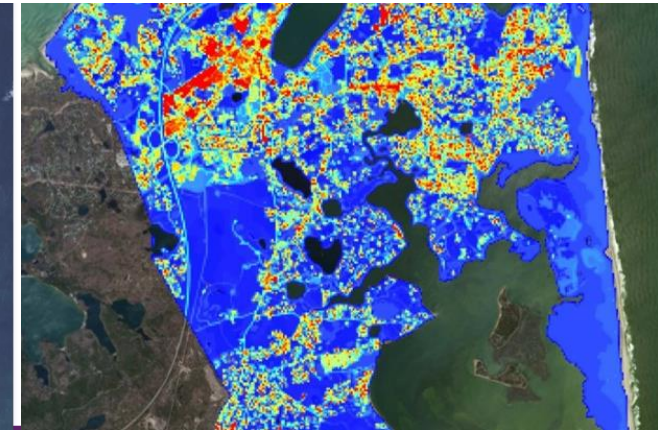
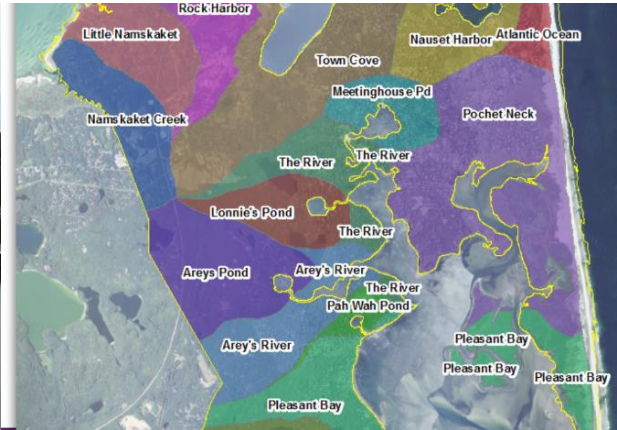


Town of Orleans Stormwater Management Project



Orleans Fresh Water Ponds Committee Meeting



January 17, 2017

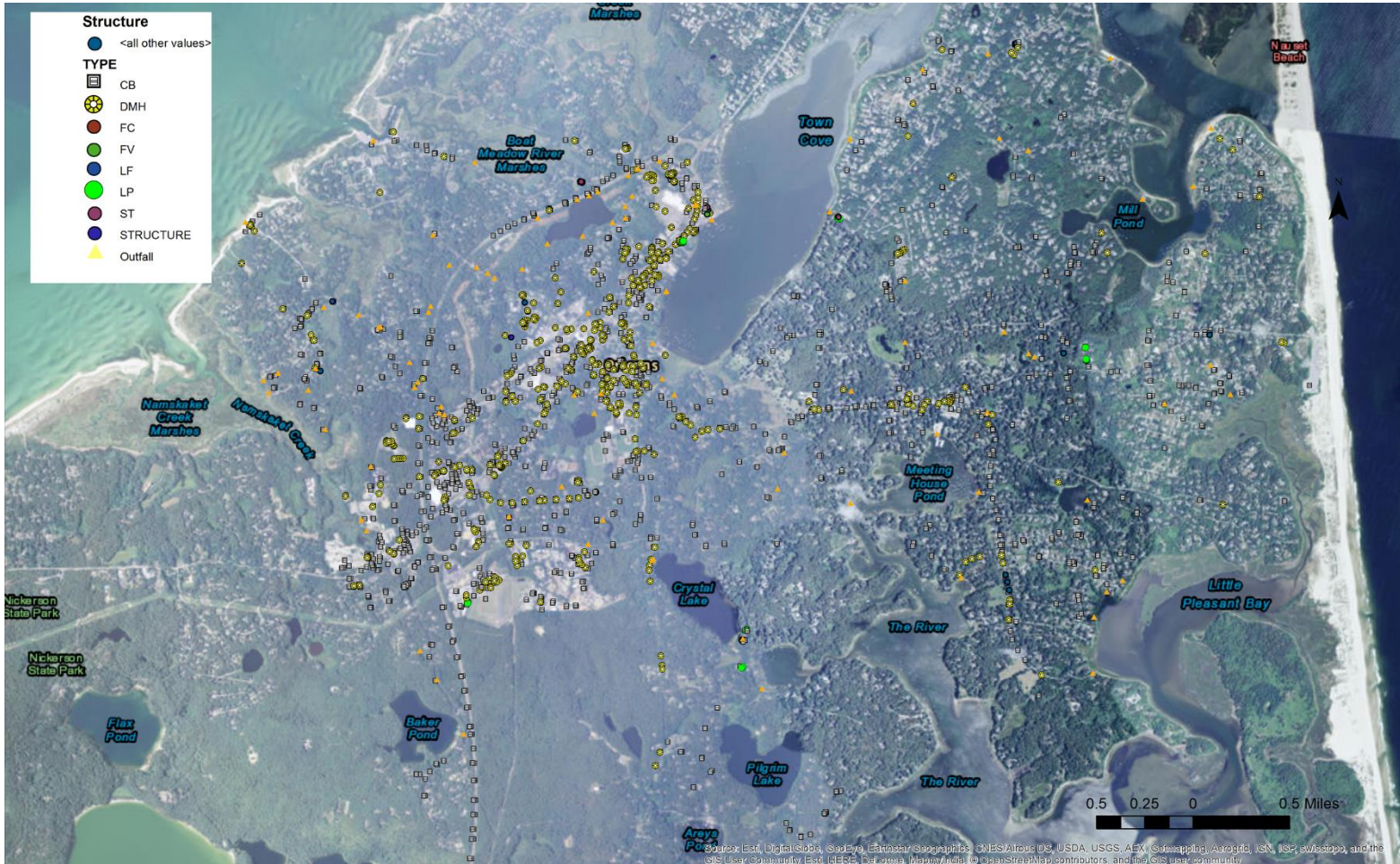
Agenda

- 1⁰⁰ - 1²⁰p:** **Summary of Stormwater Work to Date**
- ▶ Mapping efforts
 - ▶ Outfall inspections
 - ▶ BMP evaluation
 - ▶ Updated drainage base map
- 1²⁰ - 1⁴⁰p:** **Stormwater Planning Tool (ALERT Tool)**
- ▶ Overview
 - ▶ Baseline pollutant load assessment
 - ▶ Existing BMPs and load reduction
 - ▶ NPDES MS4 Permit considerations
- 1⁴⁰ - 2⁰⁰p:** **Prioritization of Future Stormwater Projects**
- ▶ Maintenance and rehabilitation of existing BMPs
 - ▶ Retrofit opportunities for existing BMPs
 - ▶ Pollutant loads and new BMP opportunities
 - ▶ Integration of watershed planning activities/priorities



Summary of Stormwater Work to Date

► Initial mapping by NSTAR and CDM (aerials) in GIS

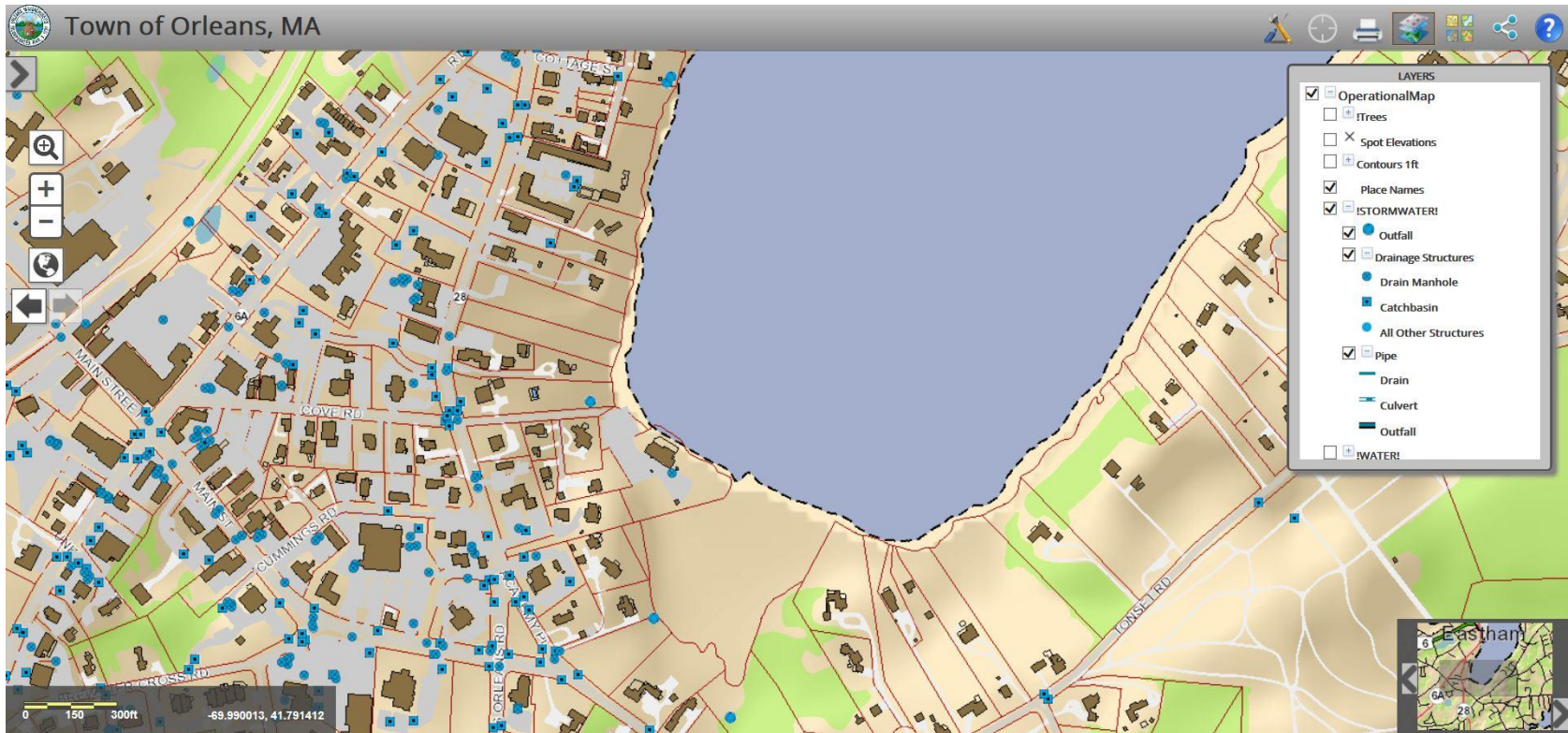




Summary of Stormwater Work to Date

- Town website drainage map (GIS)

