: Locust Road Orleans, MA		*Boring Number:* *Sheet:* 1 of 1 *Surface Elevation (ft-asl):* *Equipment:* Geoprobe 6620, Vac-Truck *Inside Diameter:* 2"	**Well Data** Boring Depth: Screen Depth: Screen length:
Project Manager: Reggie Donoghue	*Field Techs:* R. Donoghue, C		
Pre-Clear Contractor: Strategic	*Pre-Clear Date:* 2/8/2017		
Drill Contractor: NE Geotech	*Driller:* H *Drill Date:* 2/22/2017		

Depth	Sample Identification	Rec (ft)		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft			0” to 12” - Pavement					1
2				12” to 18” - Gravel					2
3				18” to 48” - Fine Sand					3
4				48” to 60” - Coarse Sand and Cobbles					4
5									5
6	5 ft to 10 ft	4 ft		5 to 6.6 ft: Tan fine to medium sand					6
7				6.6 to 9 ft: Brown fine sand, some silt, trace coarse sand					7
8									8
9									9
10									10
11	10 ft to 15 ft	4 ft		Brown mottled fine sand and silt, **wet at 12 ft**					11
12									12
13									13
14									14
15									15
16	15 ft to 20 ft	4.7		15 to 15.7 ft: Brown fine to medium sand					16
17				15.7 to 19.7 ft: Brown fine sand and silt					17
18									18
19									19
20				---------- End of Boring at 18' ----------					20
21									21
22									22
23									23
24									24
25									25
26									26
27									27
28									28
29									29
30									30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Locust Street
Orleans, MA

Boring: B-91

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 30 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Tech: R. Donoghue, C.Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/8/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/16/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0" to 8" - Pavement					1
2					8" to 16" - Gravel					2
3					16" to 30" - Coarse Sand					3
4					30" to 60" - Fine Sand					4
5										5
6	5 ft to 10 ft	3.6 ft	wet		Tan brown-mottled medium sand, little coarse sand					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	3.8 ft	wet		Orange-Light Brown medium sand, little coarse sand					11
12										12
13										13
14										14
15										15
16	15 ft to 20 ft	3.7			Tan brown-mottled medium sand, little coarse sand **-->wet at 16.3 ft**					16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft	3.3			Medium to coarse sand, intermittently switches between Tan and Orange					21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft				Tan coarse sand					26
27										27
28										28
29										29
30					---------- End of Boring at 27' ----------					30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Locust Street
Orleans, MA

Boring: B-92

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 15 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Tech: R. Donoghue, C.Hayden
Pre-Clear Contractor:Strategic
Pre-Clear Date: 2/8/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/16/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0" to 8" - Pavement					1
2					8" to 14" - Gravel					2
3					14" to 60" - Fine Sand					3
4										4
5										5
6	5 ft to 10 ft	3.8 ft	wet		Tan medium sand, little fine sand					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	3.8 ft	wet		Tan medium sand, little fine sand					11
12										12
13										13
14										14
15					---------- End of Boring at 11' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Locust Street
Orleans, MA

Boring: B-93

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 25 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Tech: R. Donoghue, C.Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/8/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/16/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0" to 6" - Pavement 6" to 12" - Gravel 12" to 60" - Fine Sand					1
6	5 ft to 10 ft	3.7 ft	wet		5 to 5.7 ft: Tan medium sand 5.7 to 6.2 ft: Tan fine sand 6.2 to 7.2 ft: Tan fine to medium sand 7.2 to 8.7 ft: Light Brown medium sand, trace fine and coarse sand **-->tight Grey fine to medium sand at 8.4 ft**					6
11	10 ft to 15 ft	4.4 ft	wet		Brown silt and fine sand **-->coarse sand and gravel lens at 12.3 to 12.6 ft**					11
16	15 ft to 20 ft	3.3 ft	wet		15 to 15.9 ft: Brown silt and fine sand 15.9 to 17.3 ft: Dense Dark Grey fine sand and silt 17.3 to 18.3 ft: Brown medium sand, little coarse sand					16
21	20 ft to 25 ft	3 ft	wet		20 to 21 ft: Tan medium sand, trace coarse sand 21 to 23 ft: Tan coarse sand, trace medium gravel ---------- End of Boring at 21' ----------					21
26	25 ft to 30 ft									26

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Locust Street
Orleans, MA

Boring: B-94

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 25 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Tech: R. Donoghue, C.Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/8/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/16/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0" to 12" - Pavement (2 layers) 12" to 24" - Gravel 24" to 60" - Fine Sand					1
6	5 ft to 10 ft	3.1 ft			5 to 5.7 ft: Light Brown/Orange medium sand 5.7 to 8.1 ft: Tan medium sand, some coarse sand **-->broken cobble fragment at 7.5 ft**					6
11	10 ft to 15 ft	3.5 ft	wet		10 to 11 ft: Tan coarse sand 11 to 11.4 ft: Tan fine to medium sand 11.4 to 11.7 ft: Orange/Red medium sand, trace medium gravel 11.7 to 12 ft: Tan fine sand, some fine gravel 12 to 12.8 ft: Tan medium to coarse sand 12.8 to 13.5 ft: Mottled Tan/Orange fine sand					11
16	15 ft to 20 ft	3.3 ft	wet		15 to 16 ft: Light Brown fine sand 16 to 16.4 ft: Light Brown medium sand 16.4 to 17.3 ft: Light Brown/Orange coarse sand 17.3 to 18.3 ft: Light Brown/Orange medium to coarse sand 10 to 11 ft: Tan coarse sand					16
21	20 ft to 25 ft	3.4 ft	wet		20 to 22.6 ft: Light Orange medium to coarse sand **-->Transition from Light Orange to Tan at 22 ft** 22.6 to 22.8 ft: Tan fine sand 22.8 to 23.4 ft: Tan fine sand, some medium sand ---------- End of Boring at 22' ----------					21
26	25 ft to 30 ft									26

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Locust Street
Orleans, MA

Boring: B-95

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 25 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Tech: S. Chmiel, C.Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 3/13/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 3/15/2017

Depth	Sample Identification	Rec (ft)	Moisture		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 8" Pavement					1
2					8 to 10" Gravel					2
3					10 to 60" Tan Medium to Course Sand with Stones					3
4										4
5										5
6	5 ft to 10 ft	3.1 ft	moist		5 to 5.5 ft: Brown fine sand					6
7					5.5 to 8.1 ft: Brown/Tan medium sand, little coarse sand					7
8										8
9										9
10										10
11	10 ft to 15 ft	3.6 ft	moist /	wet	10 to 16 ft: Tan medium sand, some coarse sand, **wet at 12.4 ft**					11
12										12
13										13
14										14
15										15
16	15 ft to 20 ft	3 ft	wet		16 to 18 ft: Tan coarse sand, some medium sand, trace rotted rock					16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft	3 ft	wet		20 to 22.5 ft: Tan medium to coarse sand					21
22					22.5 to 23 ft: Tan fine sand, little medium sand					22
23										23
24										24
25					---------- End of Boring at 25' ----------					25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Liberty Lane
Orleans, MA

Boring: B-96

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth: 15 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Tech: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/14/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/16/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1-5	0 ft to 5 ft				0 - 2" : Asphalt 2" - 5' : Dark orange to brown, fine to medium sand					1-5
6-10	5 ft to 10 ft	3.3 ft	wet		5 to 5.5 ft: Dark Brown fine sand, some medium sand 5.5 to 7.5 ft: Orange to Brown to Tan fine to medium sand, trace large gravel and broken cobble 7.5 to 8.3 ft: Brown fine sand and silt					6-10
11-15	10 ft to 15 ft	4.6 ft	wet		Brown/Grey silt and fine sand, little medium sand ---------- End of Boring at 13' ----------					11-15
16-30										16-30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Liberty Lane
Orleans, MA

Boring: B-97

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 15 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/14/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/16/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 4" : Asphalt					1
2					4" - 5' : Brown/Orange fine to medium sand. Larger cobbles encountered.					2
3										3
4										4
5										5
6	5 ft to 10 ft	4.3 ft	wet		5 to 8.6 ft: Tight brown fine sand, trace medium sand					6
7					8.6 to 9 ft: Loose, Tan fine sand					7
8										8
9										9
10										10
11	10 ft to 15 ft	3.9 ft	wet		10 to 12 ft: Brown fine sand, little medium sand					11
12					12 to 12.5 ft: Dense, Light Brown fine sand and silt					12
13					12.5 to 12.9 ft: Tan fine to medium sand					13
14					12.9 to 13.9 ft: Light Brown fine sand					14
15					---------- End of Boring at 11' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Canal Street
Orleans, MA

Boring: B-98

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 15 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/14/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/16/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0"-12" : Asphalt over gravel					1
2					12" - 5' : Orange-brown and brown, medium to fine sand					2
3										3
4										4
5										5
6	5 ft to 10 ft	3.6 ft			5 to 6.8 ft: Tan fine sand					6
7					6.8 to 8.6 ft: Tan fine to medium sand, trace coarse sand					7
8										8
9										9
10										10
11	10 ft to 15 ft	3.6 ft	wet		10 to 12.2 ft: Tan/Orange fine to coarse sand					11
12					12.2 to 13.6 ft: Orange medium sand, some coarse sand					12
13										13
14										14
15					---------- End of Boring at 12' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Canal Street
Orleans, MA

Boring: B-99

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 15 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Tech: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/14/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/16/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0"-10" : Asphalt 10" - ? : Medium to coarse sand with some fine material. Orange-brown and brown, small angular gravel 5%					1
2										2
3										3
4										4
5										5
6	5 ft to 10 ft	3.5 ft			5 to 6.8 ft: Tan medium sand, trace coarse sand					6
7					6.8 to 7 ft: Dark Red/Brown coarse sand					7
8					7 to 7.4 ft: Tan/Orange coarse to medium sand					8
9					7.4 to 7.5 ft: Dense Brown fine sand and silt, broken cobble fragments					9
10					7.5 to 8.6 ft: Tan medium sand					10
11	10 ft to 15 ft	3.5 ft	wet		10 to 11.7 ft: Tan medium to fine sand					11
12					11.7 to 12.7 ft: Tan medium to coarse sand, little fine sand **-->wet at 12.3 ft**					12
13					12.7 to 13.5 ft: Brown/Red medium to coarse sand, trace fine gravel					13
14										14
15					---------- End of Boring at 11' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Canal Street
Orleans, MA

Boring: B-100

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 15 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Tech: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/14/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/15/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 8" : Asphalt 8"-12" : Orange sand, fine to medium 1' - 5' : Light brown and brown, fine to medium sand with <5% medium sized cobble					1
2										2
3										3
4										4
5										5
6	5 ft to 10 ft	3.3 ft	moist		Tan medium to coarse sand, trace fine gravel					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	3.5 ft	moist		Tan medium to coarse sand, trace fine gravel					11
12										12
13										13
14										14
15					---------- End of Boring at 12' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Canal Street
Orleans, MA

Boring: B-101

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 20 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Tech: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/14/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/15/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 44				0 to 14" : Pavement					1
2					14" to 20" : Gravel					2
3					20" to 5 ft : Orange to brown fine to medium sand					3
4										4
5										5
6	5 ft to 10 ft	3.2 ft	moist		Tan to Light Brown medium to coarse sand, trace fine gravel					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	3.3 ft	moist		10 to 11.3 ft: Tan medium to coarse sand, trace fine gravel					11
12					11.3 to 12.5 ft: Tan/Light Grey coarse sand					12
13										13
14					12.5 to 13.3 ft: Tan/Light Grey tight, coarse sand and medium gravel, broken cobble					14
15										15
16	15 ft to 20 ft	3.3 ft	moist		15 to 15.7 ft: Grey tight, fine sand					16
17					15.7 to 18.3 ft: Tan medium sand					17
18										18
19										19
20					---------- End of Boring at 19' ----------					20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Canal Street
Orleans, MA

Boring: B-102

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth: 20 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Tech: R. Donoghue, C.Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/8/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/15/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0" to 4" - Pavement 4" to 9" - Gravel 9" to 60" - Medium Sand					1
2										2
3										3
4										4
5										5
6	5 ft to 10 ft	2.8 ft	moist		5 to 7.3 ft: Tan medium to coarse sand, trace fine gravel					6
7					7.3 to 7.8 ft: Tan coarse sand, broken cobble fragments					7
8										8
9										9
10										10
11	10 ft to 15 ft	3.7 ft	wet		10 to 12.5 ft: silt, little fine sand, trace clay (Blue-Grey to Brown color transition)					11
12					12.5 to 12.6 ft: Red/Brown silt					12
13					12.6 to 13.7 ft: Brown fine sand, trace medium sand					13
14										14
15										15
16	15 ft to 20 ft	3.6 ft	wet		15 to 18.4 ft: Brown/Green-Grey mottled fine sand, little silt					16
17										17
18					18.4 to 18.6 ft: Red/Brown fine sand, little medium sand					18
19										19
20					---------- End of Boring at 18' ----------					20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Jones Way
Orleans, MA

Boring: B-103

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 20 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Tech: R. Donoghue, C.Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/8/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/15/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0" to 6" - Pavement 6" to 12" - Hardener 12" to 60" - Medium to Coarse Sand					1
6	5 ft to 10 ft	3.4 ft	moist to wet		Tan to Light Orange medium to coarse sand					6
11	10 ft to 15 ft	3.4 ft	wet		10 to 11.5 ft: Tan to Light Orange medium sand, little fine sand, trace coarse sand 11.5 to 13.4 ft: Tan/Grey medium sand					11
16	15 ft to 20 ft	3.6 ft	wet		15 to 16 ft: Grey/Tan medium sand 16 to 18.6 ft: Mottled fine sand (Tan with brown streaks) ---------- End of Boring at 18' ----------					16
21	20 ft to 25 ft									21
26	25 ft to 30 ft									26

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Canal Street
Orleans, MA

Boring: B-104

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth: 15 ft
Screen Depth:
Screen length:

Project Manager: Mark Owen
Field Tech: R. Donoghue, C.Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/8/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/15/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0" to 8" - Pavement					1
2					8" to 24" - Gravel					2
3					24" to 60" - Silty Sand & perched water					3
4										4
5					Groundwater @ 60" +/-					5
6	5 ft to 10 ft	3 ft	moist to wet		5 to 5.5 ft: Tan to Light Orange medium to coarse sand					6
7					5.5 to 6 ft: Tan mottled silt, little clay					7
8					6 to 6.3 ft: Tan fine sand					8
9					6.3 to 8 ft: Tan medium sand, little coaarse sand, rock in drive-shoe					9
10										10
11	10 ft to 15 ft	3.6 ft	wet		Tan fine to medium sand					11
12										12
13										13
14										14
15					---------- End of Boring at 14' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Canal Street
Orleans, MA

Boring: B-105

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth: 25 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Tech: R. Donoghue, C.Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/8/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/15/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0" to 8" - Pavement 8" to 12" - Gravel 12" to 60" - Medium Sand					1
2										2
3										3
4										4
5										5
6	5 ft to 10 ft	3.6 ft	moist to wet		5 to 8.6 ft: Tan toYellow medium to coarse sand **-->wet at 6.5 ft**					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	3.6 ft	wet		Tan medium to coarse sand, little fine gravel					11
12										12
13										13
14										14
15										15
16	15 ft to 20 ft	3.7 ft	wet		15 to 16.5 ft: Tan fine to coarse sand, trace fine gravel 16.5 to 18.1 ft: Tan medium to coarse sand, trace fine gravel 18.1 to 18.7 ft: Grey silt, little clay					16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft	4.1 ft	wet		20 to 20.9 ft: Grey silt, some clay 20.9 to 21 ft: Brown silt 21.0 to 22.9 ft: Grey fine sand 22.9 to 23.1 ft: Grey silt 23.1 to 24.1 ft: Grey fine sand ---------- End of Boring at 22' ----------					21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Canal Street
Orleans, MA

Boring: B-106

Boring Number:
Sheet: 1 of 2
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth: 35 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Tech: R. Donoghue, C.Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/8/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/15/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0" to 8" - Pavement 8" to 12" - Gravel 12" to 60" - Medium Sand					1
2										2
3										3
4										4
5										5
6	5 ft to 10 ft	3.2 ft	moist to wet		5 to 5.7 ft: Tan medium sand, some coarse sand 5.7 to 6.2 ft: Tan fine to medium sand 6.2 to 8 ft: Tan/Orange medium to coarse sand, trace fine gravel -->Orange from Iron-staining 8 to 8.2 ft: Brown silt					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	3.7 ft	moist		10 to 10.2 ft: Brown coarse sand 10.2 to 11.2 ft: Brown to Grey to Red-Orange silt, some clay, root fibers observed 11.2 to 12.2 ft: Mottled Tan-Brown fine sand 12.2 to 13.2 ft: **SAA 10.2 to 11.2 ft** 13.2 to 13.7 ft: Red/Brown fine sand					11
12			moist							12
13			moist							13
14			wet							14
15										15
16	15 ft to 20 ft	3.1 ft	wet		15 to 16.2 ft: Light Brown to Brown/Tan fine to medium sand 16.2 to 16.4 ft: Tan to Light Grey fine sand 16.4 to 16.5 ft: Grey silt 16.5 to 17.7 ft: Grey medium to coarse sand, trace fine to medium gravel 17.7 ft: Grey medium to coarse sand and fine gravel					16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft	2.9 ft	wet		20 to 20.9 ft: Grey fine sand 20.9 to 21.5 ft: Grey medium sand 21.5 to 22.9 ft: Grey coarse sand, little medium sand					21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft	2.9 ft			Grey medium to coarse sand					26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Canal Street
Orleans, MA

Boring: B-106

Boring Number:
Sheet: 2 of 2
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth: 35 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Tech: R. Donoghue, C.Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/8/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/15/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
31	30 ft to 35 ft	3.2 ft	wet		30 to 30.6 ft: Grey medium sand					31
32					30.6 to 33.2 ft: Grey medium to coarse sand					32
33										33
34										34
35					---------- End of Boring at 34' ----------					35
36	35 ft to 40 ft									36
37										37
38										38
39										39
40										40

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Canal Street
Orleans, MA

Boring: B-107

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth: 15 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Tech: R. Donoghue, C.Hayden
Pre-Clear Contractor: Strategic
Pre-Clear Date: 2/8/2017
Drill Contractor: NE Geotech
Driller: Hayes
Drill Date: 2/15/2017

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0" to 7" - Pavement					1
2					7" to 10" - Gravel					2
3					10" to 24" - Fine to Medium Sand					3
4					24" to 48" - Coarse Sand					4
5					48" to 60" - Fine to Medium Sand					5
6	5 ft to 10 ft	3 ft			5 to 7.8 ft: Tan medium to coarse sand					6
7					7.8 to 8 ft: Red/Brown fine sand					7
8										8
9										9
10										10
11	10 ft to 15 ft	3.3 ft	wet		10 to 11.1 ft: Brown medium sand, trace coarse sand					11
12					11.1 to 12.7 ft: Light Brown/Green silt, trace clay					12
13					12.7 to 12.8 ft: Brown silt, trace clay					13
14					12.8 to 13 ft: Brown fine sand					14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20					---------- End of Boring at 14' ----------					20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: RT 6A
Orleans, MA

Boring: B-108

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: B. Barra
Pre-Clear Contractor: Strategic | Pre-Clear Date: 5/2/2019
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 5/7/2019

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear				0" - 6" : Topsoil					1
2	0 ft to 6 ft				6" - 72" : Fine cohesive sand					2
3										3
4										4
5										5
6	5 ft to 10 ft		wet		*Liner jammed due to water around 4'					6
7					5' - 7' : Light brown fine sand with trace silt, loose and non-plastic					7
8					7' - 9' : Greyish brown silt with fine sand, dense, non-plastic					8
9					9' - 10' : Dark brown fine to medium sand, loose and non-plastic					9
10					---------- End of Boring @ 10' ----------					10
11	10 ft to 15 ft									11
12										12
13										13
14										14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Stop & Shop
Orleans, MA