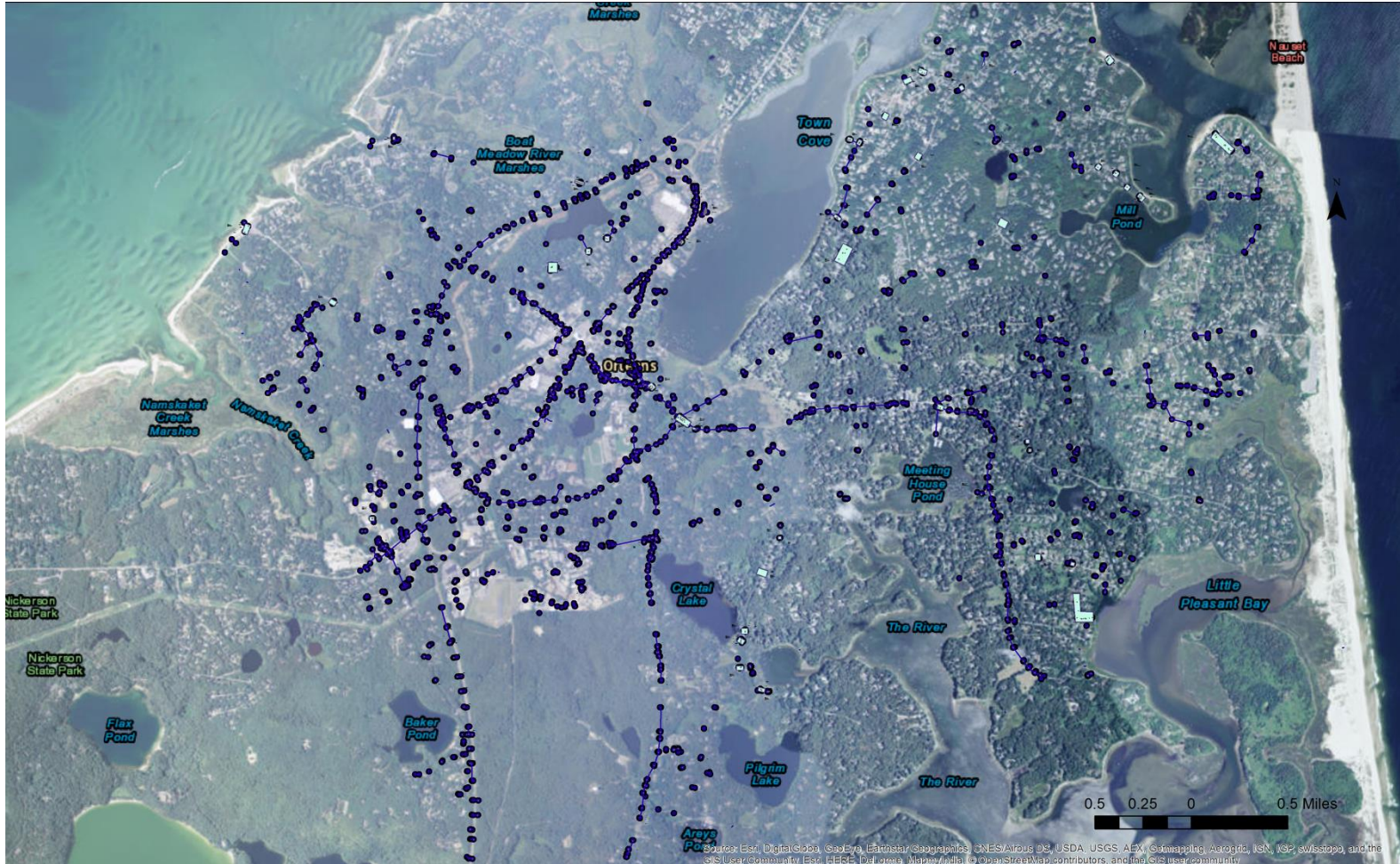
<http://host.cdmsmithgis.com/orleansma/>





Summary of Stormwater Work to Date

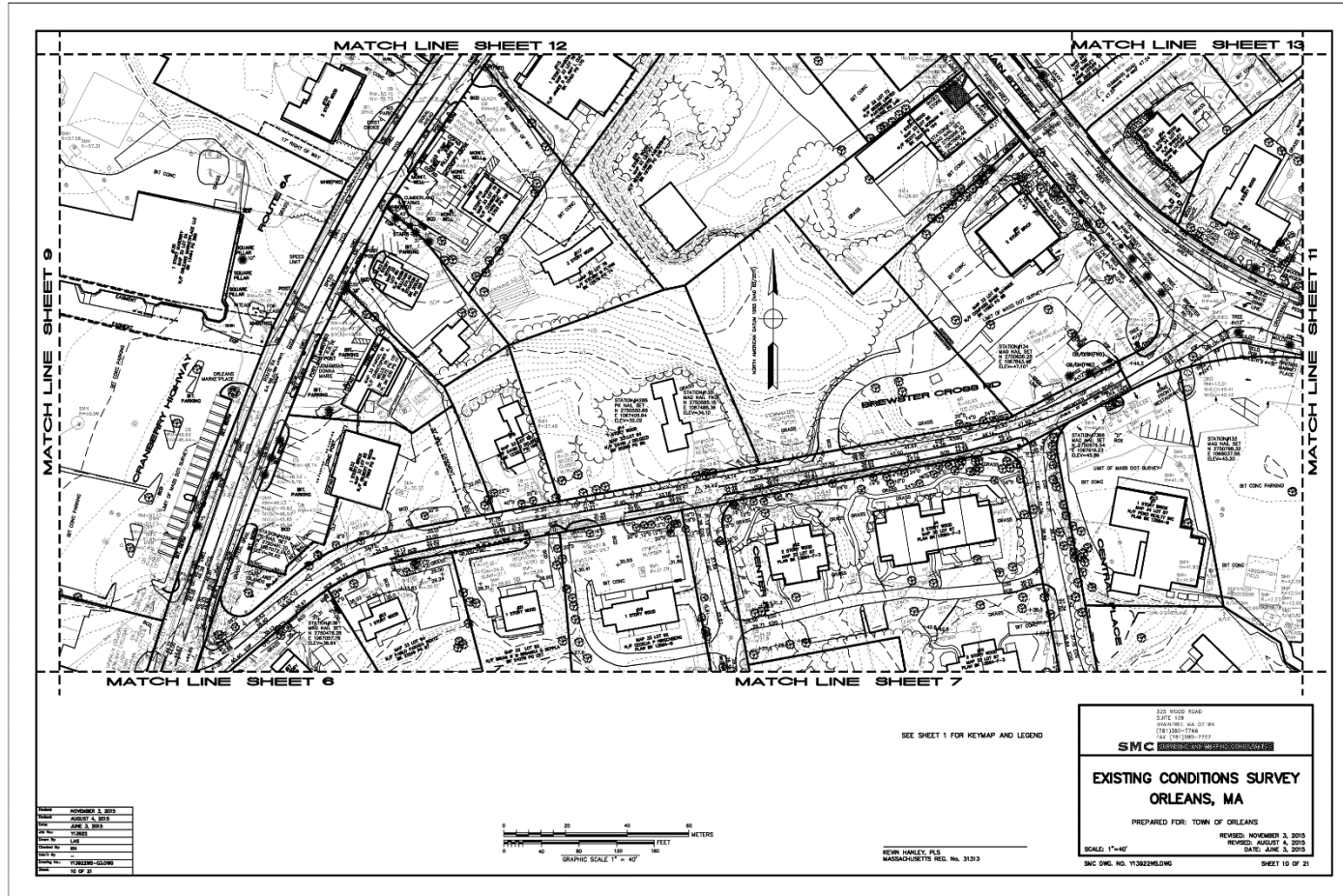
- ▶ GHD and Greenseal field mapping using GPS (brought into GIS)





Summary of Stormwater Work to Date

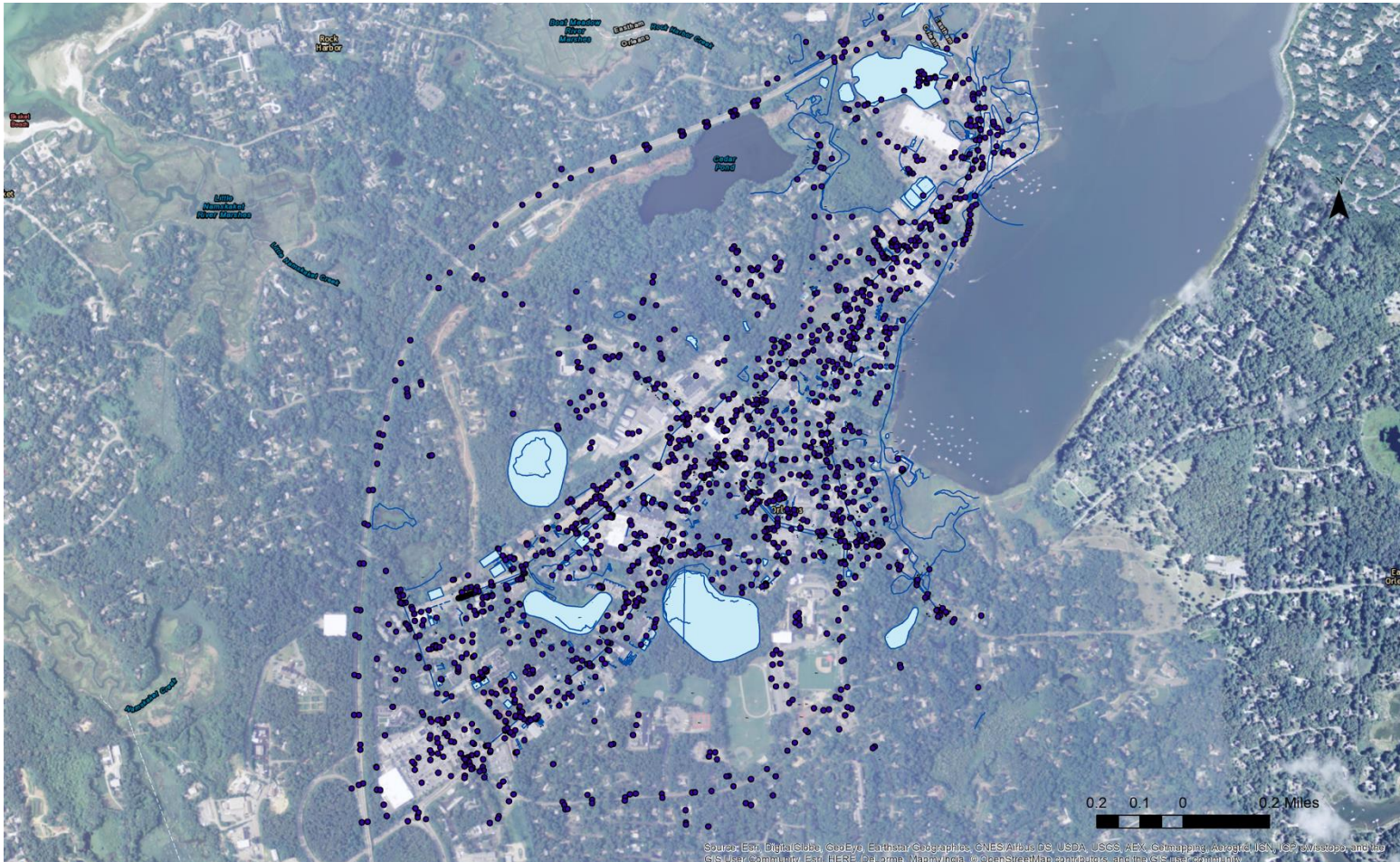
- SMC mapping of downtown (detailed ground survey)





Summary of Stormwater Work to Date

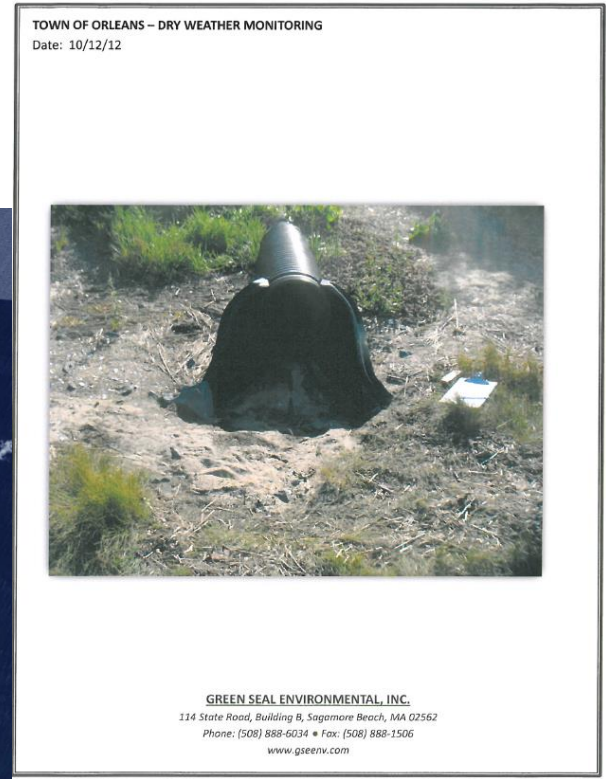
► SMC mapping brought into GIS





Summary of Stormwater Work to Date


- ▶ Greenseal outfall inspections
- ▶ Outfalls inspected for dry weather flows
- ▶ ~120 outfalls total mapped to date







Summary of Stormwater Work to Date

► GHD BMP evaluation (Town-owned BMPs)



ORLEANS Stormwater Best Management Practice Inventory

Revised July 2016



BMP ID: 11-BMP-1 Asa's Landing
Location: Asa's Landing

System Description:
Subsurface treatment - two deep sump catch basins with eight leaching pits and 18-inch outfall to Town Cove

Treatment Type:
Subsurface

Structures Opened?:
Yes


Standing Water in Leaching Facility?
No

Accumulated Sediment?
2-feet of sediment in catch basins

Condition of System:
4

Additional Notes:
System needs routine catch basin cleaning. Site has room for expansion. Installed in 1999.

Picture#:

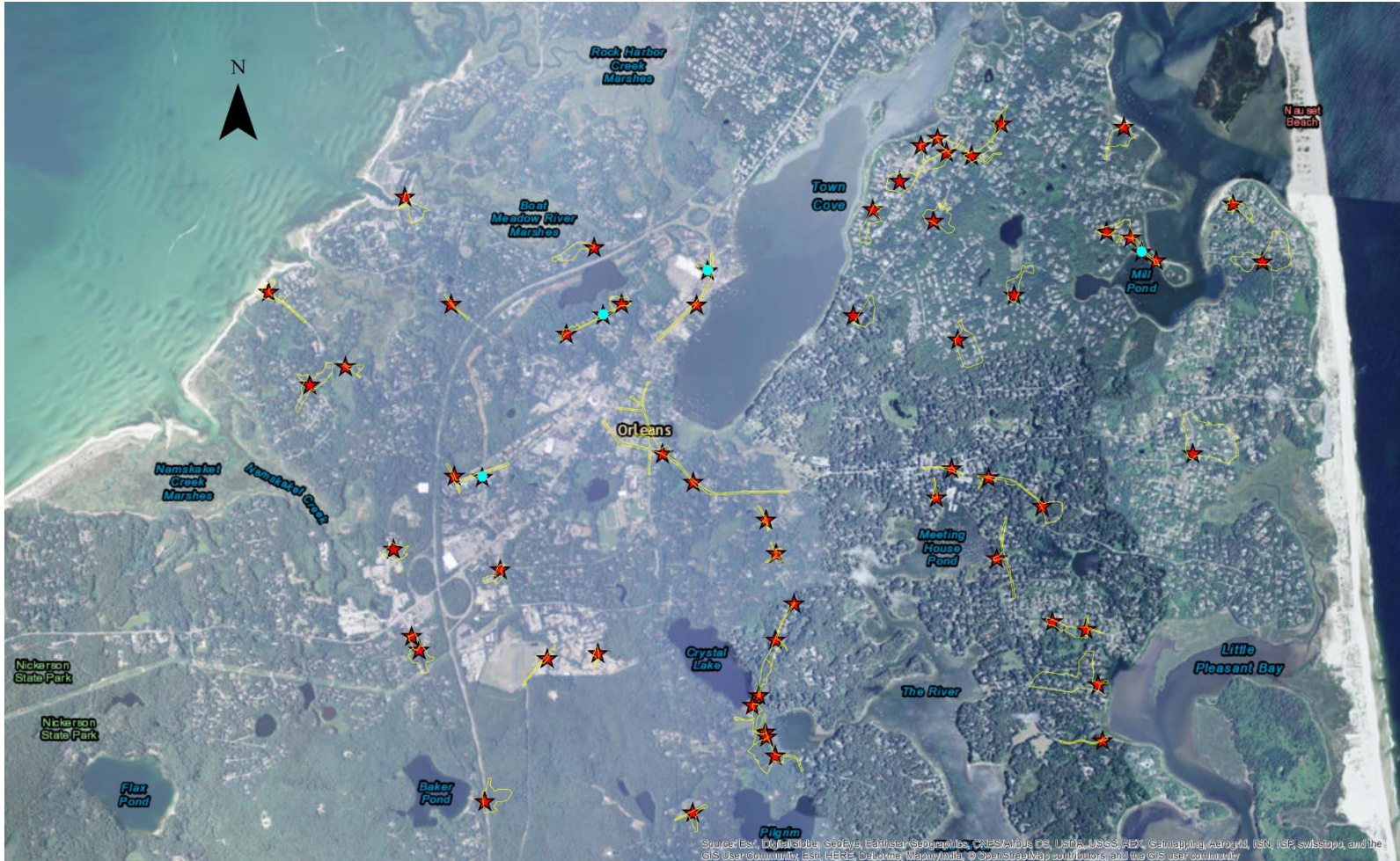


5 of 64



Summary of Stormwater Work to Date

► Additional BMPs to be evaluated





Summary of Stormwater Work to Date

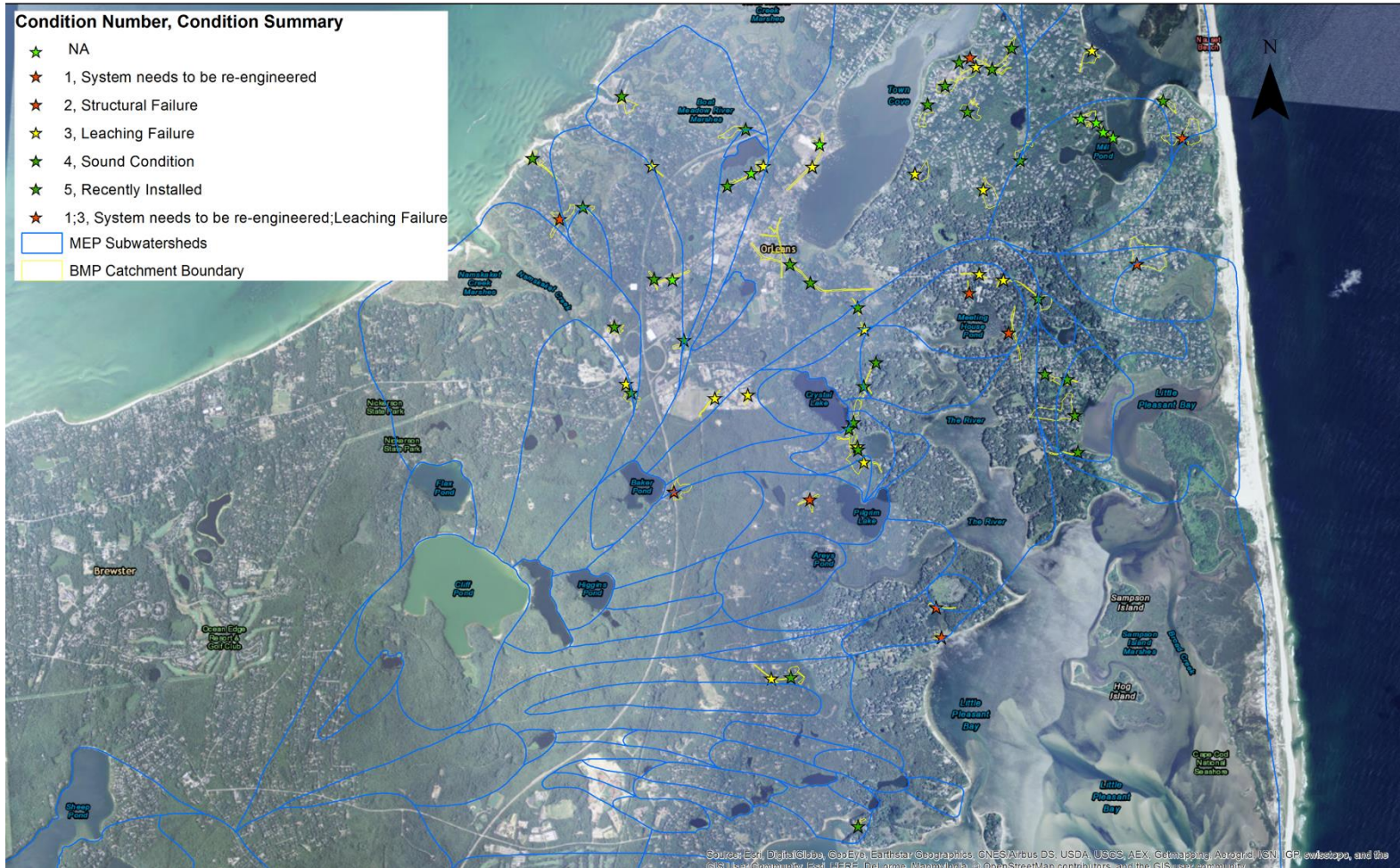
► GHD BMP evaluation

OBJECTID	address	note	bmp_id	condition	condition summar	treatment type	O M	rehab needs	bmp ty	P removal	N removal	TSS_r	Runoff	Field10
1	Gibson Rd and Ruggles Rd inters	2 CBs with 2 LPs	11-BMP-3	5	Recently Installed	Subsurface	1.7	No accumulated sediment	11	60	55	80	90	MA Stormwater Handbook v2c2
2	Tonset road and Freeman Lane In	Constructed Pocket Wetland	12-BMP-1	5	Recently Installed	Constructed Wetland, Gras	3.5,6	Submergent plants need replacement in micropools	5	50	38	80	90	MA Stormwater Handbook v2c2
3	End of mill pond road	2 DSCB, 3 LPs	21-BMP-2	0	NA	Subsurface	1.7	System likely failed. Unable to open pit covers	11	60	55	80	90	MA Stormwater Handbook v2c2
4	Mill Pond Road and Norsemens D	2 DSCB, 3 LPs	21-BMP-4	0	NA	Subsurface	1.7	System likely failed. Unable to open pit covers	11	60	55	80	90	MA Stormwater Handbook v2c2
5	30 Mill Pond road	2 DSCB, 2 LPs	21-BMP-5	0	NA	Subsurface	1.7	Unable to open	11	60	55	80	90	MA Stormwater Handbook v2c2
6	Skaket Beach Parking Facility	2 DSCB, 2 tanks, 30 chambers	15-BMP-1	4	Sound Condition	Subsurface, Setting Tank	12,8	System is regularly clogged with drifted sand	12	46	46	80	83	MA Stormwater Handbook v2c2
7	210 Rock Harbor Road	2 DSCB and tank	17-BMP-1	4	Sound Condition	Subsurface, Setting Tank	1.2	No accumulated sediment	12	46	46	80	83	MA Stormwater Handbook v2c2
8	Hopkins Lane and Brick Hill Rd In	2 DSCB and 2 pits	20-BMP-1	4	Sound Condition	Subsurface	1.7	One CB needs hood/elbow. No accumulated sediment	11	60	55	80	90	MA Stormwater Handbook v2c2
9	Saltworks Circle and Tonset Road	3 DSCB, 5 pits, outfall	27-BMP-1	3	Leaching Failure	Subsurface	1.7	Outfall buried. Additional leaching and re-eng	11	60	55	80	90	MA Stormwater Handbook v2c2
10	Tonset Road and Main Street Inte	4 CBs, leaching pits	34-BMP-1	4	Sound Condition	Subsurface	1.7	No accumulated sediment	11	60	55	80	90	MA Stormwater Handbook v2c2
11	Barley Neck Rd and Beach Rd Int	2 DSCBs, outfall	36-BMP-1	3	Leaching Failure	Subsurface	1.7	Poor condition, needs replacement	11	60	55	80	90	MA Stormwater Handbook v2c2
12	<Null>	DSCB, 2 leaching pits	36-BMP-3	5	Recently Installed	Subsurface	1.7	no accumulated sediment	11	60	55	80	90	MA Stormwater Handbook v2c2
13	Keziah's Way and Monument Ro	3 DSCBs and 3 leaching pits	48-BMP-1	4	Sound Condition	Subsurface	1.7	no accumulated sediment	11	60	55	80	90	MA Stormwater Handbook v2c2
14	Frost Fish Lane and Monument R	3 DSCB, 3 leaching pits	49-BMP-1	4	Sound Condition	Subsurface	1.7	no accumulated sediment	11	60	55	80	90	MA Stormwater Handbook v2c2
15	19 Fox Ridge Lane	2 DSCB, one leaching pit	50-BMP-1	5	Recently Installed	Subsurface	1.7	no accumulated sediment	11	60	55	80	90	MA Stormwater Handbook v2c2
16	38 Fox Ridge Lane	3 DSCBs, two leaching pits	50-BMP-2	5	Recently Installed	Subsurface	1.7	no accumulated sediment	11	60	55	80	90	MA Stormwater Handbook v2c2
17	Gilman Lane	13 CBs, 16 LPs, chambers, outfa	51-BMP-1	4	Sound Condition	Subsurface	1.7	no accumulated sediment	12	46	46	80	83	MA Stormwater Handbook v2c2
18	Crystal Lake Parking Lot	2 DSCBs, tank, outfall	55-BMP-1	5	Recently Installed	Subsurface, Setting Tank	1.2	no accumulated sediment	12	46	46	80	83	MA Stormwater Handbook v2c2
19	Herring Brook Rd and Alewife Rd	3 ST biofilter systems, 3 DSCB,	55-BMP-2	3	Leaching Failure	Subsurface, Stormtreat	1.9	Cleaning, vegetation maintenance	13	90	77	98	0	http://www.mass.gov/eea/docs/eea/step/
20	158 namequoit Road	leaching CB with outfall	70-BMP-1	13	System needs to be	Subsurface	1.7	Needs re-engineering	9	60	55	80	90	MA Stormwater Handbook v2c2
21	Quanset Boat Ramp	2 DSCBs and culcet infiltration	93-BMP-1	5	Recently Installed	Subsurface, Culcet	1.8	no sediment accumulation	12	46	46	80	83	MA Stormwater Handbook v2c2
22	Academy Place and Main Street I	tank, ten leaching pits	34-BMP-2	4	Sound Condition	Subsurface, Setting Tank	12,7	Settling tanks need cleaning	11	60	55	80	90	MA Stormwater Handbook v2c2
23	Barley Neck and Pochet	2 DSCBs, 3 leaching pits	36-BMP-2	3	Leaching Failure	Subsurface	1.7	System needs replacement	11	60	55	80	90	MA Stormwater Handbook v2c2
24	Barley Neck and Payson	3 DSCBs, 2 LPs, culcet infiltratio	58-BMP-1	5	Recently Installed	Subsurface, Culcet	1,7,8	no accumulated sediment	12	46	46	80	83	MA Stormwater Handbook v2c2
25	5 Bakers Pond Rd	1 DSCB to leach pit	46-BMP-3	3	Leaching Failure	Subsurface	1.7	Accumulated sediment, needs addtl leaching	11	60	55	80	90	MA Stormwater Handbook v2c2
26	16 Bakers Pond	1 DSCB to leach Pit	46-BMP-2	4	Sound Condition	Subsurface	1.7	leaching system always partially full of water	11	60	55	80	90	MA Stormwater Handbook v2c2
27	Bakers Pond Boat Ramp	3 DSCBs, 4 LPs, outfall	60-BMP-1	13	System needs to be	Subsurface	1.7	no accumulated sediment	11	60	55	80	90	MA Stormwater Handbook v2c2
28	Chickadee Lane	2 DSCBs, 4 LPs	20-BMP-2	3	Leaching Failure	Subsurface	1.7	leaching field is a swamp; should be re-located	11	60	55	80	90	MA Stormwater Handbook v2c2
29	Countryside Drive	8 CBs and outfall	37-BMP-1	13	System needs to be	Subsurface	1.7	needs re-engineering	1	5	5	25	0	MA Stormwater Handbook v2c2
30	Doane Road System	10 CBs, LPs, outfall	22-BMP-1	31	System needs to be	Subsurface	1.7	needs re-engineering	11	60	55	80	90	MA Stormwater Handbook v2c2
31	Giddiah Hill at Rayber	3 DSCBs, 3 LPs	47-BMP-1	3	Leaching Failure	Subsurface	1.7	accumulated sediment	11	60	55	80	90	MA Stormwater Handbook v2c2
32	2 Harbor Hill Drive	2 DSCBs, 2 LPs	16-BMP-2	3	Leaching Failure	Subsurface	1.7	Needs re-engineering	11	60	55	80	90	MA Stormwater Handbook v2c2
33	17 Herring Brook	1 CB, 6 LPs	55-BMP-4	3	Leaching Failure	Subsurface	1.7	leaching facility has failed	11	60	55	80	90	MA Stormwater Handbook v2c2
34	20 Herring Brook	2 CBs, 4 LPs	55-BMP-3	4	Sound Condition	Subsurface	1.7	no accumulated sediment	11	60	55	80	90	MA Stormwater Handbook v2c2
35	48 Locust Road	3 CBs, 1 LP, 1 outfall	25-BMP-3	3	Leaching Failure	Subsurface	1.7	leaching pit failed	11	60	55	80	90	MA Stormwater Handbook v2c2
36	Lots Hollow at Eldridge Parkway	1 DSCB, 5 LPs	40-BMP-1	5	Recently Installed	Subsurface	1.7	no accumulated sediment	11	60	55	80	90	MA Stormwater Handbook v2c2
37	62 Monument Road	1 DSCB and 1 LP	49-BMP-2	5	Recently Installed	Subsurface	1.7	no accumulated sediment	11	60	55	80	90	MA Stormwater Handbook v2c2
38	Monument at Pond	2 DSCBs and 3 LPs	42-BMP-1	3	Leaching Failure	Subsurface	1.7	accumulated sediment and standing water	11	60	55	80	90	MA Stormwater Handbook v2c2
39	Monument Road and Uncle Vick's	1 DSCB and 2 LPs	41-BMP-1	4	Sound Condition	Subsurface	1.7	System overtops berm during storm events	11	60	55	80	90	MA Stormwater Handbook v2c2
40	Pilgrim Terrace and Monument R	4 DSCBs and 1 LP	62-BMP-1	31	System needs to be	Subsurface	1.7	Needs re-engineering and additional leaching	11	60	55	80	90	MA Stormwater Handbook v2c2
41	18 Portanimit	1 DSCB, 3 LPs	75-BMP-2	5	Recently Installed	Subsurface	1.7	no accumulated sediment	11	60	55	80	90	MA Stormwater Handbook v2c2
42	Portanimit Boat Ramp	2 DSCBs	76-BMP-1	1	System needs to be	Subsurface	1.7	needs re-engineering	1	5	5	25	0	MA Stormwater Handbook v2c2
43	Portanimit and Quanset	3 DSCBs and LPs	75-BMP-1	3	Leaching Failure	Subsurface	1.7	to be replaced	11	60	55	80	90	MA Stormwater Handbook v2c2
44	69 Rayber	2 DSCBs and 5 LPs	47-BMP-2	3	Leaching Failure	Subsurface	1.7	needs re-engineering	11	60	55	80	90	MA Stormwater Handbook v2c2
45	25 Seawers	2 DSCBs and 3 LPs	12-BMP-3	3	Leaching Failure	Subsurface	1.7	needs re-engineering	11	60	55	80	90	MA Stormwater Handbook v2c2
46	244 Tonset	DSCB with galleys and pits	19-BMP-2	4	Sound Condition	Subsurface	1.7	no accumulated sediment	12	46	46	80	83	MA Stormwater Handbook v2c2
47	West Road at Rail Trail	4 DSCBs, 2 outfalls, wetland	33-BMP-1	4	Sound Condition	Subsurface	1,4,7	consider adding vegetation	5	50	38	80	90	MA Stormwater Handbook v2c2
48	Willie Atwood at Calt. Linnell	2 DSCBs, 5 LPs approx	24-BMP-2	31	System needs to be	Subsurface	1.7	consider re-engineering	11	60	55	80	90	MA Stormwater Handbook v2c2
49	<Null>	2 DSCBs, 1 LP, 2 chambered div	25-BMP-1	4	Sound Condition	Subsurface	1.7	No sediment accumulation	12	46	46	80	83	MA Stormwater Handbook v2c2
50	<Null>	2 DSCBs, 11 LPs, settling tank	36-BMP-5	31	System needs to be	Subsurface, Setting Tank	1,2,7	Needs re-engineering, regularly inundated	11	60	55	80	90	MA Stormwater Handbook v2c2