Boring: B-109

Boring Number: 109
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: R. Donoghue
Pre-Clear Contractor: Strategic | Pre-Clear Date: 6/3/2019
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 6/3/2019

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0" - 6" : Topsoil					1
2					6" - 60" : Fine sand					2
3					*Groundwater Encountered at 3' +/-					3
4										4
5										5
6	5 ft to 10 ft				5' - 8' Fine sand					6
7					8' - 10' Peat					7
8										8
9										9
10										10
11	10 ft to 15 ft				10' - 12' Peat					11
12					12' - 15' Fine brown sand					12
13										13
14										14
15										15
16	15 ft to 20 ft				15' - 16' Fine brown sand					16
17					16' - 20' Fine tan sand					17
18										18
19					---------- End of Boring @ 20' ----------					19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Stop & Shop
Orleans, MA

Boring: B-110

Boring Number: 110
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: R. Donoghue
Pre-Clear Contractor: Strategic | Pre-Clear Date: 6/3/2019
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 6/3/2019

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0"-6" Topsoil					1
2					6" - 5' Fine Sand					2
3					*Groundwater Encountered at 3' +/-					3
4										4
5										5
6	5 ft to 10 ft				5' - 9' Medium to coarse red sand					6
7					9' - 10' Gray clay (Plastic)					7
8										8
9										9
10										10
11	10 ft to 15 ft				10' - 11.5' Gray clay (Plastic)					11
12					11.5' - 12' Fine Sand					12
13					12' - 14.5' Gray silt (non plastic)					13
14					14.5' - 15' Fine sand					14
15										15
16	15 ft to 20 ft				15' - 18' Medium sand					16
17					18' to 20' Coarse sand					17
18										18
19										19
20										20
21	20 ft to 25 ft				20' - 22' Medium sand					21
22					22' - 25' Fine Gray Sand					22
23										23
24					---------- End of Boring @ 20' ----------					24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Route 6A
Orleans, MA

Boring: B-111

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: B. Barra
Pre-Clear Contractor: Strategic | Pre-Clear Date: 5/3/2019
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 5/7/2019

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear				0" - 12" : Topsoil					1
2	0 ft to 6 ft				12" - 36 : Sandy Fill					2
3					36" - 72" : Medium sand					3
4										4
5										5
6	5 ft to 10 ft	5.0	dry		5' - 9' : Light brown/tan fine sad with trace small angular and subangular grave loose and non-plastic					6
7					9' - 10' : Dark orange fine to medium sand, trace subang gravel, loose and no					7
8										8
9										9
10										10
11	10 ft to 15 ft	5.0	dry		10' - 11' : brown fine to medium sand with trace small subang gravel, loose ar					11
12					11' - 12.3' : Tan silt with trace fine sand, medium dense, non-plastic					12
13					12.3' - 12.7' : Tan fine to medium sand, loose and non-plastic					13
14					12.7' - 13' : Tan silt with trace fine sand, medium dense, non-plastic					14
15					13' - 15' : Light brown silty sand, dense, non-plastic					15
16	15 ft to 20 ft	5.0	dry		15' - 18.4' : Tan/orange fine to medium sand with trace subangular gravel, loo					16
17					18.4' - 18.7' : silt lens					17
18					18.7' - 20' : Light tan fine sand, loose and non-plastic					18
19										19
20					---------- End of Boring @ 20' ----------					20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Exploration Location

NORTHING: 2,753,899.36 **EASTING:** 1,069,216.28 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 12.1

LOCATION: Stop & Shop Plaza **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG
B-112

Drilling Information

DATE START / END: 5/28/2019 - 5/28/2019 **TOTAL DEPTH (FT):** 40.0

CONTRACTOR: Desmond Well Drilling **DRILLER:** P. Desmond **LOGGED BY:** K. Harten

EQUIPMENT: CME 45C **EXPLORATION TYPE/METHOD:** Hollow Stem Augers

AUGER ID/OD: 3.25 in. **CASING ID/OD:** N/A **CORE INFORMATION:** N/A

HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30

WATER LEVEL DEPTHS (ft): Measured 5'2" inside vac'd hole at time of drilling

GENERAL NOTES: Boring backfilled with cuttings upon completion

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; SS = Sample
ST = Undisturbed Tube Sample; RC = Rock Core; FVS = Field Vane Shear; CBR = California Bearing Ratio
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
Q_p = Pocket Penetrometer Strength; S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
										Cuttings consist of well graded SAND with Gravel and Silt (SW/SM) - brown, fine to coarse sand, little to some fine to coarse gravel, few fines, occasional small cobbles; dry, FILL		Utility Clear w/ Vactor to 5.0 ft.
	10									Bituminous Concrete (~6")		
										Cuttings similar to those described above		
5			SS-1		5 to 7	24/14	3-3-3-4			Poorly graded SAND (SP) - light brown, clean, fine to coarse grained, trace fines; wet	▽	
	5		SS-2		8 to 10	24/16	5-4-4-3			Poorly graded SAND (SP) with Silt (SP/SM) - light brown and gray, fine to coarse grained, few fines, trace to few fine gravel; wet		
10										SS-2 spoon tip contains Silty SAND with Roots (SM) - dark brown, fine to medium grained; wet, organic appearance		
	0		SS-3		13 to 15	24/13	1-1-1-1			Top 1.5": PEAT/ORGANIC SOIL (PT/OL) - dark brown, mostly non-fibrous; wet		
15										Silty SAND (SM) - dark brown, fine to medium grained, little fines, trace coarse sand, trace fine gravel; wet, organic appearance		
	-5		SS-4		18 to 20	24/12	6-12-8-8			Top 3": Poorly graded SAND with Silt (SP/SM) - light brown, fine to medium grained, few fines; wet		
										Bottom 9": Well graded SAND with Silt (SW/SM) - brown, fine to coarse grained, few fine gravel,		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM
PROJECT NAME: Orleans DACSD
CITY/STATE: Orleans, MA
AECOM PROJECT NUMBER: 60476644

AECOM

Exploration Location

NORTHING: 2,753,899.36 **EASTING:** 1,069,216.28 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 12.1

LOCATION: Stop & Shop Plaza **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

B-112

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
										few fines; wet		
	-10		SS-5		23 to 25	24/5	5-4-5-7			Well graded SAND with Gravel and Silt (SW/SM) - brown, fine to coarse sand, little to some fine to coarse gravel, few to trace fines; wet		
25												
	-15		SS-6		28 to 30	24/4	2-2-3-7			Poorly graded SAND (SP) - wet, brown, fine to coarse sand, trace fine gravel, trace fines; sample contains a layer (to 3/4") of gray, plastic, sandy silt at its approx. midpt.		
30												
	-20		SS-7		33 to 35	24/7	3-5-6-7			Top 6": Poorly graded SAND (SP) - brown, fine to coarse grained, few fine gravel, trace fines; wet		
35										Bottom 1": Silty SAND (SM) to a Sandy SILT (ML) - gray, silty fine sand to a fine sandy silt in spoon bottom and tip; wet		
	-25		SS-8		38 to 40	24/11	7-10-9-8			Top 2": Silty SAND (SM) - gray, fine to coarse grained, little fines; wet Bottom 9": Silty SAND (SM) - mostly gray with brown, fine grained, some fines; wet		
40										End of Boring at 40 feet		
	-30											
45												

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Cove Road
Orleans, MA

Boring: B-113

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/21/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/21/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1–5	0 ft to 5 ft				0 - 5" : Asphalt 5" - 6" : Gravel 6" - 5' : Brown fine sand.					1–5
6–10	5 ft to 10 ft	3.9 ft			Tan fine to medium sand					6–10
11–15	10 ft to 15 ft	3.3 ft	dry		10 to 10.2 ft: Brown very fine sand 10.2 to 10.9 ft: Brown fine sand, intermittent brown silt lenses 10.9 to 11.4 ft: Brown/Orange fine to coarse sand and fine gravel 11.4 to 12.5 ft: Brown fine sand 12.5 to 13.2 ft: Tight, Brown fine sand ---------- End of Boring at 12' ----------					11–15
16–30										16–30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Cove Road
Orleans, MA

Boring: B-115

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/21/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/23/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 - 4" : Asphalt					1
2					4" - 5' : Brown medium sand. Medium to large cobbles encountered.					2
3										3
4										4
5										5
6	5 ft to 10 ft	3.3 ft	moist /	wet	5 to 7.2 ft: Tan-Grey fine sand, trace fine gravel					6
7					7.2 to 7.9 ft: Orange/Light Brown medium to coarse sand, little fine gravel					7
8					7.9 to 8.3 ft: Broken cobble					8
9										9
10										10
11	10 ft to 15 ft	3.4 ft	wet		10 to 11 ft: Orange medium to coarse sand, little fine gravel					11
12					11 to 13.4 ft: Tan/Orange fine to medium sand					12
13										13
14										14
15					---------- End of Boring at 15' ----------					15
16										16
17										17
18										18
19										19
20										20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Cove Road
Orleans, MA

Boring: B-116

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/21/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/23/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1-5	0 ft to 5 ft				0" - 5" : Asphalt 5" - 5' : Orange\Brown medium sand. Medium - Large (angular and round) cobbles encountered					1-5
6-10	5 ft to 10 ft	3.4 ft	moist /	wet	Brown very fine sand and silt, **wet at 6.5 ft**					6-10
11-15	10 ft to 15 ft	3.5 ft	wet		Loose, Brown fine sand, saturated ---------- End of Boring at 15' ----------					11-15
16-30										16-30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Cove Road
Orleans, MA

Boring: B-117

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 2/21/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 2/23/2017

Depth	Sample Identification	Rec (ft)	Moist		Field Identification	Description	Fil Mat.	Tube	Fil Mat.	Depth
1	0 ft to 5 ft				0 - 6" : Asphalt 6" - 7" : Gravel 7" - 5' : Brown\Orange medium to fine sand.					1
2										2
3										3
4										4
5										5
6	5 ft to 10 ft	4 ft	dry		5 to 6.8 ft: Tan, Iron-stained medium to coarse sand, little fine gravel 6.8 to 9 ft: Tan-Light Brown fien to medium sand, some silt from 8.2 to 9 ft					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	4 ft	dry		Tan-Brown fine sand, Trace fine gravel, broken cobble at 12.5 ft					11
12										12
13										13
14										14
15					---------- End of Boring at 12' ----------					15
16										16
17										17
18										18
19										19
20										20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Stop & Shop
Orleans, MA

Boring: B-118

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: R. Donoghue
Pre-Clear Contractor: Strategic | Pre-Clear Date: 6/3/2019
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 6/3/2019

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1-5	0 ft to 5 ft				0" - 5' Fine Sand					1-5
6-10	5 ft to 10 ft				5' - 8' Fine gray sand 8' - 9' Peat 9' - 10' Fine sand					6-10
11-15	10 ft to 15 ft				10' - 15' Medium sand					11-15
16-20	15 ft to 20 ft				15' - 20' Fine to medium sand ---------- End of Boring @ 20' ----------					16-20
21-25	20 ft to 25 ft									21-25
26-30	25 ft to 30 ft									26-30

Project Number: 60476644
Client: Town of Orleans

AECOM

250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: West Road
Orleans, MA

Boring: B-119

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth: 10 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: S. Chmiel, C.Hayden
Pre-Clear Contractor: Strategic | Pre-Clear Date: 3/13/2017
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 3/15/2017

Depth	Sample Identification	Rec (ft)	Moisture		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 8” Dark Brown Loamy Sand with Fine Roots (Topsoil)					1
2					8 to 60” Tan Medium to Fine Sand					2
3										3
4										4
5										5
6	5 ft to 10 ft	3.7 ft	dry		Light Brown/Tan fine to medium sand, trace coarse sand					6
7										7
8										8
9										9
10					---------- End of Boring at 10' ----------					10
11										11
12										12
13										13
14										14
15										15
16										16
17										17
18										18
19										19
20										20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Canal Street
Orleans, MA

Boring: B-121

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data
Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: B.Morrill, C. Hayden
Pre-Clear Contractor: Strategic
Driller: Hayes
Pre-Clear Date: 2/14/2017
Drill Contractor: NE Geotech
Drill Date: 2/15/2017

Depth	Sample Identification	Rec (ft)	Moisture		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	0 ft to 5 ft				0 to 1 ft: Pavement					1
2					1 to 1.3 ft: Fine to medium orange sandl					2
3					1.3 to 1.5 ft: Brown-grey fine to medium sand					3
4					1.5 ft to 5 ft : Orange-brown, fine to medium sand					4
5										5
6	5 ft to 10 ft	3 ft	moist		5 to 7.8 ft: Tan medium to coarse sand					6
7					7.8 to 8 ft: Red/Brown fine sand					7
8										8
9										9
10										10
11	10 ft to 15 ft	3.3 ft	wet		10 to 11.5 ft: Brown medium to coarse sand, trace fine gravel					11
12					11.5 to 12.1 ft: Grey fine sand, little medium sand					12
13					12.1 to 13.3 ft: Grey medium sand					13
14										14
15										15
16	15 ft to 20 ft	2.7	wet		15 to 16 ft: Grey medium to coarse sand					16
17					16 to 17.7 ft: Grey fine to medium sand					17
18										18
19										19
20					---------- End of Boring at 16' ----------					20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30										30

Project Number: 60476644
Client: Town of Orleans

AECOM
250 Apollo Drive
Chelmsford, Massachusetts
(978) 905-2100

Site Location: Canal Street
Orleans, MA

Boring: B-123

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-Truck
Inside Diameter: 2"

Well Data

Boring Depth: 15 ft
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue
Field Techs: C. Hayden
Pre-Clear Contractor: Strategic
Driller: Hayes
Pre-Clear Date:
Drill Contractor: NE Geotech
Drill Date: 2/15/2017

Depth	Sample Identification	Rec (ft)	Moisture		Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1-5	0 ft to 5 ft									1-5
6-10	5 ft to 10 ft	3.5 ft	moist /	wet	Dark Brown-Brown fine to medium sand, trace coarse sand and root fibers -wet at 6 ft -some coarse sand and fine gravel from 8 to 8.4 ft					6-10
11-15	10 ft to 15 ft	4.4 ft	wet		10 to 13.5 ft: Light brown fine to medium sand, trace gravel 13.5 to 14.4 ft: Light Brown fine sand, little medium sand, trace tree twigs ---------- End of Boring at 15' ----------					11-15
16-30										16-30

Exploration Location

NORTHING: 2,749,943.63 **EASTING:** 1,064,149.4 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 43.3

LOCATION: Route 6 Crossing **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

B-130

Drilling Information

DATE START / END: 3/29/2019 - 4/1/2019 **TOTAL DEPTH (FT):** 36.0

CONTRACTOR: Desmond Well Drilling **DRILLER:** T. Desmond **LOGGED BY:** K. Harten

EQUIPMENT: CME 45C **EXPLORATION TYPE/METHOD:** Hollow Stem Augers

AUGER ID/OD: 3.25 in. **CASING ID/OD:** N/A **CORE INFORMATION:** N/A

HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30

WATER LEVEL DEPTHS (ft): Measured 28 ft. inside HSA at time of drilling

GENERAL NOTES: Boring backfilled with cuttings upon completion

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; SS = Sample
ST = Undisturbed Tube Sample; RC = Rock Core; FVS = Field Vane Shear; CBR = California Bearing Ratio
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
Q_p = Pocket Penetrometer Strength; S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
										Cuttings consist of Silty SAND (SM): reddish brown, fine to medium grained, little fines, few fine to coarse gravel; dry, grades with depth to a clean tan sand		Utility Clear w/ Vactor to 5.0 ft.
	40											
5			SS-1		5 to 7	24/16	2-3-5-5			Poorly graded SAND (SP) - rust orange, clean, fine to medium grained, trace fine gravel, trace coarse sand, trace silt; dry		
	35											
10			SS-2		9 to 11	24/14	2-4-9-21			Poorly graded SAND (SP) - rust brown and tan, stratified, mostly fine to medium grained, trace to few fine to coarse gravel, trace to few fines; dry, broken gravel @ spoon tip		
	30											
15			SS-3		14 to 16	24/18	4-6-8-10	Gradation		Poorly graded SAND with Silt (SP/SM) - tan, fine grained w/ few medium sand, few fines; dry		
	25											
			SS-4		19 to	24/17	4-8-13-13			Poorly graded SAND with Silt (SP/SM) - tan, fine to medium grained, few to trace fines, trace		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM
PROJECT NAME: Orleans DACSD
CITY/STATE: Orleans, MA
AECOM PROJECT NUMBER: 60476644

AECOM

Exploration Location

NORTHING: 2,749,943.63 **EASTING:** 1,064,149.4 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 43.3

LOCATION: Route 6 Crossing **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

B-130

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
					21					coarse sand, trace fine gravel ; dry		
20												
25			SS-5		24 to 26	24/17	3-12-14-14			Poorly graded SAND and SILT w/ Sand (SM-ML) - interlayers of rust brown, stratified fine to medium grained sand with few fines and trace coarse sand, and gray, low plasticity silt with little to trace fine sand	▽	
15												
			SS-6		29 to 31	24/20	1-3-2-12			Top 18": SILT (ML) - gray brown, low to medium plasticity, trace to few fine sand, occasional fine to medium sand partings; wet		
30										Bottom 2": Poorly graded SAND (SP) - brown, fine to medium grained, trace fines; wet		
10												
35			SS-7		34 to 36	24/15	3-7-7-9			Poorly graded SAND (SP) - medium brown and dark brown, stratified, fine to coarse grained, trace silt; wet		
										End of Boring at 36 feet		
5												
40												
0												
45												

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** _____

LOCATION: Route 6 Crossing **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG
B-131

Drilling Information

DATE START / END: 5/21/2019 - 5/21/2019 **TOTAL DEPTH (FT):** 35.0

CONTRACTOR: Desmond Well Drilling **DRILLER:** P. Desmond **LOGGED BY:** K. Harten

EQUIPMENT: CME 45C **EXPLORATION TYPE/METHOD:** Hollow Stem Augers

AUGER ID/OD: 3.25 in. **CASING ID/OD:** N/A **CORE INFORMATION:** N/A

HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30

WATER LEVEL DEPTHS (ft): Measured 20 ft. inside HSA at time of drilling

GENERAL NOTES: Boring backfilled with cuttings upon completion

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; SS = Sample
ST = Undisturbed Tube Sample; RC = Rock Core; FVS = Field Vane Shear; CBR = California Bearing Ratio
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
Q_p = Pocket Penetrometer Strength; S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength
NA, NM = Not Applicable, Not Measured

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
										Dark brown Topsoil/Loam		Utility Clear w/ Vactor to 5.0 ft.
5			SS-1		5 to 7	24/20	4-7-7-7			Poorly graded SAND (SP) - light brown, stratified, fine to medium with few coarse sand, trace fines; dry		
			SS-2		8 to 10	24/20	3-6-5-6	Gradation		Silty SAND (SM) - light brown, stratified, fine to medium grained, little to few fines, trace coarse sand, contains few fine sandy silt seams; dry to moist		
10												
			SS-3		13 to 15	24/21	2-3-3-3			Top 4": Silty SAND (SM) - rust colored, fine to medium grained, little to few fines including silty seams, trace coarse sand; moist Bottom 17": SILT (ML) - gray brown, low plasticity, trace fine sand; moist		
15												
			SS-4		18 to 20	24/17	3-5-6-7			Silty and poorly graded SAND (SP-SM): stratified, clean to silty, fine to medium grained, few to little fines, trace coarse sand; moist	▽	