Summary of Stormwater Work to Date

► GHD BMP evaluation

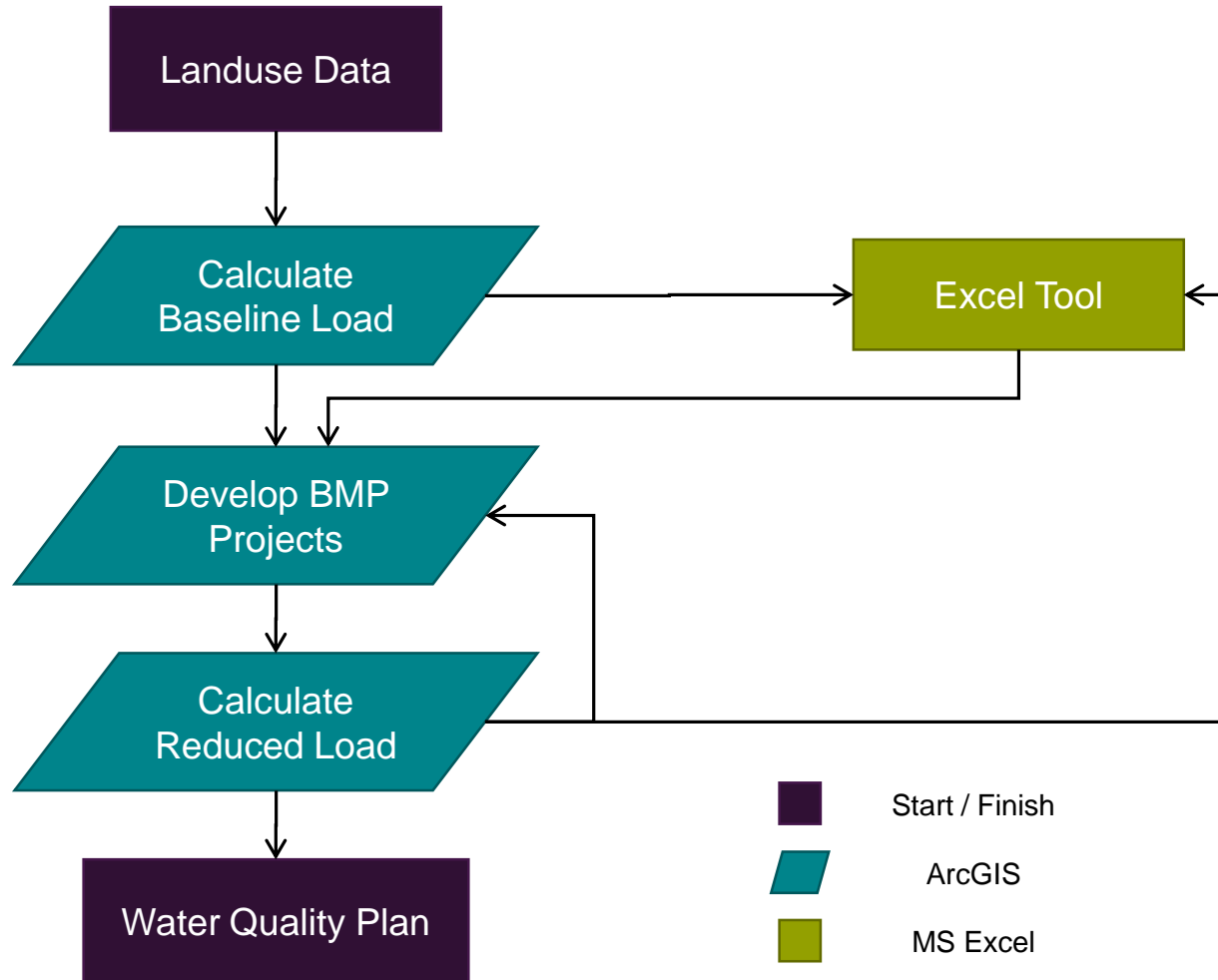


Stormwater Planning Tool (ALERT Tool)

- ▶ AMEC Load Estimation and Reduction Tracking (ALERT) Tool
- ▶ Goals:
 - ▶ Develop an understanding of stormwater pollutant loads by basin.
 - ▶ Build a GIS-based system to plan and track BMPs.
 - ▶ Help NPDES MS4 communities estimate the total cost of TMDL compliance.
 - ▶ Help prioritize the most cost-effective BMP projects.
 - ▶ Design for maximum flexibility.



ALERT Process Diagram

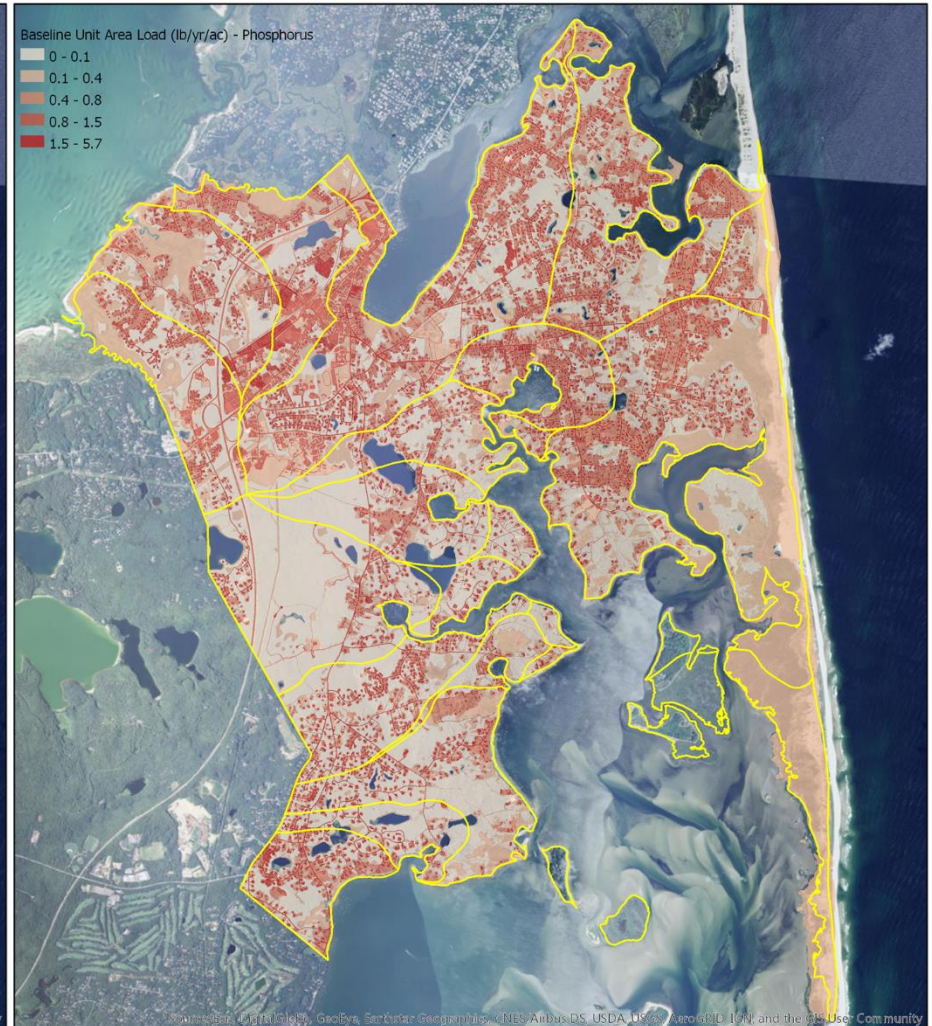


Baseline Pollutant Load Assessment

- ▶ Simple Method and land use pollutant export coefficients
- ▶ **$L = 0.226 * R * C * A$**
- ▶ Where: L = Annual load (lbs)
R = Annual runoff (inches)
C = Pollutant concentration (mg/l)
A = Area (acres)
0.226 = Unit conversion factor
- ▶ Focus on nutrients and TSS