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM
PROJECT NAME: Orleans DACSD
CITY/STATE: Orleans, MA
AECOM PROJECT NUMBER: 60476644

AECOM

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** _____

LOCATION: Route 6 Crossing **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

B-131

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
25			SS-5		23 to 25	24/14	3-5-7-9			Silty and poorly graded SAND (SP-SM): stratified, clean to silty, fine to medium grained, little fines, few to trace coarse sand, occasional gray silt laminae; wet		
30			SS-6		28 to 30	24/19	2-4-5-6			SAND with Silt (SP/SM) and SILT (ML): interbeds of brown to rust, fine to medium grained sand with few fines, trace coarse sand, and gray, low to medium plastic silt with trace fine sand; wet		
35			SS-7		33 to 35	24/20	3-7-9-9			Silty SAND (SM) - mottled gray and rust, fine grained, some fines; at its midpoint the sample has a ~2" layer of mostly clean, fine to coarse sand with few fine gravel		
										End of Boring at 35 feet		
40												
45												

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,750,011.04 **EASTING:** 1,064,331.67 **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree
VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 34.0
LOCATION: Route 6 Crossing **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG
B-132

Drilling Information

DATE START / END: 5/21/2019 - 5/21/2019 **TOTAL DEPTH (FT):** 35.0
CONTRACTOR: Desmond Well Drilling **DRILLER:** P. Desmond **LOGGED BY:** K. Harten
EQUIPMENT: CME 45C **EXPLORATION TYPE/METHOD:** Hollow Stem Augers
AUGER ID/OD: 3.25 in. **CASING ID/OD:** N/A **CORE INFORMATION:** N/A
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): Measured 18 ft. inside HSA at time of drilling
GENERAL NOTES: Boring backfilled with cuttings upon completion

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; SS = Sample
ST = Undisturbed Tube Sample; RC = Rock Core; FVS = Field Vane Shear; CBR = California Bearing Ratio
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
Q_p = Pocket Penetrometer Strength; S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
										Brown Silty Loam over Tan Sand		Utility Clear w/ Vactor to 5.0 ft.
5	30		SS-1		5 to 7	24/19	5-5-7-9			Poorly graded SAND (SP): tan, clean, fine to medium grained, trace coarse sand, trace fines; dry		
10	25		SS-2		8 to 10	24/15	3-5-7-9	Gradation		Poorly graded SAND with Silt (SP/SM): light brown to rust brown, weakly stratified, fine to coarse grained (predominantly fine to medium), trace to few fine gravel, few to trace fines; dry to moist		
15	20		SS-3		13 to 15	24/18	10-8-8-6			Silty SAND (SM): brown, weakly stratified, fine to coarse grained (predominantly fine to medium), little to some fines, few fine gravel; dry to moist, fine sandy silt in spoon tip		
	15		SS-4		18 to 20	24/17	6-6-9-10			Top 13": Silty SAND to a Sandy SILT (SM-ML) - gray brown, fine grained, some fines; non-plastic, moist	▽	
										Bottom 4": Poorly to well graded SAND (SP/SW)		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM
PROJECT NAME: Orleans DACSD
CITY/STATE: Orleans, MA
AECOM PROJECT NUMBER: 60476644

AECOM

Exploration Location

NORTHING: 2,750,011.04 **EASTING:** 1,064,331.67 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 34.0

LOCATION: Route 6 Crossing **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

B-132

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_2O Depth	Remarks
										- brown, clean, fine to coarse grained, trace fines; wet		
25	10		SS-5		23 to 25	24/16	1-2-3-5			Poorly to well graded SAND (SP/SW) - light gray brown, clean, fine to coarse grained, trace fine gravel, occasional brown silty fine sand seams (to 1"); wet		
30	5		SS-6		28 to 30	24/17	4-3-6-8			Silty SAND (SM) - gray brown with rust, stratified, fine grained, some fines; wet		
35	0		SS-7		33 to 35	24	7-14-16-18			Poorly to well graded SAND (SP/SW): brown, clean, weakly stratified, fine to coarse grained, few to little fine gravel, trace fines; wet		
40	-5									End of Boring at 35 feet		
45	-10											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,750,013.88 **EASTING:** 1,064,369.92 **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree
VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 34.2
LOCATION: Route 6 Crossing **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG
B-133

Drilling Information

DATE START / END: 5/22/2019 - 5/22/2019 **TOTAL DEPTH (FT):** 35.0
CONTRACTOR: Desmond Well Drilling **DRILLER:** P. Desmond **LOGGED BY:** K. Harten
EQUIPMENT: CME 45C **EXPLORATION TYPE/METHOD:** Hollow Stem Augers
AUGER ID/OD: 3.25 in. **CASING ID/OD:** N/A **CORE INFORMATION:** N/A
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): Measured 15 ft. inside HSA at time of drilling
GENERAL NOTES: Boring backfilled with cuttings upon completion

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; SS = Sample
ST = Undisturbed Tube Sample; RC = Rock Core; FVS = Field Vane Shear; CBR = California Bearing Ratio
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
Q_p = Pocket Penetrometer Strength; S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength
NA, NM = Not Applicable, Not Measured

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
										Brown Silty Loam over Tan Sand		Utility Clear w/ Vactor to 5.0 ft.
5	30		SS-1		5 to 7	24/20	5-5-4-6			Poorly graded SAND with Silt (SP/SM): tan, fine to medium grained, few fines, trace coarse sand; dry		
10	25		SS-2		8 to 10	24/17	3-4-4-5			Poorly graded SAND with Silt (SP/SM), as described above in SS-1		
15	20		SS-3		13 to 15	24/15	5-6-7-6	Gradation		Poorly graded SAND with Silt (SP/SM), as described above in SS-1; moist at tip	▽	
	15		SS-4		18 to 20	24/12	4-8-9-10			Poorly graded SAND with Silt (SP/SM): light brown, fine to medium grained, few coarse sand, few fines; wet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM
PROJECT NAME: Orleans DACSD
CITY/STATE: Orleans, MA
AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,750,013.88 **EASTING:** 1,064,369.92 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 34.2

LOCATION: Route 6 Crossing **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

B-133

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
25	10		SS-5		23 to 25	24/16	9-15-18-16			Silty SAND with Gravel (SM): brown, moderately graded, fine to coarse grained, little fine to coarse gravel, little fines (at top) to few fines (at bottom); wet		
30	5		SS-6		28 to 30	24/19	5-8-11-12			Sandy SILT (ML): gray and rust brown, stratified, mostly non-plastic, some fine to coarse sand (predominantly fine grained), trace fine gravel, occasional clean fine to coarse sand seams (to 1"); wet		
35	0		SS-7		33 to 35	24/10	2-2-4-5			Silty SAND (SM): gray brown, stratified, fine grained, some fines Poorly graded SAND (SP): tan, clean, fine to medium grained, trace fines		
										End of Boring at 35 feet		
40	-5											
45	-10											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,749,985.15 **EASTING:** 1,064,142.07 **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree
VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 33.8
LOCATION: Route 6 Crossing **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG
B-134

Drilling Information

DATE START / END: 3/29/2019 - 4/1/2019 **TOTAL DEPTH (FT):** 35.0
CONTRACTOR: Desmond Well Drilling **DRILLER:** T. Desmond **LOGGED BY:** K. Harten
EQUIPMENT: CME 45C **EXPLORATION TYPE/METHOD:** Hollow Stem Augers
AUGER ID/OD: 3.25 in. **CASING ID/OD:** N/A **CORE INFORMATION:** N/A
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): Measured 15 ft. inside HSA at time of drilling
GENERAL NOTES: Boring backfilled with cuttings upon completion

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; SS = Sample
ST = Undisturbed Tube Sample; RC = Rock Core; FVS = Field Vane Shear; CBR = California Bearing Ratio
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
Q_p = Pocket Penetrometer Strength; S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength
NA, NM = Not Applicable, Not Measured

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
												Utility Clear w/ Vactor to 5.0 ft.
5	30		SS-1		5 to 7	24/18	5-6-6-8			Poorly graded SAND with Silt (SP/SM) - light brown, fine to medium grained, trace to few fines; dry		
10	25		SS-2		8 to 10	24/16	1-6-8-9	Gradation Moist. %		Poorly graded SAND with Silt (SP/SM) - light brown, fine grained w/ few medium sand, few fines; appears wet		
15	20		SS-3		13 to 15	24/16	5-8-10-11			Poorly graded SAND with Silt (SP/SM) - light brown, fine grained, trace to few fines, trace medium to coarse sand; appears wet, similar to SS-2	▽	
	15		SS-4		18 to 20	24/18	4-9-10-9			Poorly graded SAND with Silt (SP/SM) - gray brown and rust brown, fine grained, few to trace fines, few medium sand, trace coarse sand, trace fine gravel; sample contains a gray, slightly plastic silt seam (to ~1") @ the spoon tip; wet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM
PROJECT NAME: Orleans DACSD
CITY/STATE: Orleans, MA
AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,749,985.15 **EASTING:** 1,064,142.07 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 33.8

LOCATION: Route 6 Crossing **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

B-134

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
25	10		SS-5		23 to 25	24/21	2-3-3-4			SILT (ML): gray, low to medium plasticity, few rust colored fine to coarse sand partings; rust colored sand in spoon tip; wet		
30	5		SS-6		28 to 30	24/17	4-3-5-4			Silty SAND (SM-ML) - rust brown and gray, stratified, fine grained, some fines including silt laminae; wet		
35	0		SS-7		33 to 35	24/17	10-10-10-11			Top: Silty SAND (SM) - rust colored, fine to medium grained, little fines, contains an approx. 1" laminated silt seam at midpoint Bottom: Poorly graded SAND (SP) - light gray, clean, fine to coarse grained, trace fines; wet End of Boring at 35 feet		
40	-5											
45	-10											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Lots Hollow Rd
Orleans, MA

Boring: B-134

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: B. Barra
Pre-Clear Contractor: Strategic | Pre-Clear Date: 5/1/2019
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 5/6/2019

Depth	Sample Identification	Rec (ft	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Ma	Depth
1	Pre-Clear				0" - 3" : Topsoil					1
2	0 ft				3" - 10" : Pavement					2
3	to				10" - 84" : Medium sand					3
4	7 ft									4
5										5
6	5 ft									6
7	to	5.0	moist		5' - 10' : Dark orange fine to medium sand, loose, non-plastic					7
8	10 ft									8
9										9
10										10
11	10 ft				10' - 12.6' : Dark orange fine to medium sand, loose, non-plastic					11
12	to	5.0	dry		12.6' - 13.3' : Light orange fine to medium sand, loose, non-plastic					12
13	15 ft				13.3' - 13.9' : Light tan medium sand with little fine sand, loose, non-plastic					13
14					13.9' - 13.95' : Lens of tan silty clay-like material, dense, slightly plastic					14
15					13.95' - 15' : Fine light tan sand, loose, non-plastic					15
16	15 ft				---------- End of Boring @ 15' ----------					16
17	to									17
18	20 ft									18
19										19
20										20
21	20 ft									21
22	to									22
23	25 ft									23
24										24
25										25
26	25 ft									26
27	to									27
28	30 ft									28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Center Place
Orleans, MA

Boring: B-135

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: B. Barra
Pre-Clear Contractor: Strategic | Pre-Clear Date: 5/2/2019
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 5/6/2019

Depth	Sample Identification	Rec (ft)	Moisture	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear				0" - 4" : Topsoil					1
2	0 ft to 5 ft				4" - 24" : Sand and gravel					2
3					24" - 36" : Fine sand with iron nodules					3
4					36" - 60" : Tight silt (hard digging)					4
5										5
6	5 ft to 10 ft	5.0	moist		5' - 10' : brown fine sand with some silt and sm subangular gravel, medium de					6
7										7
8										8
9										9
10										10
11	10 ft to 15 ft	5.0	moist		10' - 15' : Light brown to brown fine sand with trace silt, loose and non-plastic					11
12										12
13					---------- End of Boring @ 15' ----------					13
14										14
15										15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Project Number: 60587515
Client: Town of Orleans

AECOM

9 Jonathan Bourne Drive
Pocasset, Massachusetts
(508)-833-6950

Site Location: Center Place
Orleans, MA

Boring: B-136

Boring Number:
Sheet: 1 of 1
Surface Elevation (ft-asl):
Equipment: Geoprobe 6620, Vac-truck
Inside Diameter: 2"

Well Data

Boring Depth:
Screen Depth:
Screen length:

Project Manager: Reggie Donoghue | Field Techs: B. Barra
Pre-Clear Contractor: Strategic | Pre-Clear Date: 5/2/2019
Drill Contractor: NE Geotech | Driller: Hayes | Drill Date: 5/6/2019

Depth	Sample Identification	Rec (ft)	Moist	PID (ppm)	Field Identification	Description	Fill Mat.	Tube	Fill Mat.	Depth
1	Pre-Clear				0" - 4" : Topsoil					1
2	0 ft to 5 ft				4" - 12" : Gravel					2
3					12" - 60" : Fine sand					3
4					*Ground water encountered at 42"					4
5										5
6	5 ft to 10 ft	5.0	wet		5' - 8.1' : Dark brown silty sand, medium dense					6
7					7.8' rock					7
8					8.0' rock 8.1' - 8.4' : Brown medium sand with some fine sand, little subangular gravel					8
9					8.4' - 8.8' : Brown silty sand, dense, non-plastic					9
10					8.8' - 10' : Grey silt with trace fine sand, dense, slightly plastic, clay-like mater					10
11	10 ft to 15 ft		wet		10' - 15' : Brown - grey fine to medium sand with some silt, loose, non-plastic					11
12					bottom 2" is a plug of very dense light brown silt					12
13					*liner jammed					13
14										14
15					---------- End of Boring @ 15' ----------					15
16	15 ft to 20 ft									16
17										17
18										18
19										19
20										20
21	20 ft to 25 ft									21
22										22
23										23
24										24
25										25
26	25 ft to 30 ft									26
27										27
28										28
29										29
30										30

Exploration Location

NORTHING: 2,750,051.09 **EASTING:** 1,064,514.7 **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree
VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 34.9
LOCATION: Route 6 Crossing **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG
B-140 (OW)

Drilling Information

DATE START / END: 5/22/2019 - 5/22/2019 **TOTAL DEPTH (FT):** 35.0
CONTRACTOR: Desmond Well Drilling **DRILLER:** P. Desmond **LOGGED BY:** K. Harten
EQUIPMENT: CME 45C **EXPLORATION TYPE/METHOD:** Hollow Stem Augers
AUGER ID/OD: 3.25 in. **CASING ID/OD:** N/A **CORE INFORMATION:** N/A
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): Measured 17 ft. inside HSA at time of drilling
GENERAL NOTES: Converted boring to observation well with a screened interval of approx. 17' to 27'

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; SS = Sample
ST = Undisturbed Tube Sample; RC = Rock Core; FVS = Field Vane Shear; CBR = California Bearing Ratio
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
Q_p = Pocket Penetrometer Strength; S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength
NA, NM = Not Applicable, Not Measured

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
										Apparent Fill Area - shallow Fill materials include pavement pieces and small boulders; estimate a fill thickness of ~5 feet in immediate B-140 vicinity		Utility Clear w/ Vactor to 5.0 ft.
5	30		SS-1		5 to 7	24/20	3-3-4-3			Poorly graded SAND (SP) - tan, clean, stratified, fine to medium grained with few to trace coarse sand, trace fines		
			SS-2		8 to 10	24/18	3-3-4-4			Poorly graded SAND (SP) - tan, clean, fine to medium grained with few to trace coarse sand, trace fines		
10	25		SS-3		13 to 15	24/18	3-3-3-5			Poorly graded SAND (SP) - as described in SS-2 above; bottom 6-in. is slightly moist		
15	20		SS-4		18 to 20	24/19	2-3-6-7			Poorly graded SAND (SP) - light brown, clean, stratified, mostly fine to medium grained with few coarse sand, trace fines; wet, occasional rust stained seams	▽	

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM
PROJECT NAME: Orleans DACSD
CITY/STATE: Orleans, MA
AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,750,051.09 **EASTING:** 1,064,514.7 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 34.9

LOCATION: Route 6 Crossing **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

B-140 (OW)

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
25	10		SS-5		23 to 25	24/10	2-5-3-5			Poorly to well graded SAND (SP/SW) - brown, fine to coarse grained (predominantly fine to medium), few to little fine to coarse gravel (8 to 12%), trace fines; wet		
30	5		SS-6		28 to 30	24/19	7-14-14-15			Silty SAND (SM) - mottled gray brown and rust brown, fine grained with some fines, few medium to coarse sand, trace fine gravel; wet		
35	0		SS-7		33 to 35	24/13	3-4-5-6			Poorly graded SAND (SP) and SILT (ML) - interlayers of brown, stratified, fine to coarse sand with trace to few fines, and gray, fine sandy to a non-sandy silt; sample non-plastic except for the non-sandy seams of silt; wet		
										End of Boring at 35 feet		
40	-5											
45	-10											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,750,030.22 **EASTING:** 1,064,836.86 **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree
VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 45.0
LOCATION: 84 Old Colony Way **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG
PS1-1

Drilling Information

DATE START / END: 5/23/2019 - 5/23/2019 **TOTAL DEPTH (FT):** 60.0
CONTRACTOR: Desmond Well Drilling **DRILLER:** P. Desmond **LOGGED BY:** K. Harten
EQUIPMENT: CME 45C **EXPLORATION TYPE/METHOD:** Hollow Stem Augers
AUGER ID/OD: 3.25 in. **CASING ID/OD:** N/A **CORE INFORMATION:** N/A
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): Measured 30' inside HSA at time of drilling
GENERAL NOTES: Boring backfilled with cuttings upon completion

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; SS = Sample
ST = Undisturbed Tube Sample; RC = Rock Core; FVS = Field Vane Shear; CBR = California Bearing Ratio
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
Q_p = Pocket Penetrometer Strength; S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength
NA, NM = Not Applicable, Not Measured

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
												Utility Clear w/ Vactor to 5.0 ft.
5	40		SS-1		5 to 7	24/16	2-1-2-1			Poorly graded SAND with Silt (SP/SM) - tan, predominantly fine to medium grained with trace to few coarse sand, trace to few fines; dry		
			SS-2		8 to 10	24/14	1-2-1-2			Poorly graded SAND with Silt (SP/SM) - tan, weakly stratifed, fine to coarse grained, trace to few fines; dry		
10	35		SS-3		13 to 15	24/9	4-2-3-2	Gradation		Poorly graded SAND (SP/SM) - tan to rust brown, mostly clean, fine to coarse grained, few fines, trace fine gravel, occasional silty sand seams (to 1" thick); dry		
15	30		SS-4		18 to 20	24/8	12-6-6-6			Poorly graded SAND (SP/SM) - light gray and light brown, stratified, fine to coarse grained, trace to few fines; dry		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM
PROJECT NAME: Orleans DACSD
CITY/STATE: Orleans, MA
AECOM PROJECT NUMBER: 60476644

AECOM

Exploration Location

NORTHING: 2,750,030.22 **EASTING:** 1,064,836.86 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 45.0

LOCATION: 84 Old Colony Way **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

PS1-1

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
25	20		SS-5		23 to 25	24/18	2-4-4-4			Silty SAND (SM) - tan, fine grained, some to little fines; sample is siltier with depth, dry		
			SS-6		28 to 30	24/11	4-6-5-6			Poorly graded SAND (SP) - light brown, fine grained with trace medium to coarse sand, trace to few fines; wet	▽	
30	15											
			SS-7		33 to 35	24/0	3-4-5-6			Poorly graded SAND (SP) - light brown, clean, fine to medium grained, trace fines; wet		Redrove SS-7 sampler to recover the described material
35	10											
			SS-8		38 to 40	24/13	4-4-6-7			Poorly graded SAND (SP) - light brown, clean, stratified, fine grained with infrequent medium to coarse grained seams (of <1/4" thickness), trace fines; wet		
40	5											
			SS-9		43 to 45	24/16	3-5-6-7			Poorly graded SAND (SP) - light gray, clean, fine to medium grained, trace fines; wet		
45	0											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,750,030.22 **EASTING:** 1,064,836.86 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 45.0

LOCATION: 84 Old Colony Way **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

PS1-1

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
			SS-10		48 to 50	24/14	4-6-8-11			Sandy SILT (ML) - gray brown and rust brown, interbedded and laminated, some fine sand in top half and little to few fine sand at bottom; silt is sandy to clean (w/o sand) and includes clean, medium plastic laminae, wet		
50	-5											
			SS-11		53 to 55	24/17	3-2-4-5			SILT (ML) - gray brown and rust stained, interbedded and laminated, little fine sand, few rust colored medium to coarse sand partings; silt is sandy (low plasticity) to clean (no sand and of medium plasticity), wet		
55	-10											
			SS-12		58 to 60	24/17	4-8-7-7			SILT (ML) - Similar to SS-1 above, but the silt contains little to some fine sand and the sample has an ~1.5" silty sand seam; wet		
60	-15									End of Boring at 60 feet		
65	-20											
70	-25											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,750,045.73 **EASTING:** 1,064,850.77 **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree
VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 45.3
LOCATION: 84 Old Colony Way **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG
PS1-2

Drilling Information

DATE START / END: 5/23/2019 - 5/23/2019 **TOTAL DEPTH (FT):** 60.0
CONTRACTOR: Desmond Well Drilling **DRILLER:** P. Desmond **LOGGED BY:** K. Harten
EQUIPMENT: CME 45C **EXPLORATION TYPE/METHOD:** Hollow Stem Augers
AUGER ID/OD: 3.25 in. **CASING ID/OD:** N/A **CORE INFORMATION:** N/A
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): Measured 28 ft. inside HSA at time of drilling
GENERAL NOTES: Boring backfilled with cuttings upon completion

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; SS = Sample
ST = Undisturbed Tube Sample; RC = Rock Core; FVS = Field Vane Shear; CBR = California Bearing Ratio
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
Q_p = Pocket Penetrometer Strength; S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength
NA, NM = Not Applicable, Not Measured

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
	45											Utility Clear w/ Vactor to 5.0 ft.
5	40		SS-1		5 to 7	24/3	3-6-5-6			Well graded SAND (SW) - brown, clean, fine to coarse grained, trace fine gravel, trace fines; dry		
			SS-2		8 to 10	24/18	3-3-4-3			Top 4: Same as SS-1 above Bottom 14": SILT with Sand (ML) - mottled gray brown and rust brown, low plasticity, little to few fine sand; sand in spoon tip, dry		
10	35											
			SS-3		13 to 15	24/17	3-3-3-3			Silty to poorly graded SAND (SM-SP) - tan, stratified, fine grained, few fines, occasional silt seams (to 1/4"); less fines with depth, dry		
15	30											
			SS-4		18 to 20	24/18	3-3-4-5			Silty to poorly graded SAND (SM-SP) - tan, stratified, fine grained, some fines; middle of sample contains clean, fine to coarse sand with trace fines; dry		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM
PROJECT NAME: Orleans DACSD
CITY/STATE: Orleans, MA
AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,750,045.73 **EASTING:** 1,064,850.77 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 45.3

LOCATION: 84 Old Colony Way **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

PS1-2

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
25	20		SS-5		23 to 25	24/16	6-4-5-4			Silty SAND (SM) - tan, fine grained, some fines; borderline cohesive, similar to top and bottom portions of SS-4; dry		
30	15		SS-6		28 to 30	24/17	5-3-5-6			Silty SAND (SM) - light gray brown, stratified, fine grained, some fines, occasional silt seams (<1/4"), occasional medium sand partings	▽	
35	10		SS-7		33 to 35	24/16	3-3-4-4			Top 14": SILT with Sand (ML) - mottled gray brown with rust, stratified, non-plastic, little fine sand; wet Bottom 2": Silty SAND (SM) - Fine to medium grained w/ a thin coarse sand seam		
40	5		SS-8		38 to 40	24/14	4-3-4-6			Poorly graded SAND with Silt (SP-SM) - light brown, stratified, fine grained, few fines, trace medium sand, occasional gray silt seams (<1/4"); more silty @ tip, wet		
45	0		SS-9		43 to 45	24/0	4-2-3-3			Poorly to well graded SAND (SP/SW) - light brown, clean, fine to coarse grained, trace fines; wet		Redrove SS-9 sampler to recover the described material

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,750,045.73 **EASTING:** 1,064,850.77 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 45.3

LOCATION: 84 Old Colony Way **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

PS1-2

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
50	-5		SS-10		48 to 50	24/7	7-5-7-8			Poorly graded SAND w/ Silt (SP-SM): light gray brown, stratified, clean to slightly silty, fine to coarse grained, few to trace fines, trace coarse gravel; ~1/4" silt seam at bottom of sample; wet		
55	-10		SS-11		53 to 55	24/7	8-7-7-6			Poorly graded SAND with Silt (SP-SM) - light gray brown, mostly clean, fine to coarse grained, trace fines (@top) to few fines (at bottom); Wet Gray and rust brown SILT (ML) layer @ spoon tip (~3/4" thick)		
60	-15		SS-12		58 to 60	24/5	3-6-9-8			Sandy SILT (ML) - brown and rust brown, laminated, some fine sand; wet Rust brown fine to medium SAND with silt seam in bottom 1" of sample End of Boring at 60 feet		
65	-20											
70	-25											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,750,476.54 **EASTING:** 1,068,478.05 **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree
VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 33.3
LOCATION: Snow Library **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG
PS2-1

Drilling Information

DATE START / END: 4/2/2019 - 4/2/2019 **TOTAL DEPTH (FT):** 55.0
CONTRACTOR: Desmond Well Drilling **DRILLER:** P. Desmond **LOGGED BY:** K. Harten
EQUIPMENT: CME 45C **EXPLORATION TYPE/METHOD:** Hollow Stem Augers
AUGER ID/OD: 3.25 in. **CASING ID/OD:** N/A **CORE INFORMATION:** N/A
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): Measured 22 ft. inside HSA at time of drilling
GENERAL NOTES: Boring backfilled with cuttings upon completion

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; SS = Sample
ST = Undisturbed Tube Sample; RC = Rock Core; FVS = Field Vane Shear; CBR = California Bearing Ratio
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
Q_p = Pocket Penetrometer Strength; S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength
NA, NM = Not Applicable, Not Measured

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
										TOPSOIL (~12")		Utility Clear w/ Vactor to 5.0 ft.
5	30		SS-1		5 to 7	24/16	3-3-4-3			SAND with Silt (SM) - brown, fine to medium grained, few fines (@ top) to little fines (@ bottom), trace coarse sand, trace fine gravel - coarse sand and fine gravel mostly in bottom 7" of sample; dry		
10	25		SS-2		8 to 10	24/19	3-6-5-6	Gradation Density		Poorly graded SAND with Silt (SP/SM) - brown, fine to medium grained w/ few coarse sand, few to little fines, trace fine gravel; dry		
15	20		SS-3		13 to 15	24/21	4-6-7-8			Poorly graded SAND with Silt (SP/SM) - stratified, fine to medium grained, few to little fines, few coarse sand, occasional silt seams (to 5/8"); dry		
	15		SS-4		18 to 20	24/18	6-7-10-13	Gradation		Poorly graded SAND with Silt (SP/SM) - brown, stratified, clean to silty, fine to medium grained, few to little fines, trace coarse sand, trace fine gravel; moist to wet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM
PROJECT NAME: Orleans DACSD
CITY/STATE: Orleans, MA
AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,750,476.54 **EASTING:** 1,068,478.05 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 33.3

LOCATION: Snow Library **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

PS2-1

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
25	10		SS-5		23 to 25	24/16	3-5-6-5			SAND and SILT (SM-ML) - gray and rust brown, interbedded, fine grained, some fines, few medium to coarse sand; wet, non-plastic	▽	
30	5		SS-6		28 to 30	24/14	4-7-9-10			Poorly graded SAND and Silty SAND (SP-SM) - light brown and rust brown, stratified, clean to silty, fine to coarse grained, little fines, trace fine gravel; wet		
35	0		SS-7		33 to 35	24/16	3-7-9-10			Poorly to well graded SAND (SP-SW) - light brown, mostly clean, fine to coarse grained, few to little fine gravel, trace fines; wet		
40	-5		SS-8		38 to 40	24/11	5-7-8-8			Poorly graded SAND (SP) - gray brown, stratified, mostly clean, fine to coarse grained, trace fines, trace fine gravel; wet		
45	-10		SS-9		43 to 45	24/15	4-9-7-6			Poorly graded SAND and Silty SAND (SP-SM) - brown, stratified, clean to silty, fine to coarse grained, little fines including silt laminae, trace fine gravel; wet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,750,476.54 **EASTING:** 1,068,478.05 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 33.3

LOCATION: Snow Library **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

PS2-1

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
50	-15		SS-10		48 to 50	24/14	5-6-9-10			Top 12": Poorly graded SAND (SP) - gray brown, clean, fine to coarse grained, trace fine gravel, trace fines; wet Bottom 2": SILT (ML) - gray, medium plastic, few fine to medium sand partings; wet		
55	-20		SS-11		53 to 55	24/17	2-5-8-9			Silty SAND (SM) - brown, stratified, silty to clean fine to medium grained sand, some to little fines, trace coarse sand, trace fine gravel, occasional medium plastic seams; wet End of Boring at 55 feet		
60	-25											
65	-30											
70	-35											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,750,452.15 **EASTING:** 1,068,479.3 **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree
VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 33.8
LOCATION: Snow Library **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG
PS2-2

Drilling Information

DATE START / END: 4/2/2019 - 4/4/2019 **TOTAL DEPTH (FT):** 50.0
CONTRACTOR: Desmond Well Drilling **DRILLER:** P. Desmond **LOGGED BY:** K. Harten
EQUIPMENT: CME 45C **EXPLORATION TYPE/METHOD:** Hollow Stem Augers
AUGER ID/OD: 3.25 in. **CASING ID/OD:** N/A **CORE INFORMATION:** N/A
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): Measured 22'4" inside HSA at time of drilling
GENERAL NOTES: Boring backfilled with cuttings upon completion

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; SS = Sample
ST = Undisturbed Tube Sample; RC = Rock Core; FVS = Field Vane Shear; CBR = California Bearing Ratio
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
Q_p = Pocket Penetrometer Strength; S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
										TOPSOIL (~12")		Utility Clear w/ Vactor to 5.0 ft. No surficial samples were taken.
5	30		SS-1		5 to 7	24/17	3-3-4-3	Gradation Density		Poorly graded SAND (SP) - brown, clean, fine to medium grained w/ trace coarse sand, trace fine gravel, trace fines; dry		
10	25		SS-2		8 to 10	24/16	5-4-5-7			Poorly graded SAND with Silt (SP/SM) - brown, stratified, fine to coarse grained, few fine to coarse gravel, few fines; dry		
15	20		SS-3		13 to 15	24/21	7-8-11-10	Gradation		Poorly graded SAND and Silty SAND (SP-SM): a non-homogenous mix of brown fine to coarse sand with few fine to coarse gravel and trace to few fines and gray brown silty fine sand with some fines; sample is dry, fill-like appearance		
	15		SS-4		18 to 20	24/18	9-9-10-10			Silty SAND (SM) - brown, non-stratified, poorly sorted, fine to coarse grained (w/ predominantly fine sand), some fines, few to trace gravel; moist @ tip		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM
PROJECT NAME: Orleans DACSD
CITY/STATE: Orleans, MA
AECOM PROJECT NUMBER: 60476644

AECOM

Exploration Location

NORTHING: 2,750,452.15 **EASTING:** 1,068,479.3 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 33.8

LOCATION: Snow Library **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

PS2-2

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
25	10		SS-5		23 to 25	24/11	7-15-10-10			Silty SAND (SM) - gray brown and rust brown, fine to medium grained, little fines, trace coarse sand, trace fine gravel; dry, similar to SS-4 but with less fines	▽	
30	5		SS-6		28 to 30	24/24	3-5-6-11			Poorly graded SAND (SP) - brown and rust brown, stratified, clean, fine to coarse grained, trace fines, sample has a ~1.5" thick fine sandy silt seam @ its approx. midpoint; wet		
35	0		SS-7		33 to 35	24/12	4-8-11-12			Poorly graded SAND (SP) - light gray brown, stratified, fine to medium grained, trace to few fines; wet		
40	-5		SS-8		38 to 40	24/19	3-4-10-11			Poorly graded SAND and SILT (SP-ML) - stratified and interlayered, light gray fine to medium sand with trace to few fines, and brown silt with few fine sand; wet, silt layers have a low plasticity		
45	-10		SS-9		43 to 45	24/6	6-11-16-20			Poorly graded SAND (SP) - mostly light gray brown, clean, fine to medium grained, trace fines; wet, little rust brown color stratification		Approx. 6-inches of run-in occurred before the SS-9 sample's collection

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,750,452.15 **EASTING:** 1,068,479.3 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 33.8

LOCATION: Snow Library **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

PS2-2

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
50	-15		SS-10		48 to 50	24/17	4-7-8-9			Top: Poorly graded SAND (SP) - brown, clean, fine to medium grained, trace fines, trace coarse sand; wet Bottom: SILT (ML) - gray and rust brown, interbedded and laminated, few fine sand, occasional fine sand partings; wet End of Boring at 50 feet		
55	-20											
60	-25											
65	-30											
70	-35											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,754,022.24 **EASTING:** 1,069,070.23 **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree
VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 10.5
LOCATION: Stop & Shop Plaza **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG
PS3-1 (OW)

Drilling Information

DATE START / END: 5/29/2019 - 5/29/2019 **TOTAL DEPTH (FT):** 50.0
CONTRACTOR: Desmond Well Drilling **DRILLER:** P. Desmond **LOGGED BY:** K. Harten
EQUIPMENT: CME 45C **EXPLORATION TYPE/METHOD:** Hollow Stem Augers
AUGER ID/OD: 3.25 in. **CASING ID/OD:** N/A **CORE INFORMATION:** N/A
HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): Measured 4'8" inside vac'd hole at time of drilling
GENERAL NOTES: Converted boring to observation well with a screened interval of approx. 18' to 28'

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; SS = Sample
ST = Undisturbed Tube Sample; RC = Rock Core; FVS = Field Vane Shear; CBR = California Bearing Ratio
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
Q_p = Pocket Penetrometer Strength; S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength
NA, NM = Not Applicable, Not Measured

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
	10											Utility Clear w/ Vactor to 5.0 ft.
5	5		SS-1		5 to 7	24/19	1-2-2-3			Top: PEAT (Pt) - dark brown Peat/Organic Soil	▽	
										Bottom: Poorly graded SAND with Silt (SP/SM) - gray brown (@ top) to dark brown, fine to medium grained, few to little fines (finer on bottom), few coarse sand; wet		
			SS-2		8 to 10	24/13	3-8-7-8			Poorly graded SAND with Gravel (SP) - brown, fine to coarse grained, little fine gravel, trace fines; wet		
10	0											
			SS-3		13 to 15	24/7	2-4-6-6	Gradation		Poorly graded SAND (SP) - brown, fine to coarse grained, few fine gravel, trace fines; similar to SS-2 above, wet		
15	-5											
			SS-4		18 to 20	24/14	2-4-3-3			Top: Poorly graded SAND (SP) - light gray, mostly clean, fine to medium grained with few to trace coarse sand, trace fines; wet		
										Elastic SILT (MH) - gray, high plasticity; wet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM
PROJECT NAME: Orleans DACSD
CITY/STATE: Orleans, MA
AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,754,022.24 **EASTING:** 1,069,070.23 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 10.5

LOCATION: Stop & Shop Plaza **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

PS3-1 (OW)

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
	-10											
			SS-5		23 to 25	24/9	2-2-4-4			Top 1": Elastic SILT (ML/MH) - brown and gray, medium plastic; wet Bottom 8": Poorly to well graded SAND (SP/SW) - light gray, clean, fine to coarse grained, few to little fine gravel, trace fines		
25	-15											
			SS-6		28 to 30	24/8	2-3-4-6			Poorly to well graded SAND (SP/SW) - light gray, clean, fine to coarse grained, trace fine gravel, trace fines; wet		
30	-20											
			SS-7		33 to 35	24/10	3-2-2-4			Poorly graded SAND (SP): light gray, clean, fine to coarse grained, trace fines; wet		Minor sand run-in from approx 33 to 45 ft.
35	-25											
			SS-8		38 to 40	24/8	3-5-5-6			Poorly graded SAND (SP): light gray, mostly clean, fine to coarse grained, trace fines, occasional seams of silty fine sand with some fines (up to 1" thick); wet		
40	-30											
			SS-9		43 to 45	24/6	3-5-5-6			Poorly graded SAND (SP) - light gray, clean, fine grained, trace fines; wet		
45	-35											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,754,022.24 **EASTING:** 1,069,070.23 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 10.5

LOCATION: Stop & Shop Plaza **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

PS3-1 (OW)

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
			SS-10	X	48 to 50	24/1	2-3-5-6			Poor Recovery: Poorly graded SAND (SP) - light gray, clean, fine to medium grained with few to trace coarse sand, trace fines; wet		Six to 7 ft. of sand run-in occurred during advancement to 45 feet - partially withdraw and re-spin augers to collect the SS-10 sample
50	-40									End of Boring at 50 feet		
55	-45											
60	-50											
65	-55											
70	-60											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,754,049.12 **EASTING:** 1,069,023.81 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 10.6

LOCATION: Stop & Shop Plaza **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG
PS3-2

Drilling Information

DATE START / END: 5/28/2019 - 5/28/2019 **TOTAL DEPTH (FT):** 50.0

CONTRACTOR: Desmond Well Drilling **DRILLER:** P. Desmond **LOGGED BY:** K. Harten

EQUIPMENT: CME 45C **EXPLORATION TYPE/METHOD:** Hollow Stem Augers

AUGER ID/OD: 3.25 in. **CASING ID/OD:** N/A **CORE INFORMATION:** N/A

HAMMER TYPE: Automatic **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30

WATER LEVEL DEPTHS (ft): Measured 4'2" inside vac'd hole at time of drilling

GENERAL NOTES: Boring backfilled with cuttings upon completion

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; SS = Sample
ST = Undisturbed Tube Sample; RC = Rock Core; FVS = Field Vane Shear; CBR = California Bearing Ratio
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
Q_p = Pocket Penetrometer Strength; S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
	10											Utility Clear w/ Vactor to 5.0 ft.
											▽	
5	5		SS-1		5 to 7	24/13	2-3-4-3			Well graded SAND with Silt (SW/SM): brown, fine to coarse grained, few fine gravel, few to trace fines; wet		
			SS-2		8 to 10	24/16	2-2-6-1	Sieve/ Hydrometer		Top 10": Poorly graded SAND (SP): brown, fine to coarse grained, trace fine to coarse gravel, trace fines; wet		
10	0									Middle 4": Well graded GRAVEL (GW) with Sand: brown, fine to coarse grained, some fine to coarse sand, trace fines; wet		
										Bottom 2": Fat CLAY (CH) - gray, highly plastic, occasional fine to medium sand partings; wet		
			SS-3		13 to 15	24/5	2-1-4-4			Top: Fat CLAY with Gravel (CH) - mostly gray, highly plastic, some to little fine to coarse gravel, few medium to coarse sand		
15	-5									Bottom: SILT (ML) - mostly brown, low plasticity; wet		
			SS-4		18 to 20	24/14	3-2-2-3			Fat CLAY (CH) - gray with brown, highly plastic; wet		
										Bottom: Poorly graded SAND with Silt (SP/SM) - brown, stratified, fine grained with few medium to coarse sand, trace fine gravel, few seams of gray		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM
PROJECT NAME: Orleans DACSD
CITY/STATE: Orleans, MA
AECOM PROJECT NUMBER: 60476644