Baseline Pollutant Load Assessment





Baseline Pollutant Load Assessment



Baseline Pollutant Load Assessment (stormwater contribution)



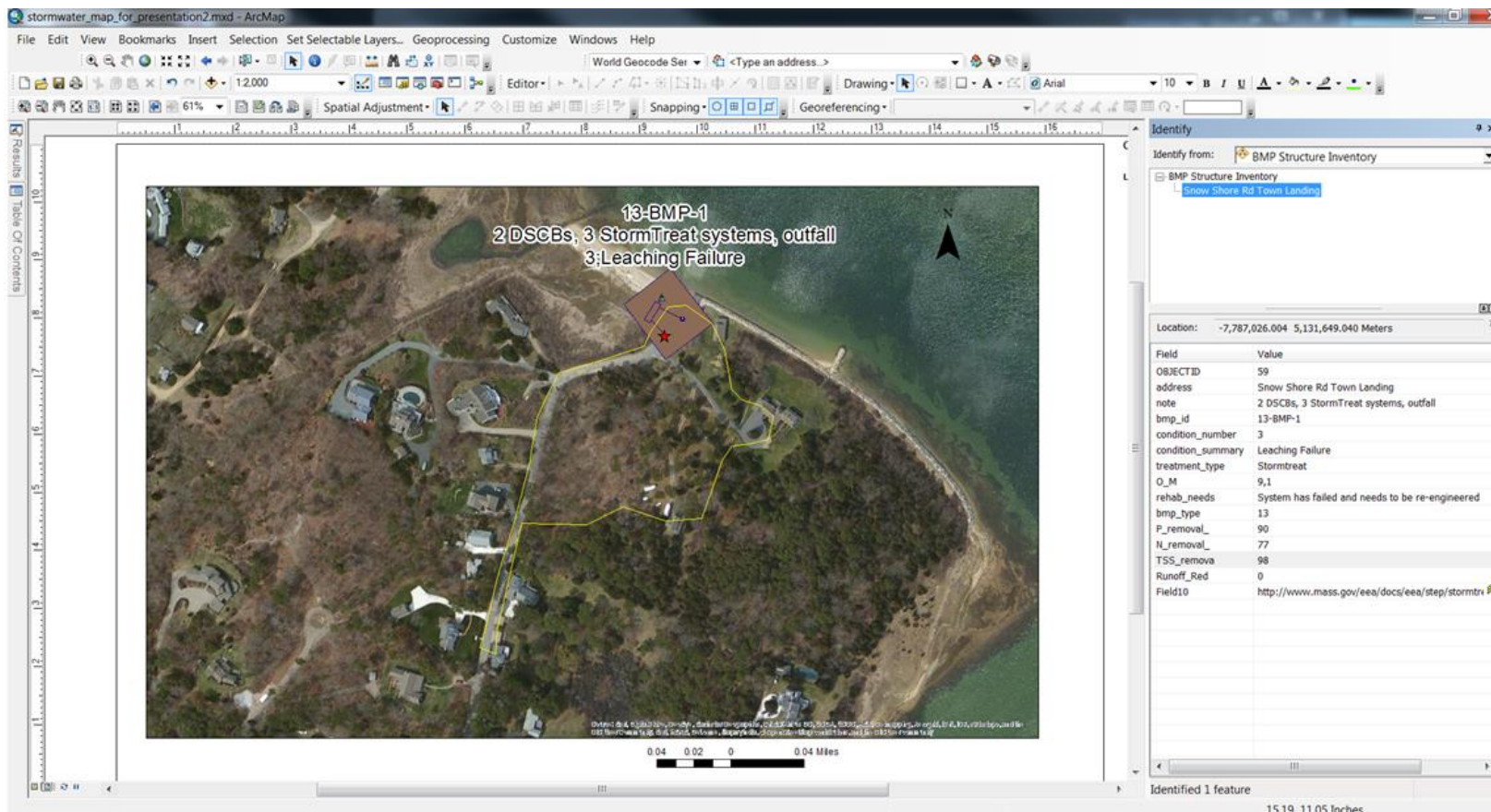
Basin	TN Load (lb/yr)	TP Load (lb/yr)	TSS Load (lb/yr)	F Coli Load (#/yr)
Arey's River	2,473	192	36,603	8,878,320,907,210
Areys Pond	2,078	147	33,754	5,889,542,083,570
Atlantic Ocean	755	59	10,112	3,031,709,144,470
Boat Meadow	251	22	7,405	2,569,877,054,410
Little Namskaket	2,738	244	44,975	17,580,549,289,700
Lonnie's Pond	1,638	118	21,322	4,153,562,780,570
Meetinghouse Pd	2,030	168	27,305	9,962,166,323,570
Namskaket Creek	2,439	173	42,082	14,676,659,474,000
Nauset Harbor	4,585	386	63,418	24,484,628,707,200
Pah Wah Pond	366	27	5,657	992,702,141,159
Pleasant Bay	4,607	349	62,249	16,395,363,959,100
Pochet Neck	6,205	473	82,046	19,824,039,741,300
Quanset Pond	847	61	11,613	2,021,090,229,150
Rock Harbor	3,416	318	66,441	42,887,914,784,800
The River	1,908	139	27,792	5,805,063,523,100
Town Cove	8,843	698	150,847	64,704,133,454,600

► Subject to change/verification with CWMP and other efforts . . .



Existing BMPs and Load Reduction

- Delineate existing BMP drainage areas and calculate pollutant load reduction (assume all function properly)

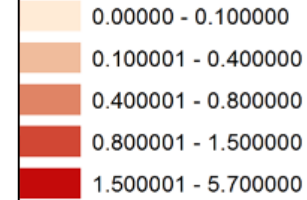




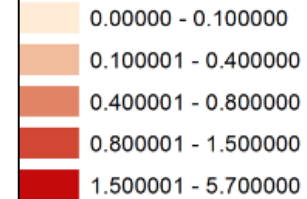
Existing BMPs and Load Reduction



Baseline Unit Area Load (lb/yr/ac) - Phosphorus



Reduced Unit Area Load (lb/yr/ac) - Phosphorus



Existing BMPs and Load Reduction

BMP ID	Reduction in N load (lb/yr)	Reduction in P load (lb/yr)	Reduction in TSS load (lb/yr)
11-BMP-3	43	4	530
12-BMP-1	10	1	226
21-BMP-2	3	0	96
21-BMP-4	27	3	412
21-BMP-5	16	2	249
20-BMP-1	29	2	397
19-BMP-2	25	2	366
12-BMP-2	25	2	344
11-BMP-1	27	2	291
11-BMP-2	34	3	380
12-BMP-3	27	2	299
27-BMP-1	32	3	421
20-BMP-2	76	6	918
36-BMP-5	8	1	86
36-BMP-3,4	22	2	387
50-BMP-2	23	2	285
50-BMP-1	14	1	158
51-BMP-1	115	10	1,312