AECOM

Exploration Location

NORTHING: 2,754,049.12 **EASTING:** 1,069,023.81 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 10.6

LOCATION: Stop & Shop Plaza **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

PS3-2

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
	-10									silty fine sand (to 1/2" thick); wet		
			SS-5		23 to 25	24/6	2-2-2-3			Poorly graded SAND (SP) - light gray, clean, fine to coarse grained (predominantly fine to medium), few fine gravel, trace fines; wet		
25	-15											
			SS-6		28 to 30	24/12	3-1-1-2			Poorly graded SAND (SP) - light gray, clean, fine to medium grained with trace to few coarse sand, trace fines; wet		Minor sand run-in (6 to 8 in.) from approx. 28 ft. to bottom of borehole.
30	-20											
			SS-7		33 to 35	24/0	2-2-2-3			Poorly graded SAND (SP) - same as described in SS-6 above		Redrove SS-7 sampler to recover the described material
35	-25											
			SS-8		38 to 40	24/7	1-1-1-2			Poorly graded SAND (SP) - gray, clean, fine to medium grained with trace coarse sand, trace fines		
40	-30											
			SS-9		43 to 45	24/10	3-4-7-9			Poorly graded SAND (SP) - gray, clean, fine to coarse grained (predominantly fine to medium), trace fine gravel, trace fines		
45	-35											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

Exploration Location

NORTHING: 2,754,049.12 **EASTING:** 1,069,023.81 **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: NAD 83 **INCLINATION FROM VERTICAL:** 0 degree

VERTICAL DATUM: NAVD88 **GROUND SURFACE ELEV. (FT):** 10.6

LOCATION: Stop & Shop Plaza **ESTIMATED/SURVEYED?:** _____

GEOLOGIC LOG

PS3-2

Depth (ft)	Elev. (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Field/ Laboratory Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
			SS-10	X	48 to 50	24/4	2-3-6-7			Well graded SAND (SW) - light gray, clean, fine to coarse grained, trace to few fine gravel, trace fines; more coarse than sample SS-9 above, wet		
50	-40									End of Boring at 50 feet		
55	-45											
60	-50											
65	-55											
70	-60											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): AECOM

PROJECT NAME: Orleans DACSD

CITY/STATE: Orleans, MA

AECOM PROJECT NUMBER: 60476644

AECOM

MASSDOT I-90 REV. 2 ORLEANS DATABASE_2019.04.03.GPJ 6/26/19

BORING LOG

Engineering a Sustainable Future

Project: Main Street Intersections with Route 6A and Route 28
Location: Orleans, MA
Nobis Project No.: 85830.01

Boring No.: MA-4
Boring Location: Southeast corner of Main Street & Rte. 6A Intersection
Checked by: A. Panwalkar
Date Start: January 8, 2013
Date Finish: January 8, 2013

Contractor: New Hampshire Boring, Inc.
Driller: G. Twombly Jr.
Nobis Rep.: J. Kalafatis

Rig Type / Model: Truck / CME 75
Hammer Type: Safety Hammer
Hammer Hoist: Rope & Cathead

Ground Surface Elev.: (+/-) 54
Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2 1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
01/08/13	12:00	Not Encountered	19	21	15 min

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	18	1-3	6			53.7 / 0.3 ASPHALT		
2				3				S-1: Loose, brown, fine to medium SAND, trace Silt, trace Gravel. moist. (FILL).	
3				2			FILL		
4				3			50.0 / 4.0		
5	S-2	18	4-6	3				S-2: Loose, brown, fine to medium SAND, trace Silt. moist.	
6				3					
7				4					
8				5					
9									
10	S-3	18	9-11	5				S-3: Medium dense, brown, fine to medium SAND, trace Silt. moist.	
11				7					
12				7					
13				9			SAND		
14									
15	S-4	24	14-16	6				S-4: Medium dense, brown, fine to medium SAND, trace Silt. moist.	
16				11					
17				12					
18				11					
19									
20	S-5	16	19-21	9				S-5: Medium dense, brown, fine to medium SAND, trace Silt. moist.	
21				9					
22				11					
23				14			33.0 / 21.0		
24								Boring terminated at 21 feet.	
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

Soil descriptions are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 3/11/13 14:50 - O:\ACTIVE\85830.00 MASSDOT STATEWIDE ENGINEERING - GPI 68386\85830.01 MASSDOT MAIN STREET INTERSECTIONS ORLEANS\EXPLORATIONS\BORING LOGS.GPJ

BORING LOG

Nobis — Engineering a Sustainable Future

Project: Main Street Intersections with Route 6A and Route 28
Location: Orleans, MA
Nobis Project No.: 85830.01

Boring No.: MA-7
Boring Location: Northeast corner of Main Street & Rte. 28 Intersection
Checked by: A. Panwalkar
Date Start: January 7, 2013
Date Finish: January 7, 2013

Contractor: New Hampshire Boring, Inc.
Driller: G. Twombly Jr.
Nobis Rep.: J. Kalafatis

Rig Type / Model: Truck / CME 75
Hammer Type: Safety Hammer
Hammer Hoist: Rope & Cathead

Ground Surface Elev.: (+/-) 28
Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2 1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
01/07/13	11:00	Not Encountered	19	21	5 min

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	LITHOLOGY Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1							27.7 / 0.3 ASPHALT		
2	S-1	12	1-3	2				S-1: Loose, brown, fine to medium SAND, trace Silt. moist. (FILL).	
				1			FILL		
3				4					
4				6			24.0 / 4.0		
5	S-2		4-6	4				S-2: Loose, brown, fine to medium SAND, trace Silt. moist.	
6				3					
7				4			SAND		
8				6					
9									
10	S-3	12	9-11	7			18.3 / 9.8	S-3A (9"): Medium dense, brown, fine to medium SAND, trace Silt. moist.	
				9				S-3B (3"): Very stiff, brown, SILT & CLAY, trace Gravel. moist. PP = 1.6 TSF TV = 5.4 TSF.	
11				9			SILT & CLAY		
12				14			16.0 / 12.0		
13								Drill Cuttings from 12'-14' show sand.	
14									
15	S-4	12	14-16	6				S-4: Medium dense, brown, fine to medium SAND, trace Silt. moist.	
				6					
16				7					
17				8			SAND		
18									
19									
20	S-5	18	19-21	10				S-5: Medium dense, brown, fine to medium SAND, trace Silt. moist.	
				11					
21				11					
22				14			7.0 / 21.0	Boring terminated at 21 feet.	
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

Soil descriptions are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

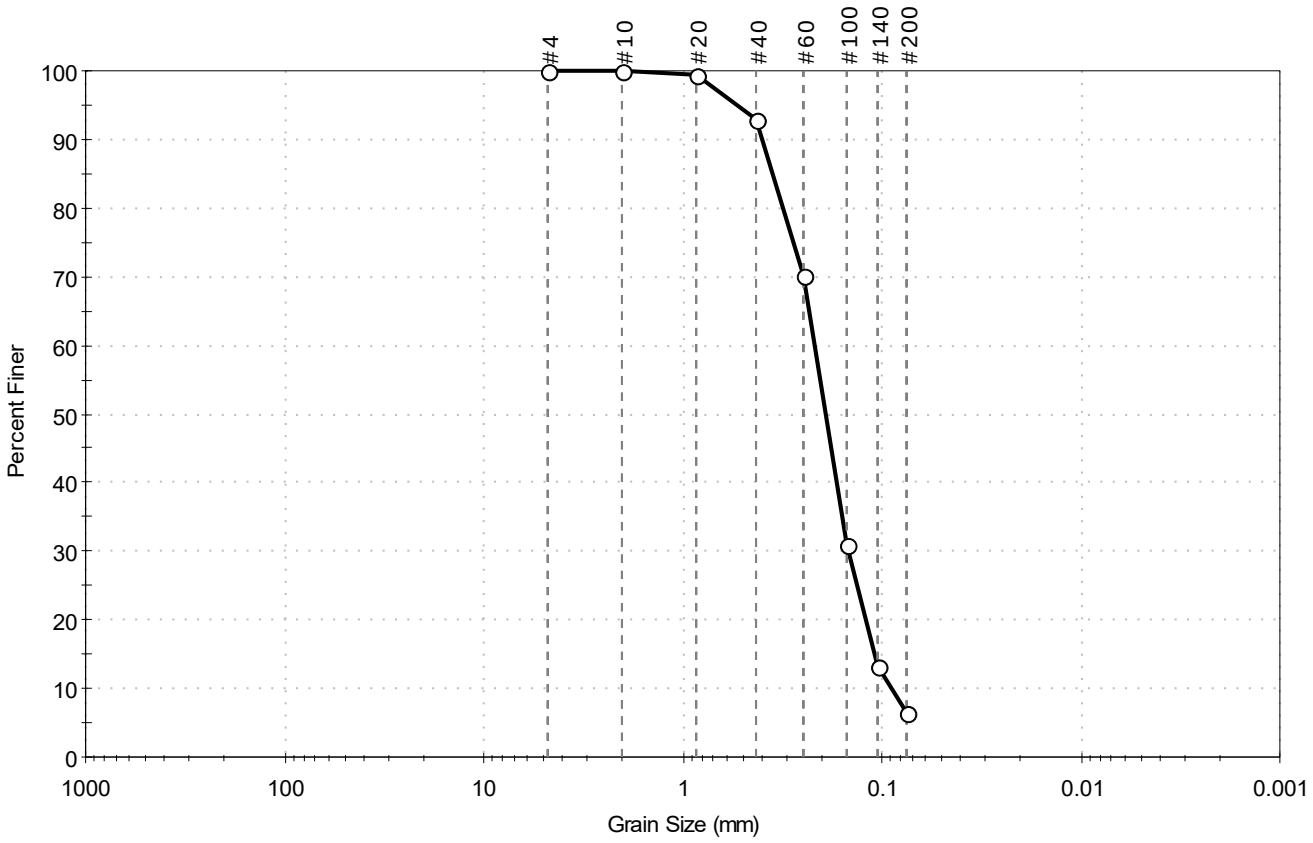
BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 3/11/13 14:50 - O:\ACTIVE\85830.00 MASSDOT STATEWIDE ENGINEERING - GPI 68386\85830.01 MASSDOT MAIN STREET INTERSECTIONS ORLEANS\EXPLORATIONS\BORING LOGS.GPJ

ATTACHMENT 2

Geotechnical Laboratory Testing Results

Client:	AECOM				
Project:	Sewer Collection System & Pump Station _WWTF				
Location:	Orleans, MA			Project No:	GTX-309806
Boring ID:	B-130	Sample Type:	jar	Tested By:	ckg
Sample ID:	SS-3	Test Date:	04/18/19	Checked By:	jdt
Depth :	14-16	Test Id:	499759		
Test Comment:	---				
Visual Description:	Moist, pale yellow sand with silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
–	0.0	93.6	6.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	93		
#60	0.25	70		
#100	0.15	31		
#140	0.11	13		
#200	0.075	6.4		

Coefficients

D_{85} = 0.3538 mm	D_{30} = 0.1469 mm
D_{60} = 0.2191 mm	D_{15} = 0.1095 mm
D_{50} = 0.1922 mm	D_{10} = 0.0898 mm
C_u = 2.440	C_c = 1.097

Classification

ASTM N/A

AASHTO Fine Sand (A-3 (1))

Sample / Test Description

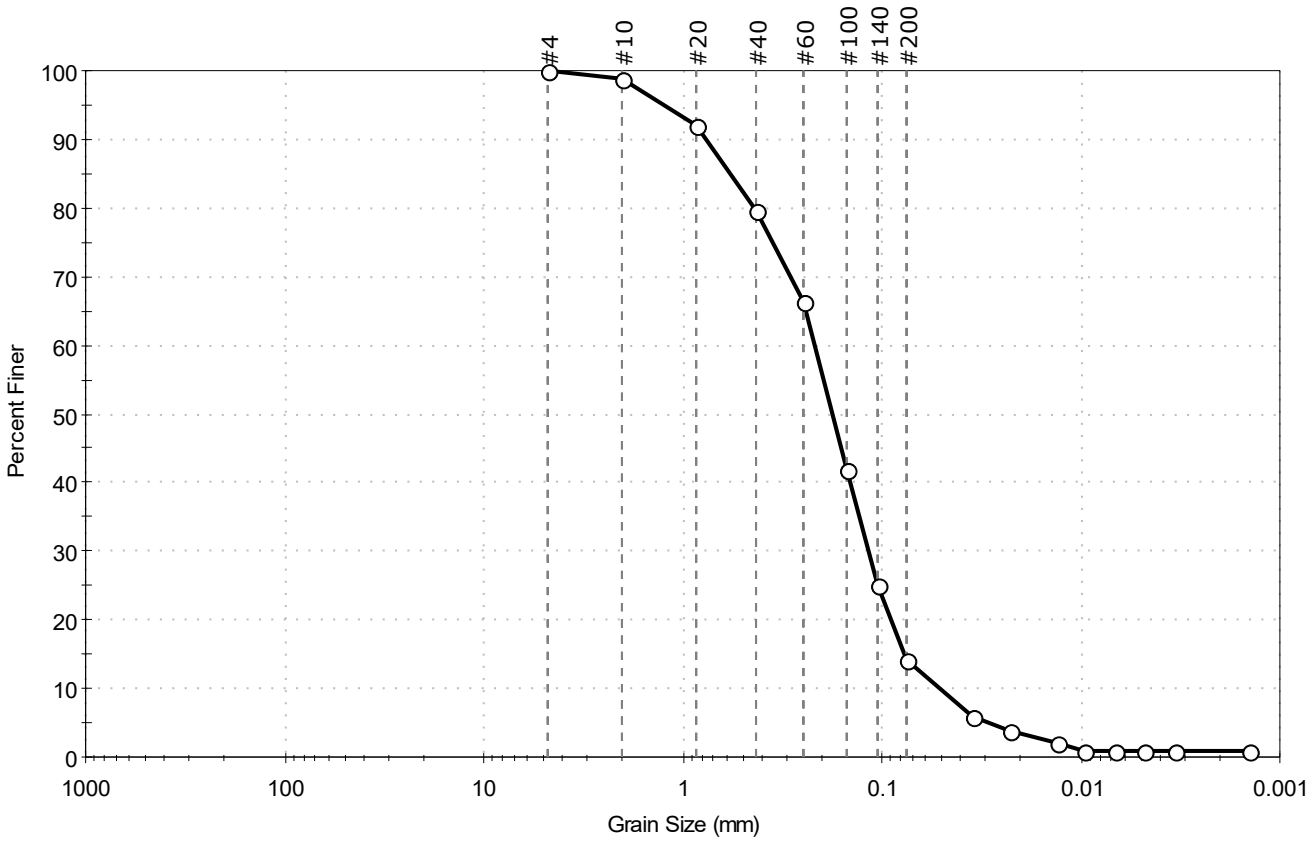
Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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Client:	AECOM				
Project:	Sewer Collection System & Pump Station _WWTF				
Location:	Orleans, MA			Project No:	GTX-309806
Boring ID:	B-131	Sample Type:	jar	Tested By:	ckg
Sample ID:	SS-2	Test Date:	06/07/19	Checked By:	bfs
Depth :	8-10	Test Id:	508009		
Test Comment:	---				
Visual Description:	Moist, brownish yellow silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	0.0	85.7	14.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.85	92		
#40	0.42	80		
#60	0.25	66		
#100	0.15	42		
#140	0.11	25		
#200	0.075	14		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0354	6		
---	0.0226	4		
---	0.0132	2		
---	0.0096	1		
---	0.0068	1		
---	0.0048	1		
---	0.0034	1		
---	0.0014	1		

Coefficients

D_{85} =0.5720 mm	D_{30} =0.1171 mm
D_{60} =0.2189 mm	D_{15} =0.0768 mm
D_{50} =0.1775 mm	D_{10} =0.0514 mm
C_u =4.259	C_c =1.219

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

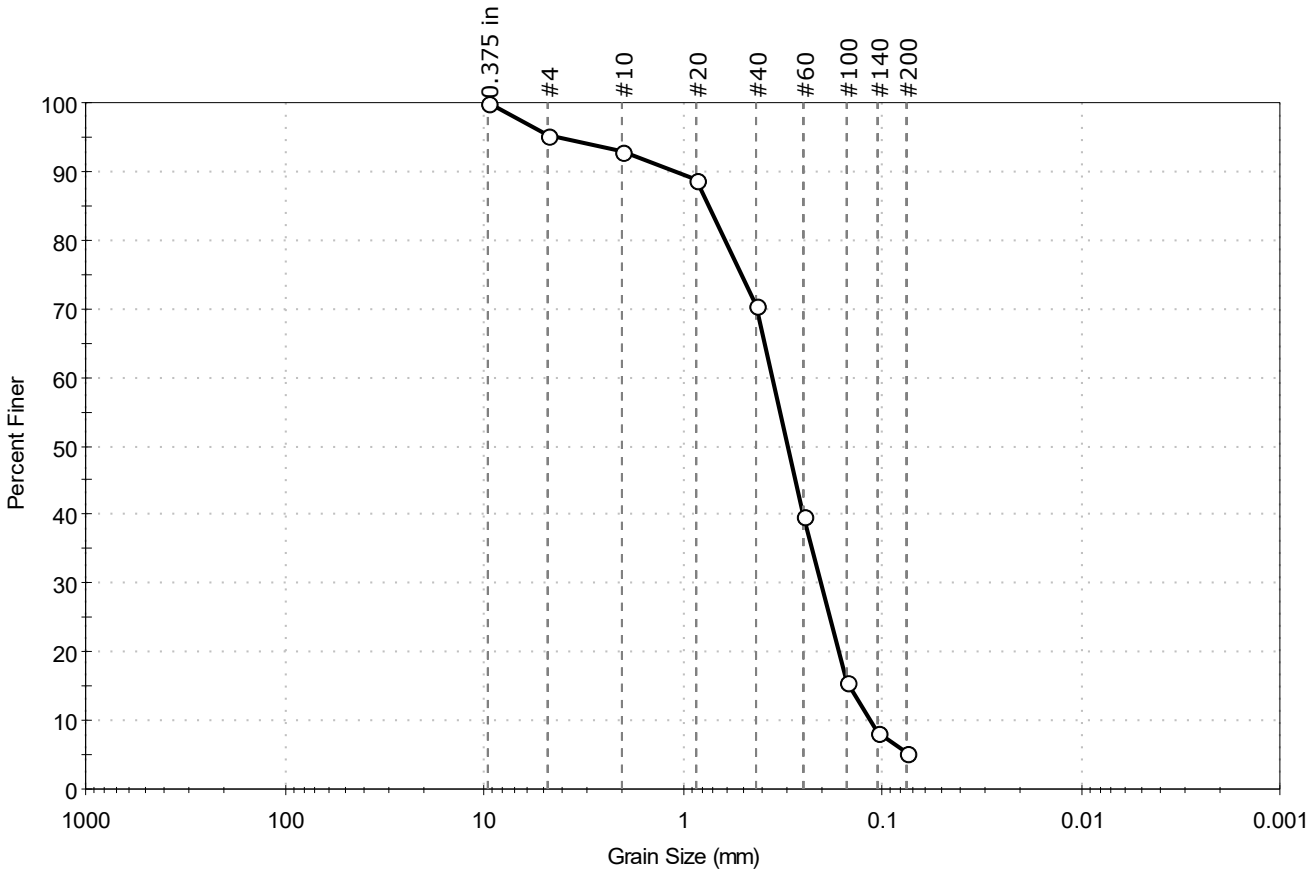
Est. Specific Gravity : 2.65

Separation of Sample: #200 Sieve

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Client:	AECOM				
Project:	Sewer Collection System & Pump Station _WWTF				
Location:	Orleans, MA			Project No:	GTX-309806
Boring ID:	B-132	Sample Type:	jar	Tested By:	ckg
Sample ID:	SS-2	Test Date:	06/08/19	Checked By:	bfs
Depth :	8-10	Test Id:	508010		
Test Comment:	---				
Visual Description:	Moist, yellowish brown sand with silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	4.7	90.0	5.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	95		
#10	2.00	93		
#20	0.85	89		
#40	0.42	71		
#60	0.25	40		
#100	0.15	15		
#140	0.11	8		
#200	0.075	5.3		

Coefficients

D_{85} = 0.7371 mm D_{30} = 0.2035 mm

D_{60} = 0.3539 mm D_{15} = 0.1464 mm

D_{50} = 0.2980 mm D_{10} = 0.1149 mm

C_u = 3.080 C_c = 1.018

Classification

ASTM N/A

AASHTO Fine Sand (A-3 (1))

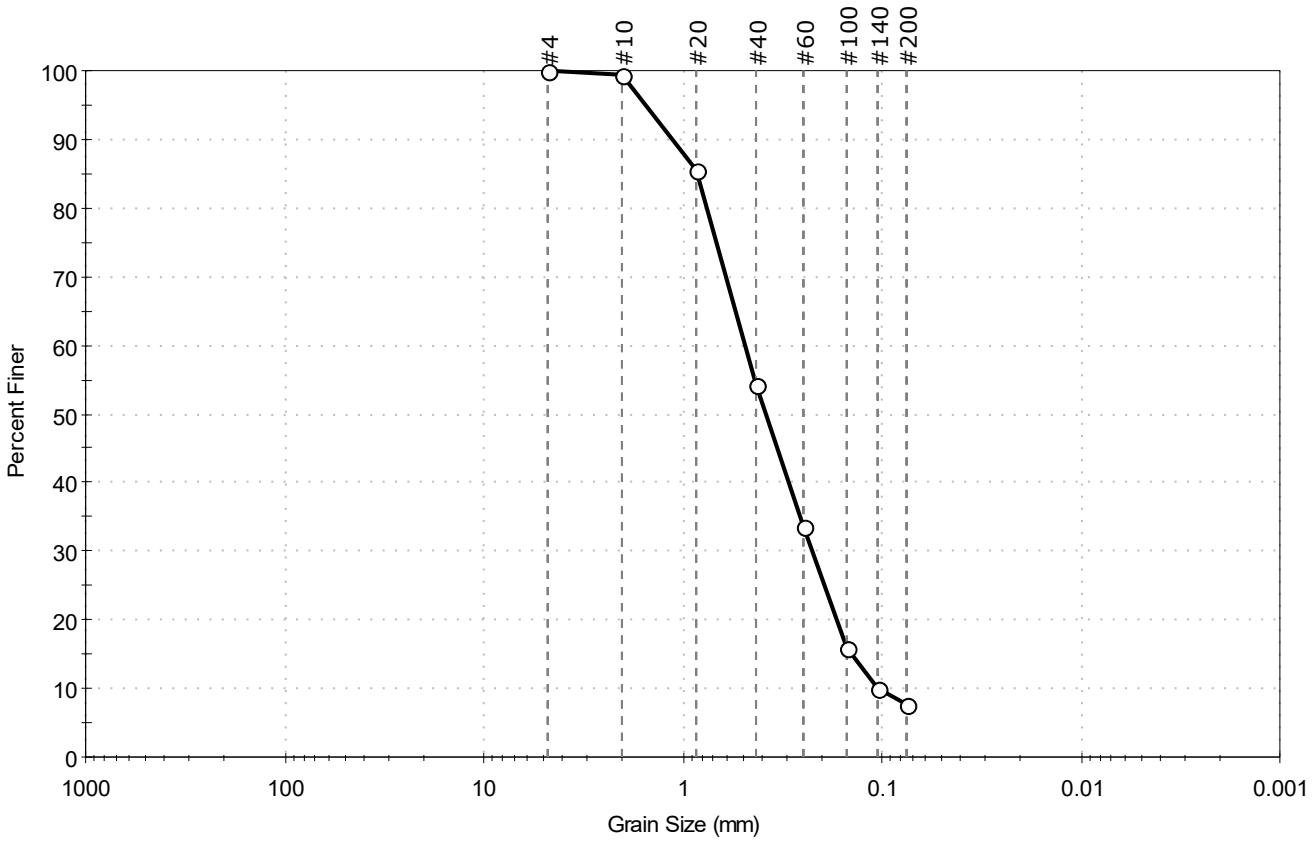
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	AECOM				
Project:	Sewer Collection System & Pump Station _WWTF				
Location:	Orleans, MA			Project No:	GTX-309806
Boring ID:	B-133	Sample Type:	jar	Tested By:	ckg
Sample ID:	SS-3	Test Date:	06/10/19	Checked By:	bfs
Depth :	13-15	Test Id:	508011		
Test Comment:	---				
Visual Description:	Moist, yellow sand with silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	0.0	92.3	7.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.85	86		
#40	0.42	54		
#60	0.25	34		
#100	0.15	16		
#140	0.11	10		
#200	0.075	7.7		

Coefficients

D_{85} = 0.8384 mm
D_{30} = 0.2250 mm
D_{60} = 0.4826 mm
D_{15} = 0.1425 mm
D_{50} = 0.3810 mm
D_{10} = 0.1066 mm
C_u = 4.527
C_c = 0.984

Classification

ASTM N/A

AASHTO Fine Sand (A-3 (1))

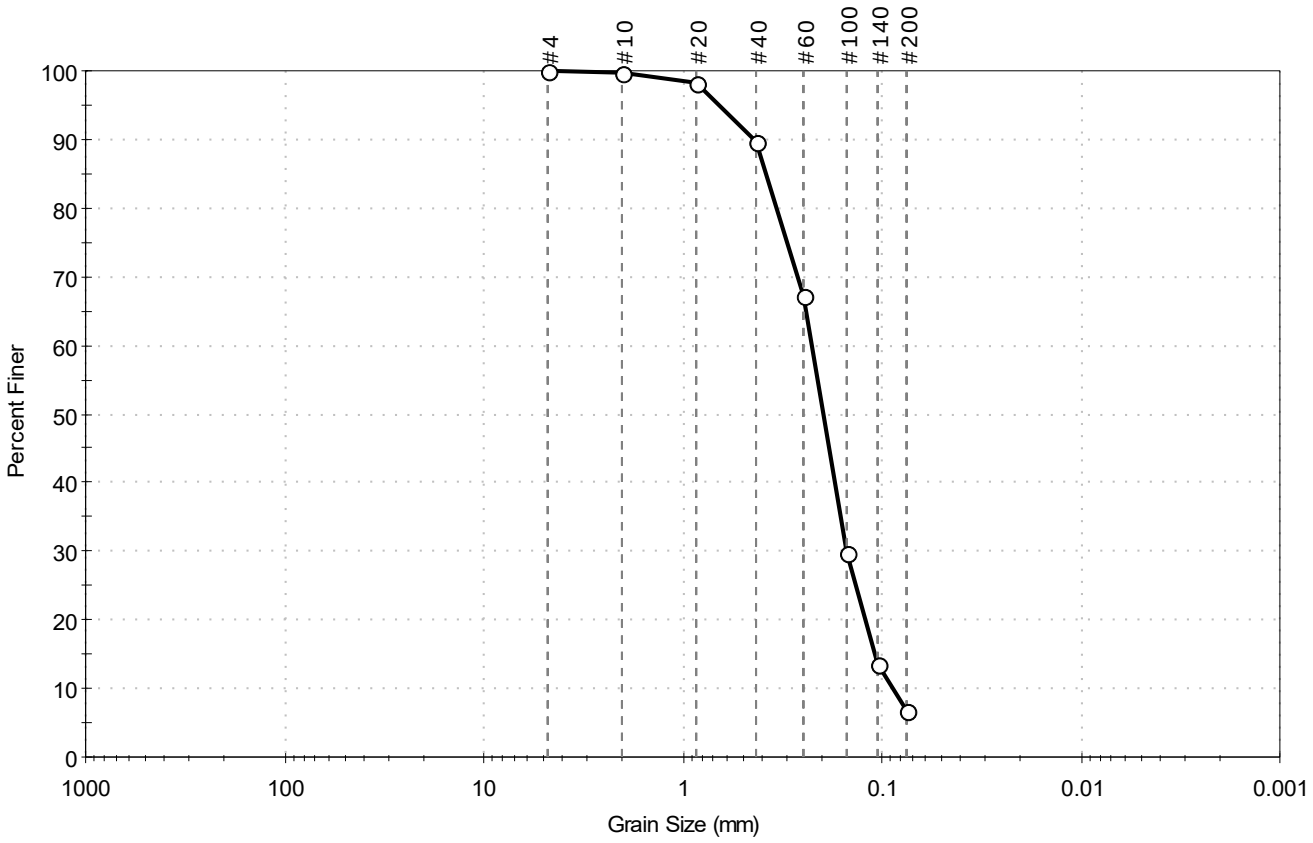
Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	AECOM				
Project:	Sewer Collection System & Pump Station _WWTF				
Location:	Orleans, MA			Project No:	GTX-309806
Boring ID:	B-134	Sample Type:	jar	Tested By:	ckg
Sample ID:	SS-2	Test Date:	04/18/19	Checked By:	jdt
Depth :	8-10	Test Id:	499760		
Test Comment:	---				
Visual Description:	Moist, brownish yellow sand with silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.1	93.0	6.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	98		
#40	0.42	90		
#60	0.25	67		
#100	0.15	30		
#140	0.11	13		
#200	0.075	6.9		

Coefficients

D_{85} = 0.3802 mm	D_{30} = 0.1505 mm
D_{60} = 0.2266 mm	D_{15} = 0.1096 mm
D_{50} = 0.1977 mm	D_{10} = 0.0883 mm
C_u = 2.566	C_c = 1.132

Classification

ASTM N/A

AASHTO Fine Sand (A-3 (1))

Sample / Test Description

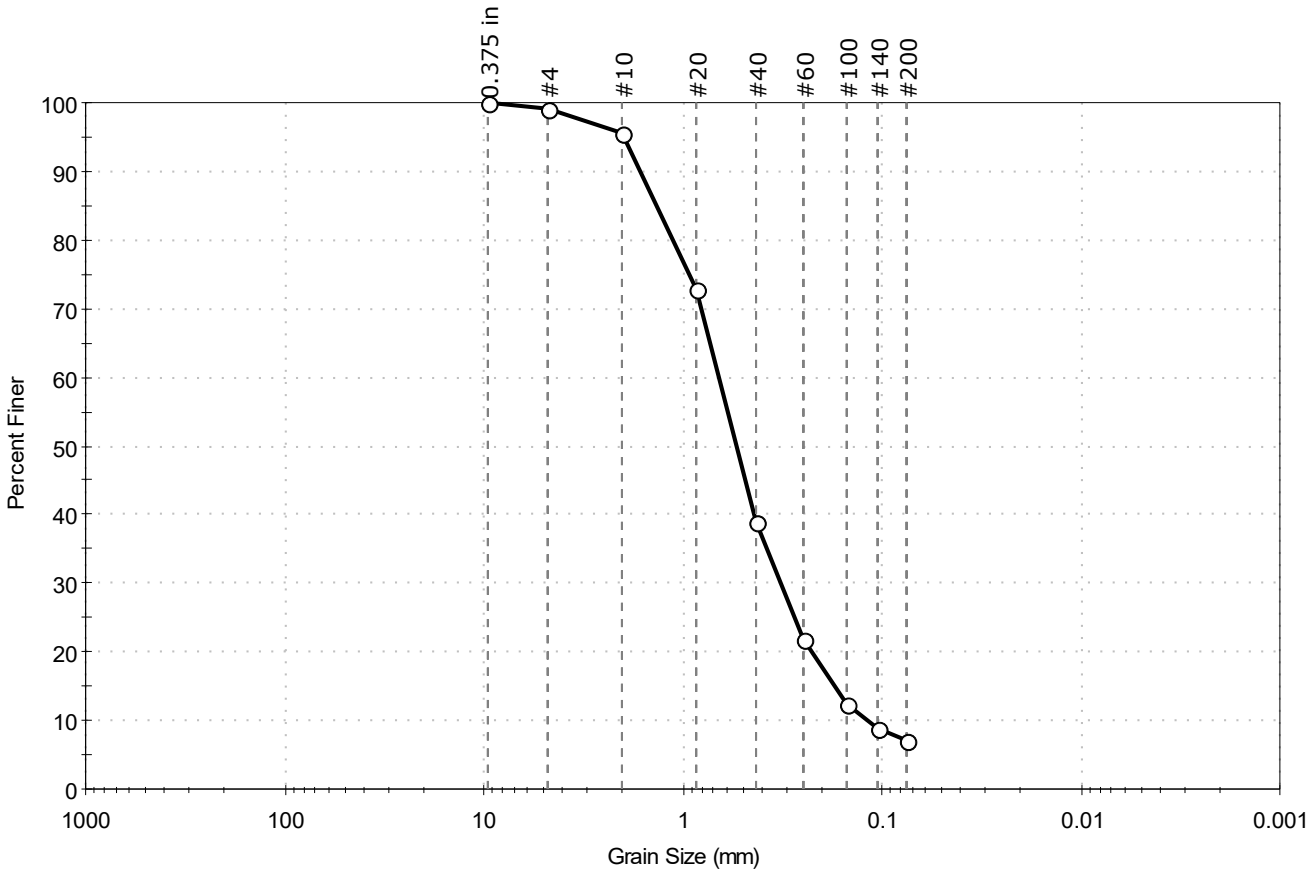
Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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Client:	AECOM				
Project:	Sewer Collection System & Pump Station _WWTF				
Location:	Orleans, MA			Project No:	GTX-309806
Boring ID:	PS1-1	Sample Type:	jar	Tested By:	ckg
Sample ID:	SS-3	Test Date:	06/10/19	Checked By:	bfs
Depth :	13-15	Test Id:	508012		
Test Comment:	---				
Visual Description:	Moist, brownish yellow sand with silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	0.9	92.1	7.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	96		
#20	0.85	73		
#40	0.42	39		
#60	0.25	22		
#100	0.15	12		
#140	0.11	9		
#200	0.075	7.0		

Coefficients

D_{85} = 1.3440 mm
D_{30} = 0.3233 mm
D_{60} = 0.6552 mm
D_{15} = 0.1734 mm
D_{50} = 0.5342 mm
D_{10} = 0.1179 mm
C_u = 5.557
C_c = 1.353

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

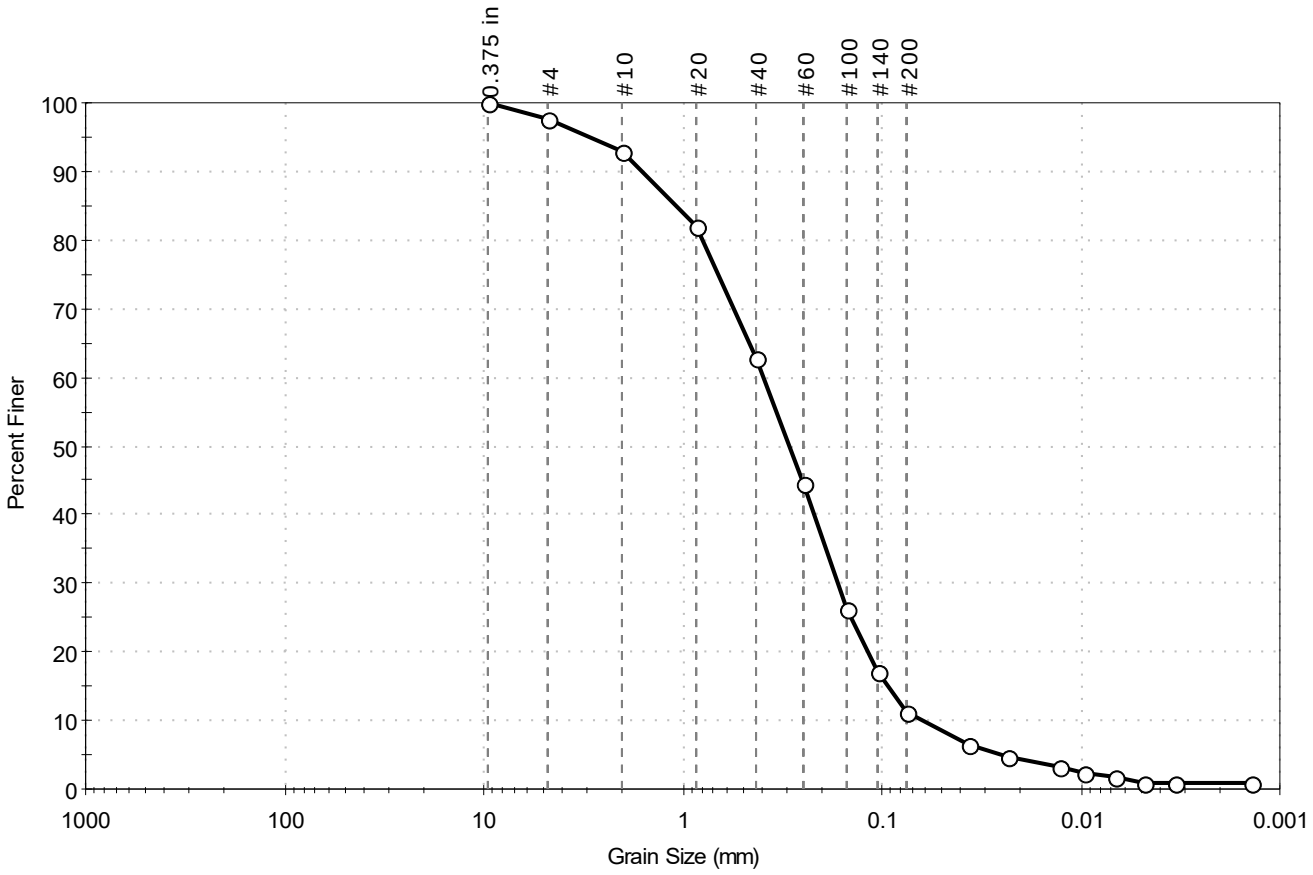
Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	AECOM				
Project:	Sewer Collection System & Pump Station _WWTF				
Location:	Orleans, MA			Project No:	GTX-309806
Boring ID:	PS2-1	Sample Type:	jar	Tested By:	ckg
Sample ID:	SS-2	Test Date:	04/22/19	Checked By:	jdt
Depth :	8-10	Test Id:	499777		
Test Comment:	---				
Visual Description:	Moist, yellowish brown sand with silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	2.4	86.4	11.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	98		
#10	2.00	93		
#20	0.85	82		
#40	0.42	63		
#60	0.25	45		
#100	0.15	26		
#140	0.11	17		
#200	0.075	11		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0368	7		
---	0.0234	5		
---	0.0130	3		
---	0.0096	2		
---	0.0068	2		
---	0.0049	1		
---	0.0033	1		
---	0.0014	1		