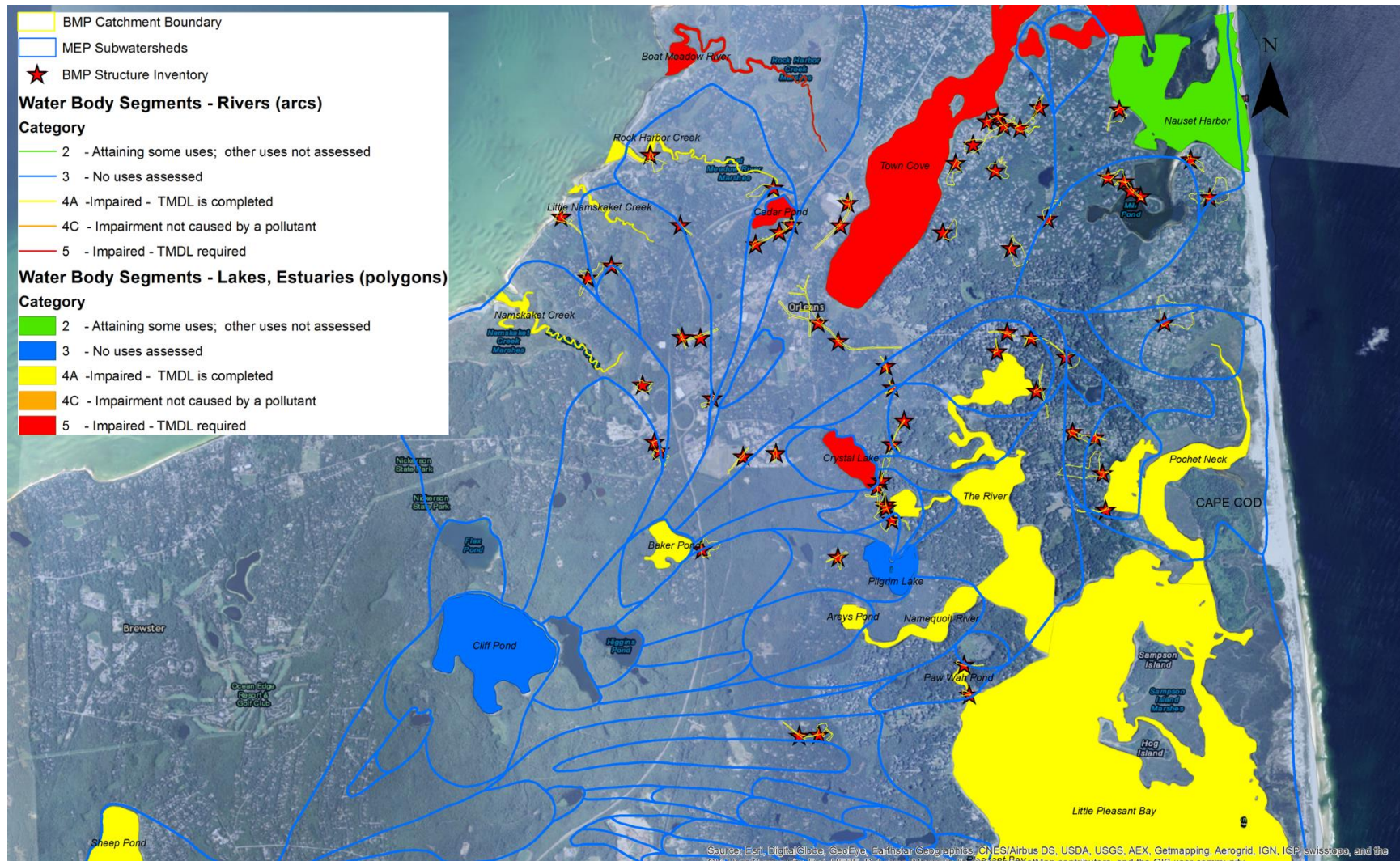
Existing BMPs and Load Reduction

Basin	Baseline TN Load (lb/yr)	Baseline TP Load (lb/yr)	Baseline TSS Load (lb/yr)	Reduced TN Load (lb/yr)	Reduced TP Load (lb/yr)	Reduced TSS Load (lb/yr)	Reduction in TN Load (lb/yr)	Reduction in TP Load (lb/yr)	Reduction in TSS Load (lb/yr)
Arey's River	2,473	192	36,603	2,440	189	36,014	33	3	589
Areys Pond	2,078	147	33,754	2,058	146	33,248	20	1	506
Atlantic Ocean	755	59	10,112	751	59	10,048	4	0	64
Boat Meadow	251	22	7,405	251	22	7,405	0	0	0
Little Namskaket	2,738	244	44,975	2,627	233	42,359	110	11	2,616
Lonnie's Pond	1,638	118	21,322	1,566	112	19,933	72	6	1,389
Meetinghouse Pd	2,030	168	27,305	1,935	160	25,951	94	8	1,354
Namskaket Creek	2,439	173	42,082	2,365	168	40,866	74	5	1,216
Nauset Harbor	4,585	386	63,418	4,360	362	59,881	225	24	3,537
Pah Wah Pond	366	27	5,657	354	26	5,473	12	1	184
Pleasant Bay	4,607	349	62,249	4,607	349	62,248	0	0	1
Pochet Neck	6,205	473	82,046	6,033	458	79,503	172	14	2,544
Quanset Pond	847	61	11,613	836	60	11,442	10	1	170
Rock Harbor	3,416	318	66,441	3,316	309	65,020	100	9	1,421
The River	1,908	139	27,792	1,864	135	27,124	43	4	668
Town Cove	8,843	698	150,847	8,310	655	142,685	533	44	8,162
Total							1,504	131	24,423

► Assumes all BMPs are functioning properly . . .



NPDES MS4 Permit Considerations



NPDES MS4 Permit Considerations

► 2014 Integrated List of Waters

Name	Segment ID	Impairment	Status
Areys Pond	MA96-70	Estuarine bioassessments, nitrogen (total)	TMDL Completed (33786)
Baker Pond	MA96008	Mercury in fish tissue	TMDL Completed (33880)
Little Namskaket Creek	MA96-26	Fecal coliform	TMDL Completed (36772)
Little Pleasant Bay	MA96-78	Fecal coliform, nitrogen (total)	TMDL Completed (42358 (FC), 33794 (N))
Namequoit River	MA96-71	Estuarine bioassessments, nitrogen (total)	TMDL Completed (33791)
Namskaket Creek	MA96-27	Fecal coliform	TMDL Completed (36772)
Paw Wah Pond	MA96-72	Estuarine bioassessments, fecal coliform, nitrogen (total)	TMDL Completed (33792 (EB), 42368 (FC), 33794 (N))
Pleasant Bay	MA96-77	Nitrogen (total)	TMDL Completed (33799)
Pochet Neck	MA96-73	Estuarine bioassessments, fecal coliform, nitrogen (total)	TMDL Completed (33793 (EB), 42369 (FC), 33793 (N))
Quanset Pond	MA96-74	Nitrogen (total)	TMDL Completed (33791, 33795)
Rock Harbor Creek	MA96-16	Fecal coliform	TMDL Completed (36772)
The River	MA96-76	Estuarine bioassessments, fecal coliform, nitrogen (total)	TMDL Completed (33787, 33788, 33789, 33790, 42359, 33880)

NPDES MS4 Permit Considerations

▶ 2014 Integrated List of Waters

Name	Segment ID	Impairment	Status
Cedar Pond	MA96-88	Chlorophyll-a, dissolved oxygen saturation, oxygen (dissolved)	TMDL Required
Crystal Lake	MA96050	Oxygen (dissolved)	TMDL Required
Town Cove	MA96-68	Estuarine bioassessments, fecal coliform	TMDL Required (EB), TMDL Completed (FC, 36772)

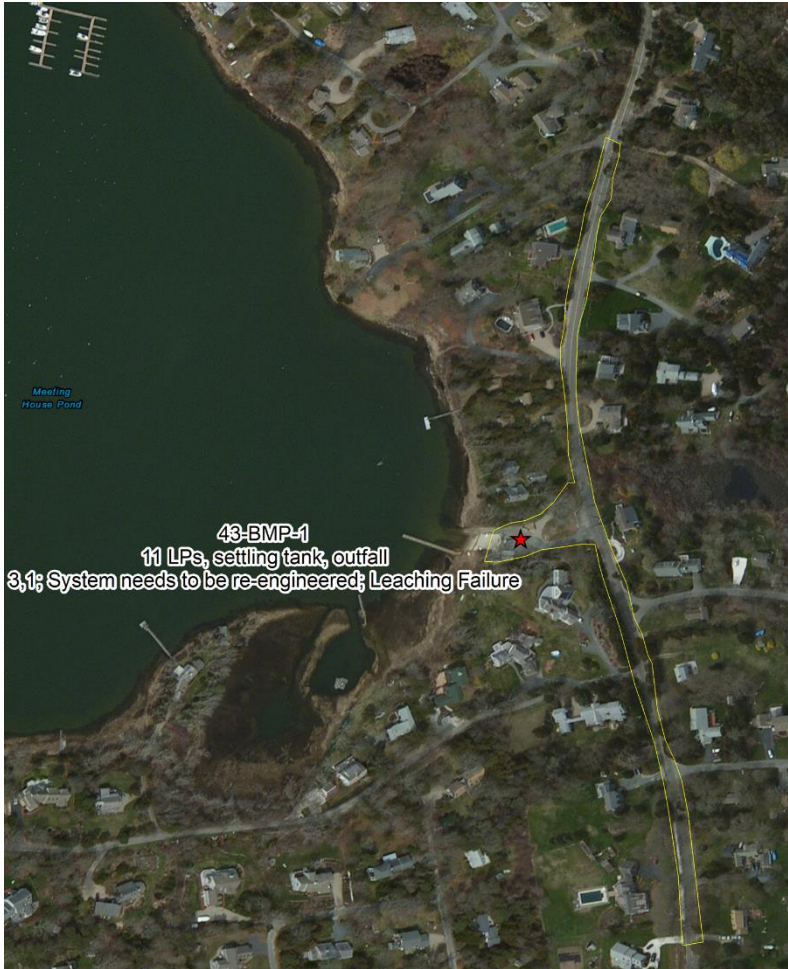
▶ 2016 NPDES MS4 Permit Requirements:


- ▶ 10 BMP retrofits in Years 4 & 5 (2021-2022) (Part 2.3.6.d)
- ▶ Bacterial TMDLs (Appendix F, Part A.III):
 - ▶ Enhanced public education
 - ▶ Outfall catchments designated as high priority for illicit discharge investigations
- ▶ Nitrogen TMDLs (Appendix F, Part A.IV):
 - ▶ Enhanced public education
 - ▶ Stormwater management requirements must optimize nitrogen removal
 - ▶ BMP retrofit inventory and priority ranking targeting nitrogen removal



Prioritization of Future Stormwater Projects

2. Retrofit opportunities for existing BMPs





BMP ID: 43-BMP-1

Location: Meeting House Pond

System Description:
Two deep sump catch basins, eleven leaching pits, settling tank, headwall and outfall to Meetinghouse Pond.

Treatment Type:
Subsurface

Structures Opened?:
Yes


Standing Water in Leaching Facility?
Yes, three feet of water.

Accumulated Sediment?
Yes, 6 inches.

Condition of System:
3,1

Additional Notes:
System regularly becomes inundated. Original design may be cause of inundation. In need of re-engineering. Site has room for expansion.