Coefficients

D_{85} = 1.0732 mm	D_{30} = 0.1664 mm
D_{60} = 0.3912 mm	D_{15} = 0.0937 mm
D_{50} = 0.2925 mm	D_{10} = 0.0620 mm
C_u = 6.310	C_c = 1.142

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

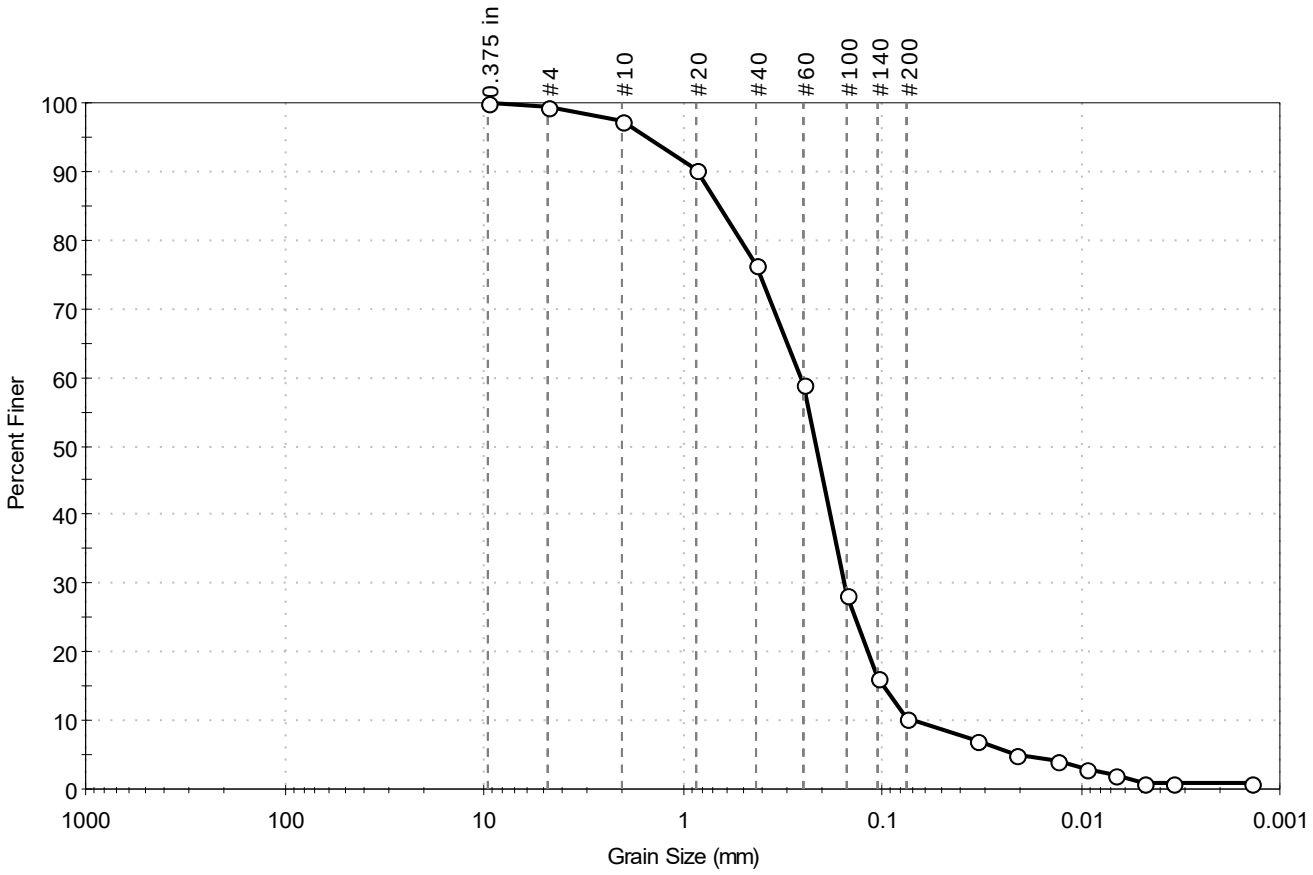
Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #200 Sieve

Client:	AECOM				
Project:	Sewer Collection System & Pump Station _WWTF				
Location:	Orleans, MA			Project No:	GTX-309806
Boring ID:	PS2-1	Sample Type:	jar	Tested By:	ckg
Sample ID:	SS-4	Test Date:	04/22/19	Checked By:	jdt
Depth :	18-20	Test Id:	499778		
Test Comment:	---				
Visual Description:	Moist, olive yellow sand with silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.6	89.2	10.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	97		
#20	0.85	90		
#40	0.42	76		
#60	0.25	59		
#100	0.15	28		
#140	0.11	16		
#200	0.075	10		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0330	7		
---	0.0210	5		
---	0.0130	4		
---	0.0094	3		
---	0.0067	2		
---	0.0048	1		
---	0.0034	1		
---	0.0014	1		

Coefficients

D_{85} = 0.6527 mm	D_{30} = 0.1545 mm
D_{60} = 0.2578 mm	D_{15} = 0.0983 mm
D_{50} = 0.2153 mm	D_{10} = 0.0707 mm
C_u = 3.646	C_c = 1.310

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

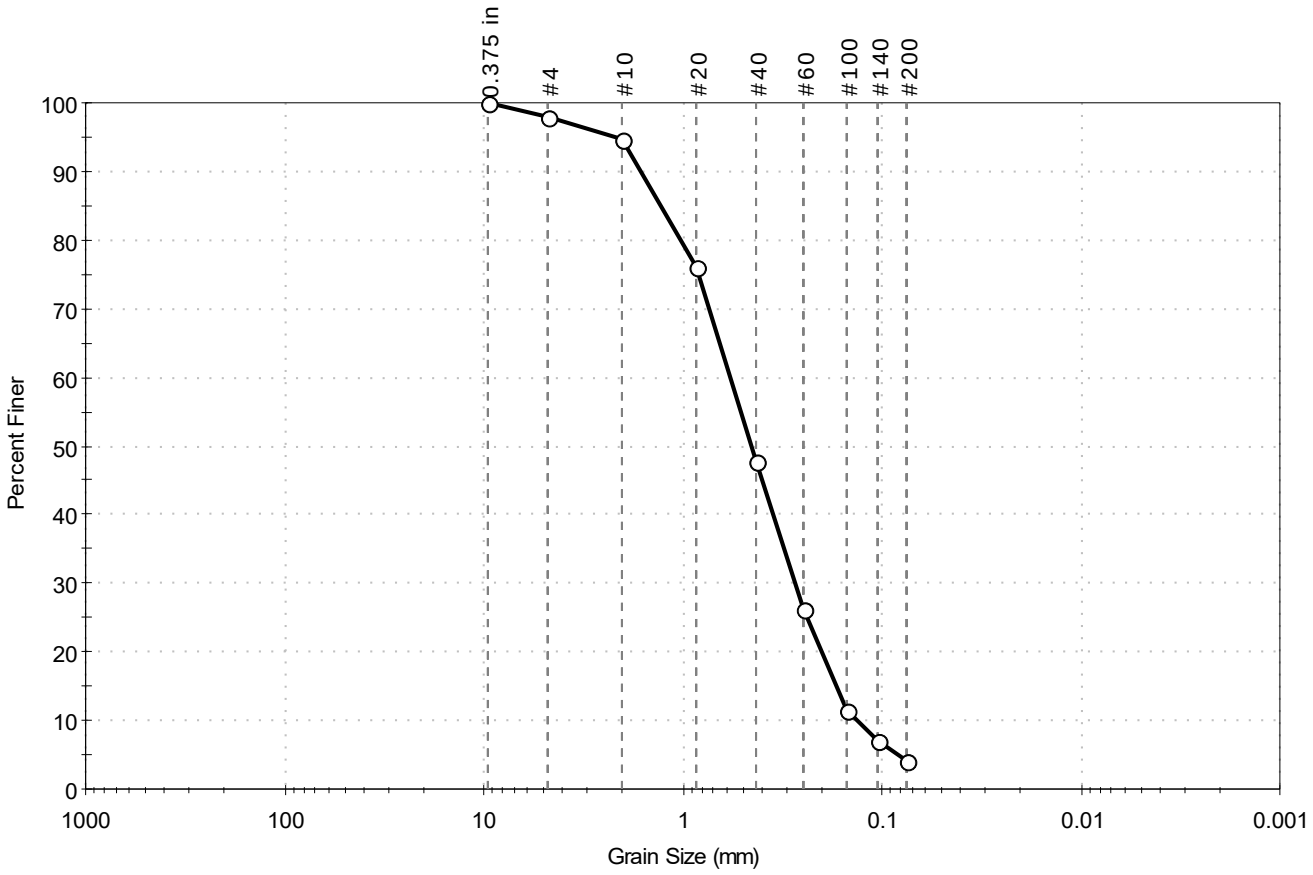
Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #200 Sieve

Client:	AECOM				
Project:	Sewer Collection System & Pump Station _WWTF				
Location:	Orleans, MA			Project No:	GTX-309806
Boring ID:	PS2-2	Sample Type:	jar	Tested By:	ckg
Sample ID:	SS-1	Test Date:	04/22/19	Checked By:	jdt
Depth :	5-7	Test Id:	499779		
Test Comment:	---				
Visual Description:	Moist, yellowish brown sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
–	2.1	93.7	4.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	98		
#10	2.00	95		
#20	0.85	76		
#40	0.42	48		
#60	0.25	26		
#100	0.15	12		
#140	0.11	7		
#200	0.075	4.2		

Coefficients

D_{85} = 1.2820 mm
D_{30} = 0.2744 mm
D_{60} = 0.5733 mm
D_{15} = 0.1693 mm
D_{50} = 0.4494 mm
D_{10} = 0.1336 mm
C_u = 4.291
C_c = 0.983

Classification

ASTM: Poorly graded SAND (SP)

AASHTO: Stone Fragments, Gravel and Sand (A-1-b (1))

Sample / Test Description

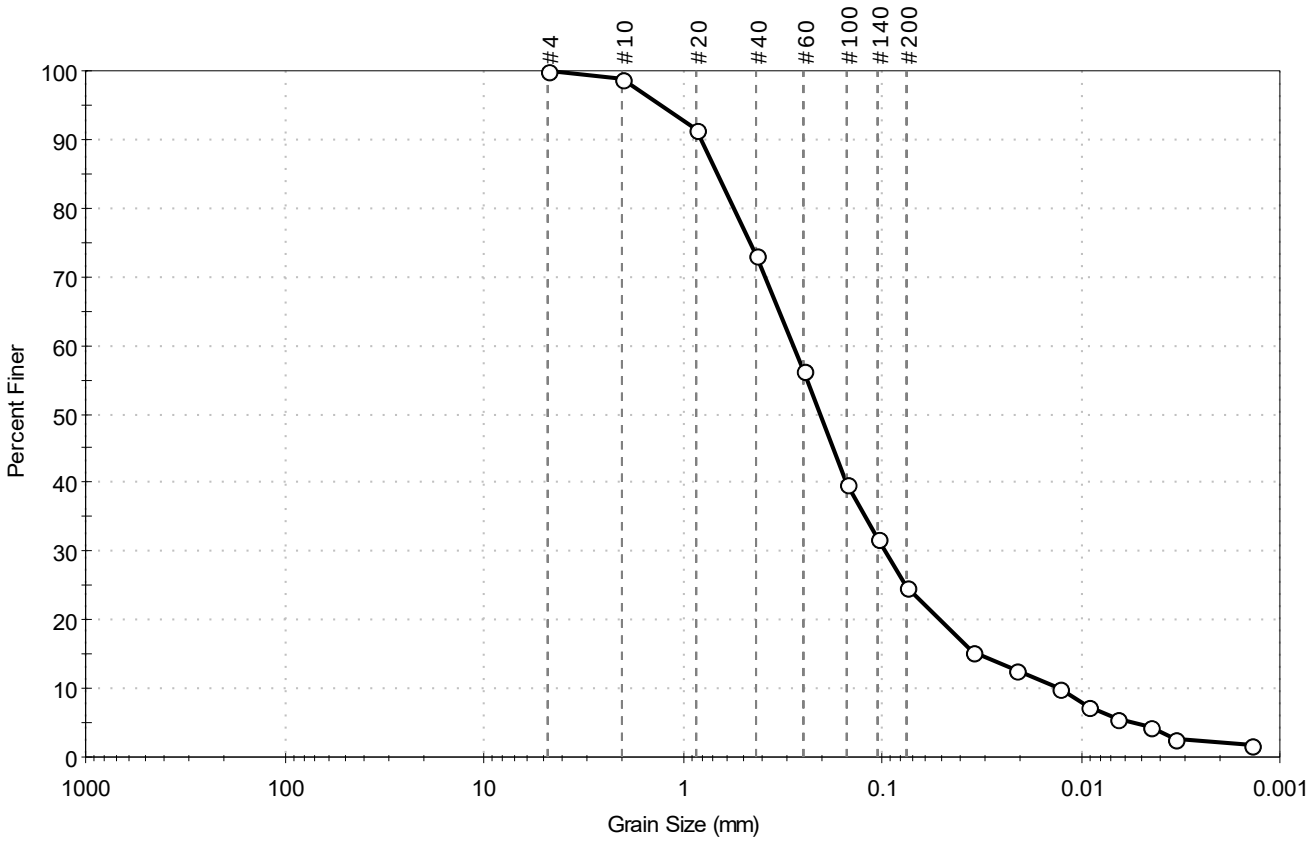
Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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Client:	AECOM				
Project:	Sewer Collection System & Pump Station _WWTF				
Location:	Orleans, MA			Project No:	GTX-309806
Boring ID:	PS2-2	Sample Type:	jar	Tested By:	ckg
Sample ID:	SS-3	Test Date:	04/22/19	Checked By:	jdt
Depth :	13-15	Test Id:	499780		
Test Comment:	---				
Visual Description:	Moist, yellow sand silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	75.2	24.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.85	92		
#40	0.42	73		
#60	0.25	56		
#100	0.15	40		
#140	0.11	32		
#200	0.075	25		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0350	15		
---	0.0211	13		
---	0.0130	10		
---	0.0092	7		
---	0.0065	5		
---	0.0045	5		
---	0.0034	3		
---	0.0014	2		

Coefficients

D_{85} = 0.6637 mm	D_{30} = 0.0968 mm
D_{60} = 0.2806 mm	D_{15} = 0.0321 mm
D_{50} = 0.2054 mm	D_{10} = 0.0130 mm
C_u = 21.585	C_c = 2.569

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

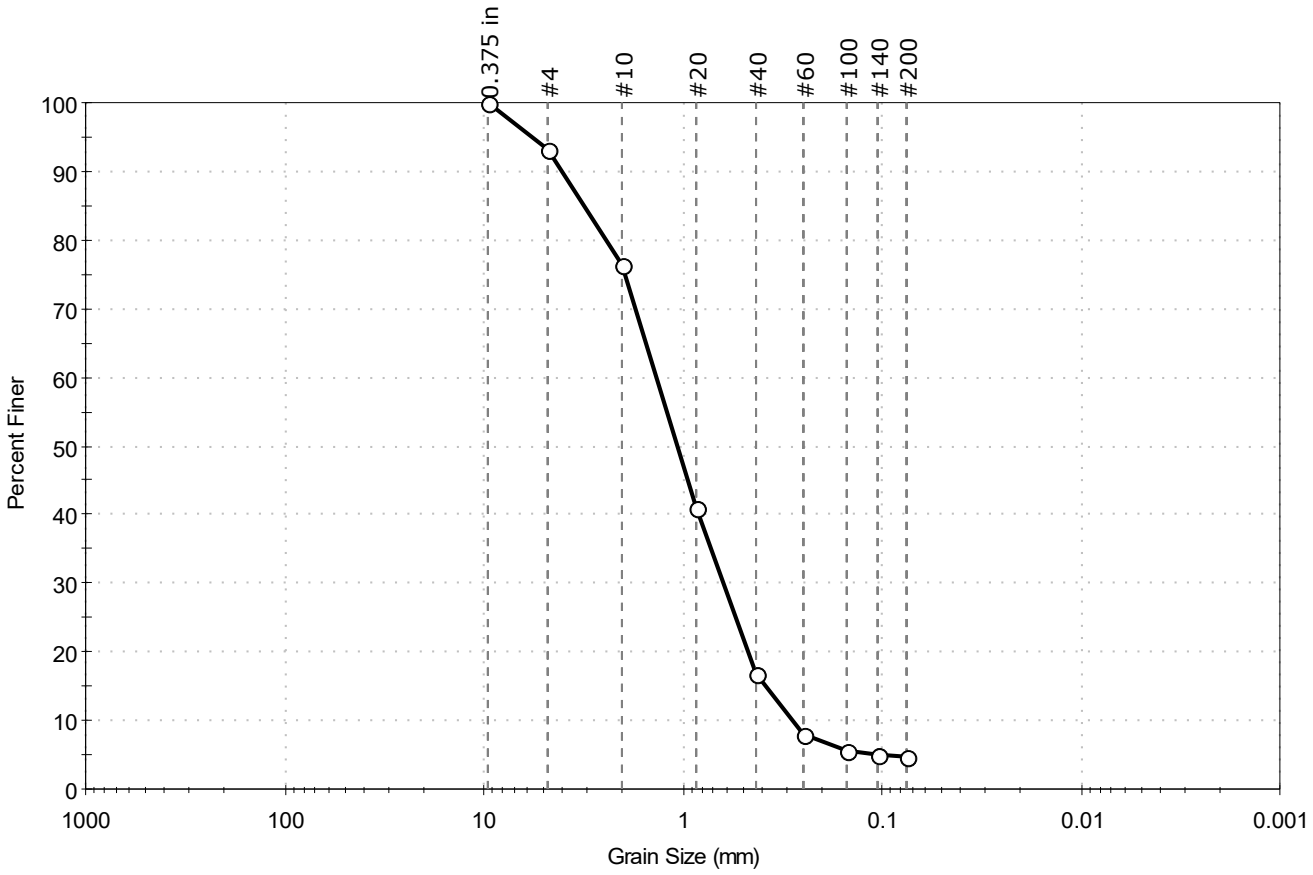
Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #200 Sieve

Client:	AECOM				
Project:	Sewer Collection System & Pump Station _WWTF				
Location:	Orleans, MA			Project No:	GTX-309806
Boring ID:	PS3-1	Sample Type:	jar	Tested By:	ckg
Sample ID:	SS-3	Test Date:	06/10/19	Checked By:	bfs
Depth :	13-15	Test Id:	508013		
Test Comment:	---				
Visual Description:	Moist, grayish brown sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	6.7	88.6	4.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	93		
#10	2.00	76		
#20	0.85	41		
#40	0.42	17		
#60	0.25	8		
#100	0.15	6		
#140	0.11	5		
#200	0.075	4.7		

Coefficients

D_{85} = 3.0977 mm D_{30} = 0.6188 mm

D_{60} = 1.3436 mm D_{15} = 0.3793 mm

D_{50} = 1.0552 mm D_{10} = 0.2822 mm

C_u = 4.761 C_c = 1.010

Classification

ASTM Poorly graded SAND (SP)

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

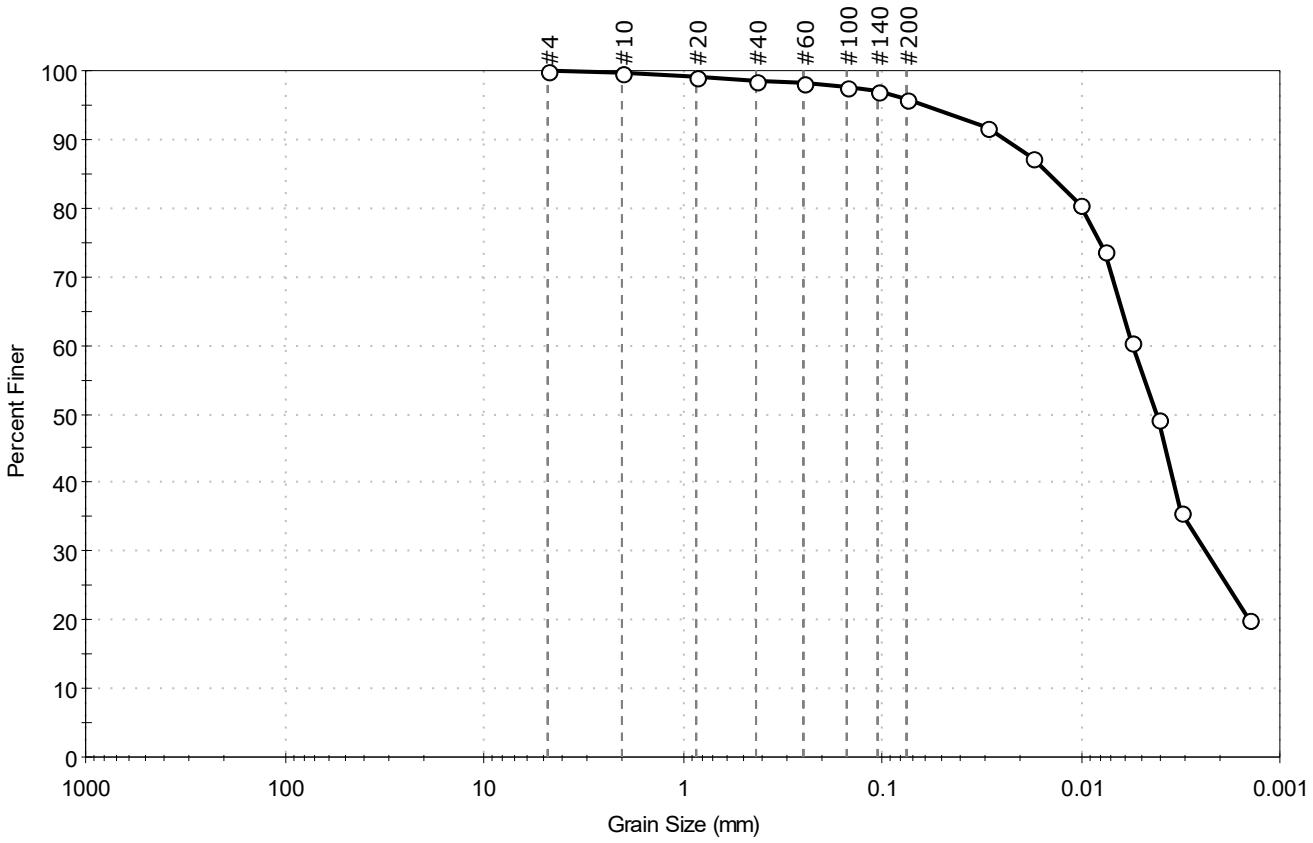
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	AECOM				
Project:	Sewer Collection System & Pump Station _WWTF				
Location:	Orleans, MA			Project No:	GTX-309806
Boring ID:	PS3-2	Sample Type:	jar	Tested By:	ckg
Sample ID:	SS-2 (Bottom)	Test Date:	06/10/19	Checked By:	bfs
Depth :	8-10	Test Id:	508008		
Test Comment:	---				
Visual Description:	Moist, light gray clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	0.0	4.0	96.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	99		
#60	0.25	98		
#100	0.15	98		
#140	0.11	97		
#200	0.075	96		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0294	92		
---	0.0176	87		
---	0.0102	81		
---	0.0077	74		
---	0.0056	60		
---	0.0041	49		
---	0.0031	36		
---	0.0014	20		

Coefficients

D_{85} = 0.0146 mm D_{30} = 0.0023 mm
D_{60} = 0.0055 mm D_{15} = N/A
D_{50} = 0.0042 mm D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Est. Specific Gravity : 2.65
Separation of Sample: #200 Sieve

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ATTACHMENT F

Downtown Area Collection System Layout

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Town of Orleans, MA

Downtown Area Collection System Layout

Legend

- WWTP
- Property to be Serviced by Low Pressure Sewer Pump
- Pump Station
- PS Forcemain
- WWTF Effluent Forcemain
- Low Pressure Sewer (LPS)
- Gravity Sewer - Existing
- Gravity Sewer - 8"
- Gravity Sewer - 10"
- Gravity Sewer - 12"
- Gravity Sewer - 16"
- Gravity Sewer - 18"
- Service Lateral - Existing
- Downtown Service Area
- Parcel
- Waterbody
- Wetland

0 125 250 500 Feet

AECOM

February 2020

Wastewater Treatment Facility 20 Overland Way

Route 6 Crossing

84 Old Colony Way

Pump Station No:1

WWTF Effluent Disposal Site 32 Lots Hollow Rd

Pump Station No.3

Cranberry Cove Plaza

Snow Library

Pump Station No.2

Downtown Service Area

Cedar Pond

Boland Pond

Town Cove

EASTHAM

E_02 E_03 E_04 E_05 D_04 D_05 F_03 F_04 F_05 F_06 G_03 G_04 G_05 H_03 H_04

NAMSKAKET ROAD
PRINCE LANE
KINGS WAY
CEDAR POND ROAD
JONES ROAD
CANAL ROAD
LOCUST ROAD
LIBERTY LANE
MAIN STREET
CAPE COD RAIL TRAIL
OLD COUNTY ROAD
OLD COLONY WAY
CRANBERRY HIGHWAY
SOUTH ORLEANS ROAD
COTTAGE STREET
NORTH COTTAGE STREET
COVE ROAD
DOANE TERRACE
CUMMINGS ROAD
ACADEMY PLACE
BREWSTER CROSS ROAD
CENTER PLACE
OLD TOTE ROAD
WEST ROAD
MID-CAPE HIGHWAY - ROUTE 6
OAK RIDGE LANE
CLAYTON CIRCLE
NICKERSON ROAD
ELDREDGE PARK WAY
LOTS HOLLOW ROAD
FINLAY ROAD
MARSTONS WAY
OLD FARM ROAD
QUAIL HILL LANE

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ATTACHMENT G

Library Parking- Option 2

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AECOM

PROJECT

Town of Orleans, MA

Library Site Layout

CLIENT

Town of Orleans, MA
19 SCHOOL ROAD
ORLEANS, MA 02653
(508) 240-3700

CONSULTANT

AECOM TECHNICAL SERVICES, INC.
9 JONATHAN BOURNE DRIVE
POCASSET, MA 02559
PHONE: (508) 833-6950
www.aecom.com

CONSULTANTS

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION

PROJECT NUMBER

Designed By:	
Drawn By:	
Dept Check:	
Proj Check:	M. DONOGHUE
Date:	OCTOBER 2018
Scale:	AS NOTED

DISCIPLINE

CIVIL

SHEET TITLE

SITE PLAN - PROPOSED PUMP STATION LAYOUT OPTION 2

SHEET NUMBER

001

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ATTACHMENT H

Pre-Bid Conference

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AECOM
9 Jonathan Bourne Drive
Pocasset, MA 02559
www.aecom.com

508.833.6950 tel
508.833.6951 fax

Attendance List

Subject	**Town of Orleans, MA** **Downtown Area Collection System and Pumping Stations** **Contract No. 2019-02 and SRF No. 4486** **Non-Mandatory Pre-Bid Conference**
Project Number	60587515
Date and Time	February 20, 2020, 9:00 am

Attendee	Affiliation	e-Mail and Telephone Number
Bill McMahon	Robert B. Our Co Inc	bmcmahon@robertbour.com office 508 432-0530 508 509-4053 cell
Chris Gates	RJV Construction Corp	cgates@rjvconstruction.com 781-821-1469
Joe Annese	Annese Electric	bleggo@annesselectric.com 781 337 6462
Ian Catlow	Tighe & Bond	icatlow@tighebond.com

Attendee	Affiliation	e-Mail and Telephone Number
Tom Daley	Orleans DPW	Tdaley@town.orleans.ma.us
Craig Fleming	Williamson Pump + Motor	CraigF@weco-Group.com.
Todd Bodreau	Williamson Pump + motor	Todd B@weco-group.com
TRSS Jaffer	AECOM	TRSS.Jaffer@aecom.com
REGGIE DONOGHUE	AECOM	MARTIN.DONOGHUE@AECOM.COM
THOMAS PORÉE	AECOM	TOM.PORÉE@AECOM.COM

Downtown Area Collection System and Pumping Stations

Contract No. 2019-02 and SRF No. 4486

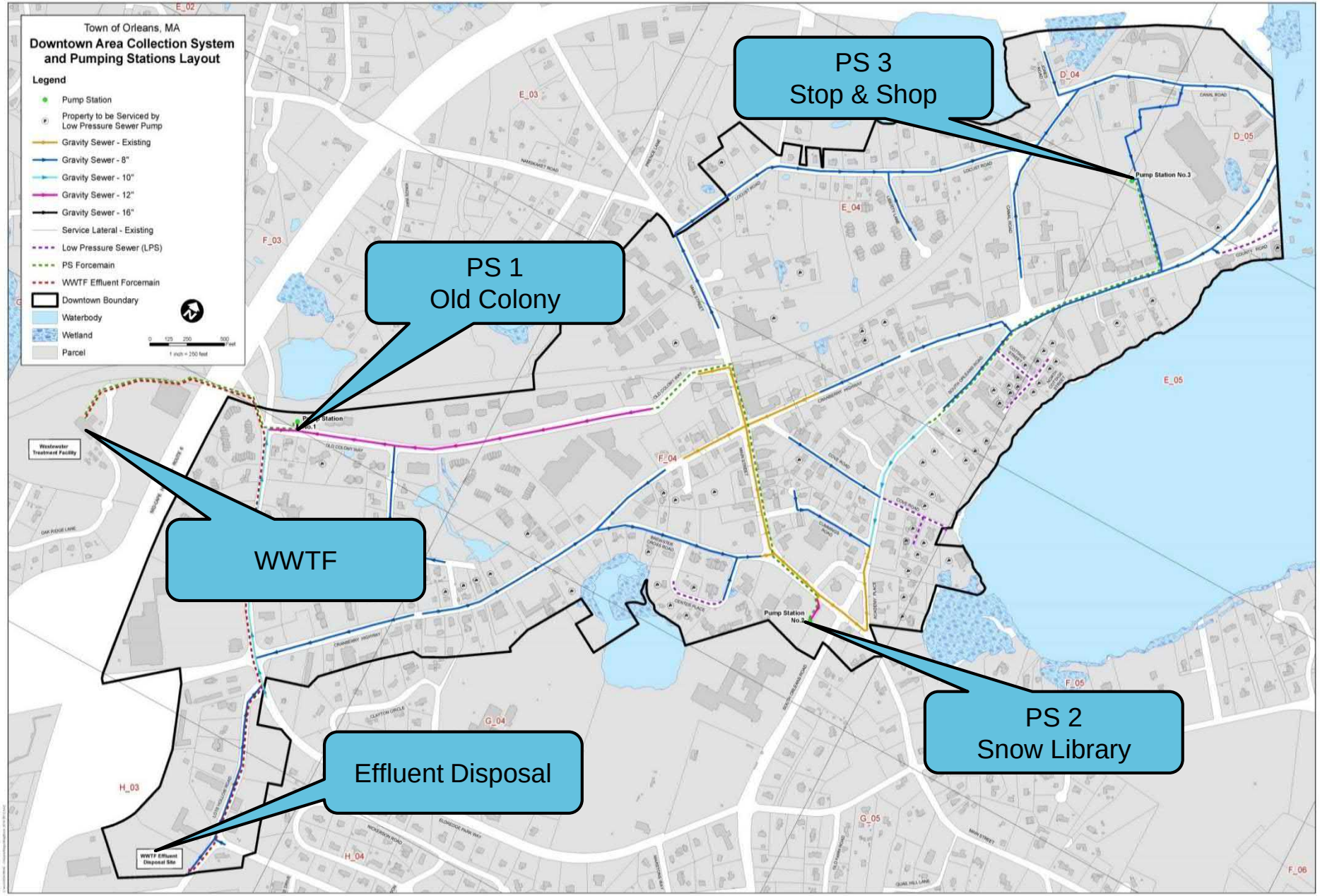
Non-Mandatory Pre-Bid Conference

February 20, 2020

9:00 am

Agenda

- **Welcome and Introduction**
  - Orleans, MA
  - Tighe & Bond
  - AECOM
- **Project Overview**
- **Special Attention to Specifications and Bidding Conditions**
- **Addendums**
- **Open Floor for Questions**
- **Site Visit**


Town of Orleans, MA
Downtown Area Collection System and Pumping Stations Layout
Legend
Pump Station
Property to be Serviced by Low Pressure Sewer Pump
Gravity Sewer - Existing
Gravity Sewer - 8"
Gravity Sewer - 10"
Gravity Sewer - 12"
Gravity Sewer - 16"
Service Lateral - Existing
Low Pressure Sewer (LPS)
PS Forcemain
WWTF Effluent Forcemain
Downtown Boundary
Waterbody
Wetland
Parcel
PS 3
Stop & Shop
PS 1
Old Colony
WWTF
PS 2
Snow Library
Effluent Disposal
Pump Station No.3
Pump Station No.2
Wastewater Treatment Facility
WWTF Effluent Disposal Site

Project Overview (cont.)

- **General Scope of Work**
  - About 32,200 Linear Feet of 8-inch through 18-inch PVC Gravity Sewer
  - About 11,400 Linear Feet of 6-inch and 8-inch PVC and HDPE Force Main
  - About 2,100 Linear Feet of 2-inch Low Pressure Sewer
  - Route 6 Pipe Jacking
  - 3 Submersible Pumping Stations
- **Time for Completion - 751 Calendar Days / 304 Working Days**
- **Bidding Submission Requirements**
  - Bids due to Orleans, MA: March 11, 2020 by 2:00 pm E.S.T.
  - Attachments to the Bid
- **No DCAMM Certification or MassDOT Highway Division Certification Required**

Project Overview (cont.)

Attachments to the Bid

- Insurance Requirements
- Statement of State Tax Compliance
- Certificate of Non-Collusion
- Acknowledgement of Principal, If a Corporation or a Partnership
- Certification of OSHA 10-Hour Training
- Massachusetts Diesel Retrofit Form

Post Bid Attachments

- State Revolving Loan
  - Disadvantaged Business Enterprise (DBE) Goals
    - Minimum 4.2 Percent D/MBE Participation
    - Minimum 4.5 Percent D/WBE Participation
  - Two Low Bidders to Submit Close of Business on the Third Business Day After Bid Opening
    - DBE Forms - EEO-DEP-190C and EEO-DEP-191C
    - DBE Certification of United States Citizenship Form

Special Attention to Specifications and Bidding Conditions

- **Preconstruction Requirements**
  - Submittals
  - Digital Videodisc Recording
  - Health and Safety Plan
  - Traffic Management Plan
    - Prepare and Submit to Town, Engineer and MassDOT for Review and Approval
    - Detours and Road Accessibility
    - Responsible for Ordering and Coordinating Traffic Details
  - Project Schedule
- **Progress Schedule - “Two-week Look Ahead”**
  - Summarizes Anticipated Construction Activities
  - Thursday of Each Week

Special Attention to Specifications and Bidding Conditions (cont.)

- **Easements Obtained**
- **Permits and Licenses Obtained**
  - Cape Cod Commission – Consistency Review
  - Massachusetts Historical Commission
  - MassDEP – CWMP Approval
  - Orleans, MA - Conservation Commission - Order of Conditions
  - United States Army Corps of Engineers
  - MassDOT - Route 6 Crossing
- **Permits and Licenses Anticipated to be Obtained**
  - MassDOT – Route 6A and Route 28 Road Opening
  - Winter and Summer Work Moratorium
- **Town Permits to be Issued After the Contract Award**

Special Attention to Specifications and Bidding Conditions (cont.)

- **EPA Construction General Permit**
  - Prepare a SWPPP and File an NOI with EPA
  - Implement SWPPP and Perform Required Inspections
- **Hours of Operation**
  - No Outdoor Activities Permitted Before 7:00 am or After 5:00 pm
  - No Outdoor Activities Permitted Saturday, Sunday, Legal Holidays and the Two Days Preceding the Legal Holidays
- **Number of Crews**
  - Minimum Number of Mainline Crews
  - One Service Connection Crew
  - One Cleanup/Restoration Paving Crew
- **Sequence of Construction**
  - Specified under Section 01030, Special Requirements

Special Attention to Specifications and Bidding Conditions (cont.)

Summer Season Work
May 15 through September 15

- Brewster Crossroads
- Jones Road
- Canal Road - Roundabout to Locust Road
- Liberty Lane
- Center Place
- Route 6 Crossing
- Cove Road – North of Route 28

Winter Season Work
October 15 through March 31

- Cottage Street
- North Cottage Street
- Cove Road – South of Route 28
- Old County Road
- Cranberry Cove Plaza

Special Attention to Specifications and Bidding Conditions (cont.)

- **Pavement Repair and Restoration**
  - Specified under Section 01030, Special Requirements
  - Required to Place Temporary Pavement Every Friday or As Specified in MassDOT Permit for State Roadways
- **Archeological Sensitive Areas**
  - Cultural Resource Training
  - Machine Monitoring
- **Existing Brick Sidewalks**
  - Installation of Service Laterals
  - Minimize the Number of Bricks Removed
  - Replace the Existing Bricks Following Installation of Service Laterals
  - No Saw Cutting and/or Splitting of Existing Bricks

Special Attention to Specifications and Bidding Conditions (cont.)

- **Monthly Photographs**
- **Crushed Stone and Processed Glass Aggregate**
- **Active Vehicle Loop Detectors**
  - Cranberry Highway with Eldredge Park Way and West Road
  - Cranberry Highway with Old County Road and Stop and Shop Plaza Entrance
- **Sensitive Sites**
  - Pump Station 2 - Snow Library
  - Pump Station 3 - Cranberry Cove Plaza with Off Season Work at Cranberry Cove Plaza
  - Minimize Disruption of Facility Operation During Construction
  - Continue on-site Sewage Disposal System Service During Construction
  - On-Site Sewage Disposal System Demolition and Restoration

Special Attention to Specifications and Bidding Conditions (cont.)

- **Water System Upgrades**
  - Water Main Replacements
  - Water Service Replacements (Pending Town Meeting Approval)
  - Canal Road Water Main Replacement (Pending Town Meeting Approval)
- **Water Quality Projects – Pending Town Meeting Approval**
  - Brewster Crossroads
  - Locust Road
- **Post Construction**
  - Photographs and Record Drawings
  - Collection System Cleaning, Testing and CCTV
  - Operation and Maintenance Manuals
  - Manufacturer's Services
  - Spare Parts

Addendums

- **Addendum No. 1 – Issued on February 13, 2020**
- **Addendum No. 2 – Issued on February 19, 2020**
- **Addendum No. 3 – Issue by March 6, 2020**
  - Bid Form (Excel)
  - Non-Mandatory Pre-Bid Conference Attendance List
  - Applicable Questions and Answers

Site Visit

- **Pumping Station No. 3**
- **Pumping Station No. 2**
- **Pumping Station No. 1**
- **Route 6 Crossing**
  - Jacking Pit
  - Receiving Pit

Town of Orleans Massachusetts

Questions and Answers