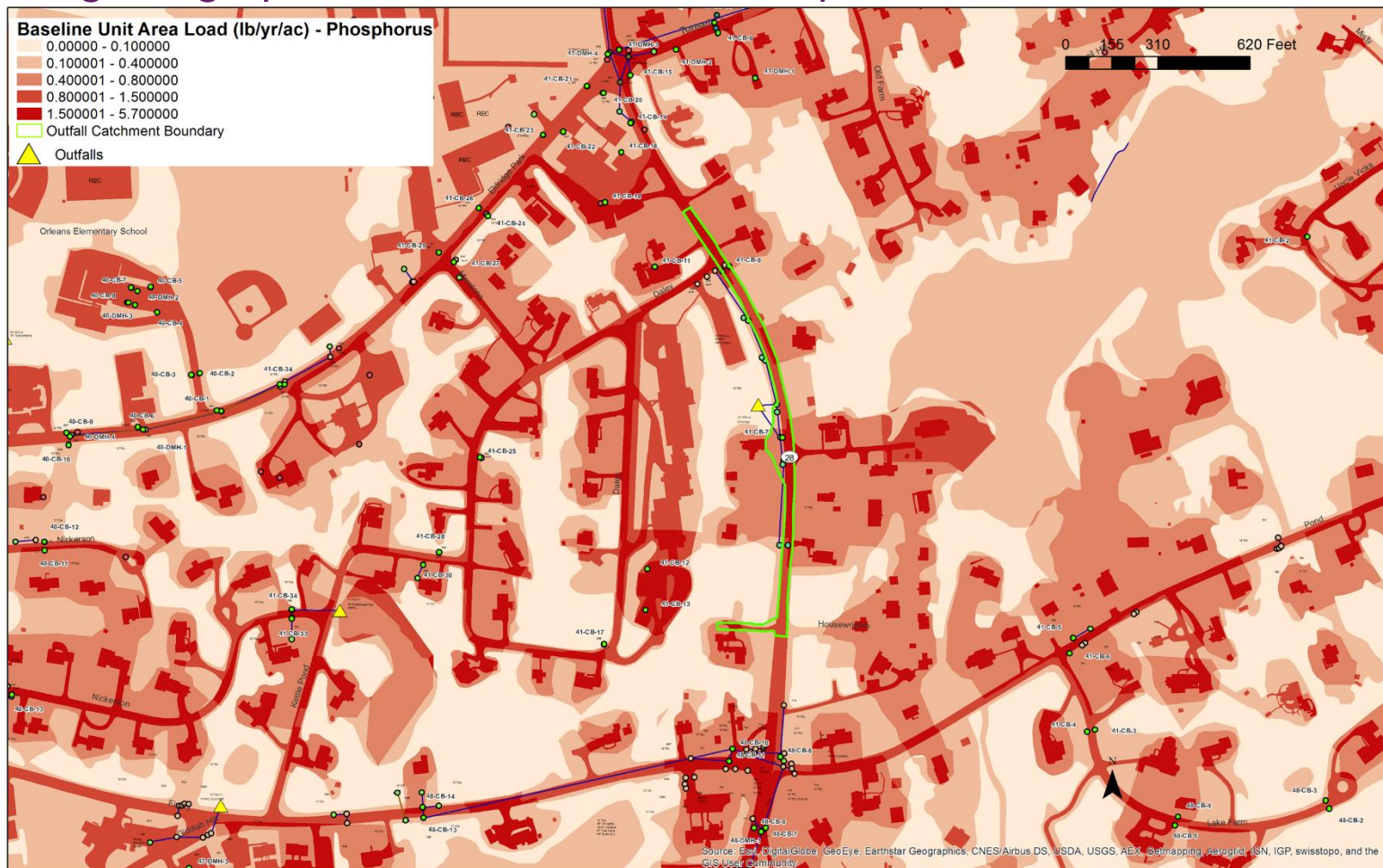
Pictures:





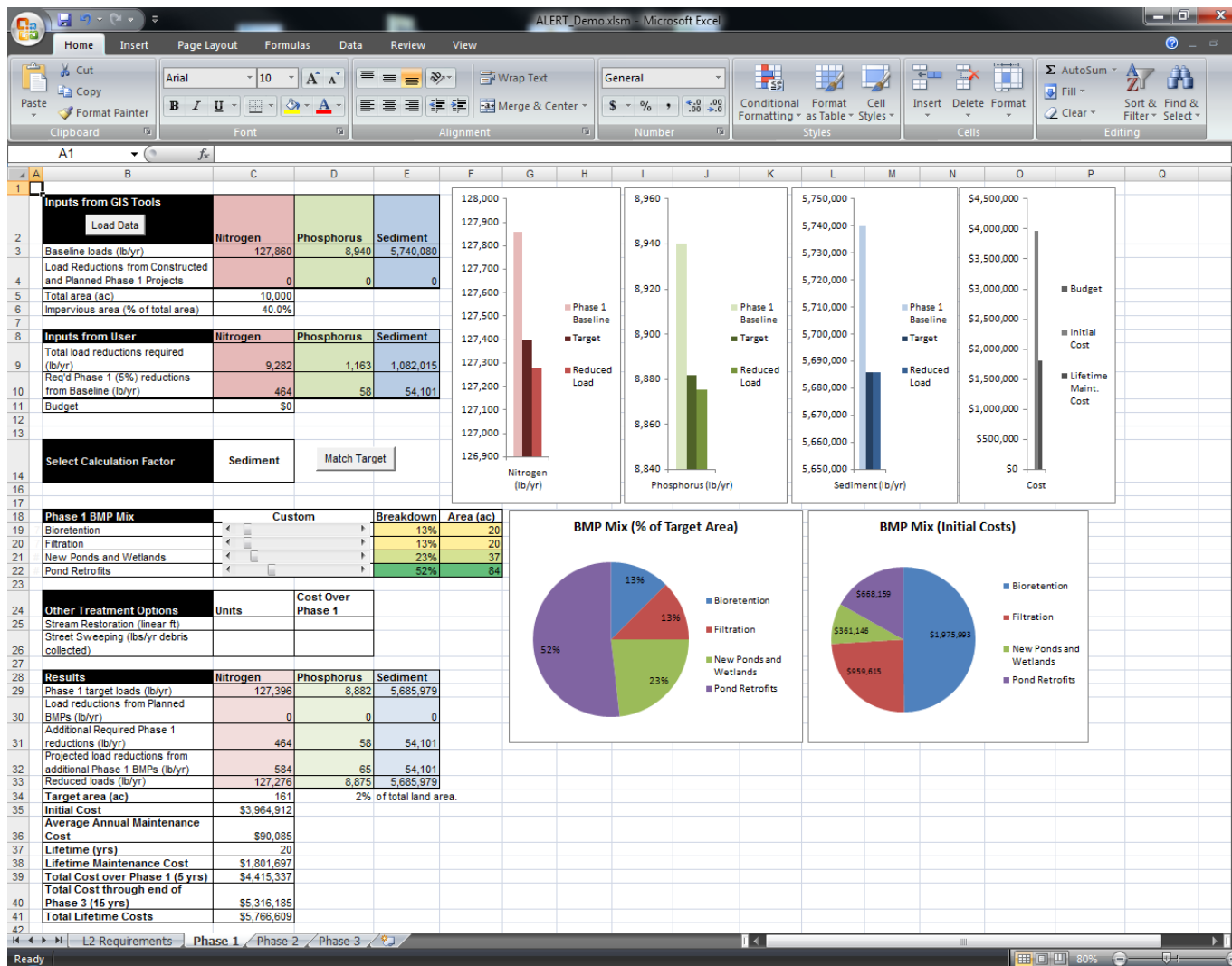
Prioritization of Future Stormwater Projects

3. Target high pollutant loads and develop new BMPs

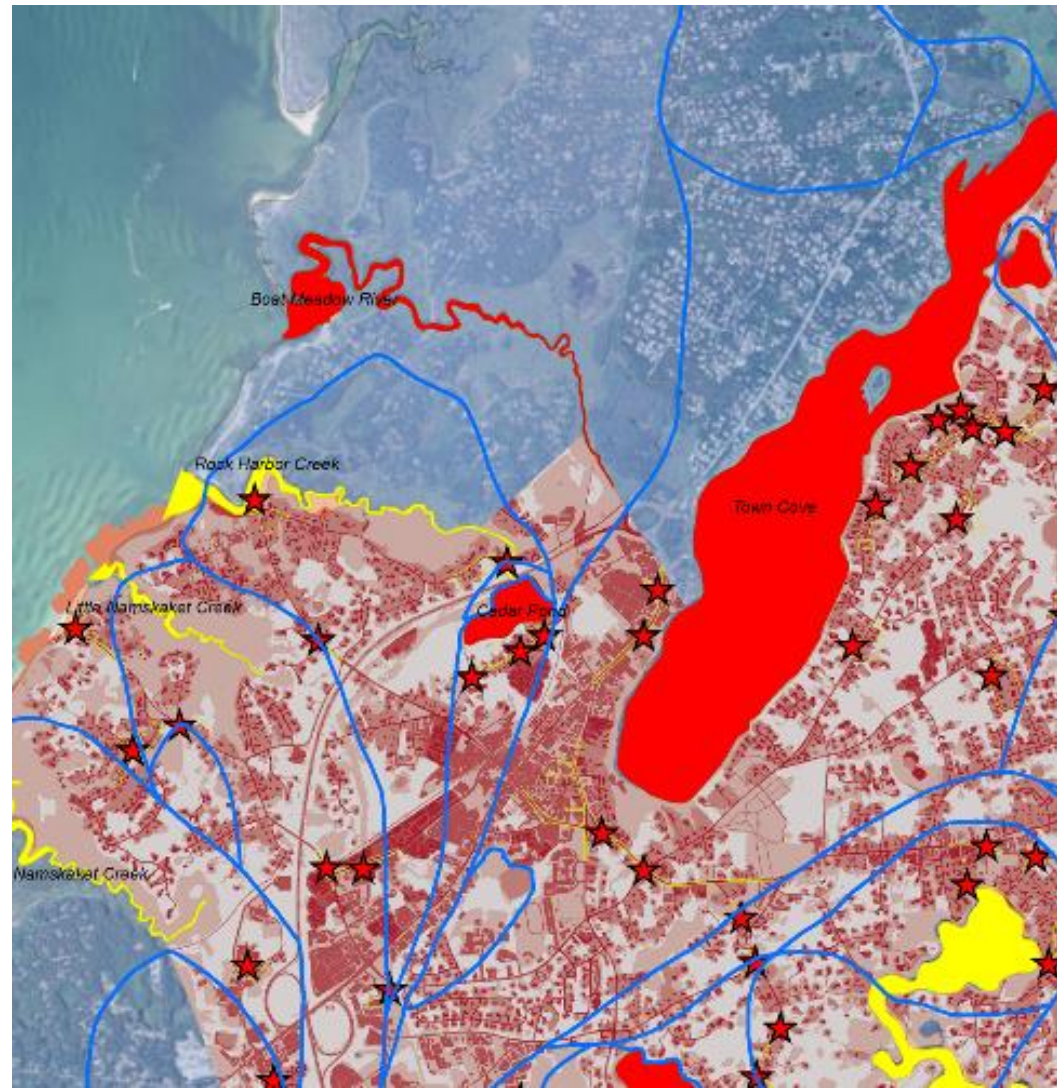
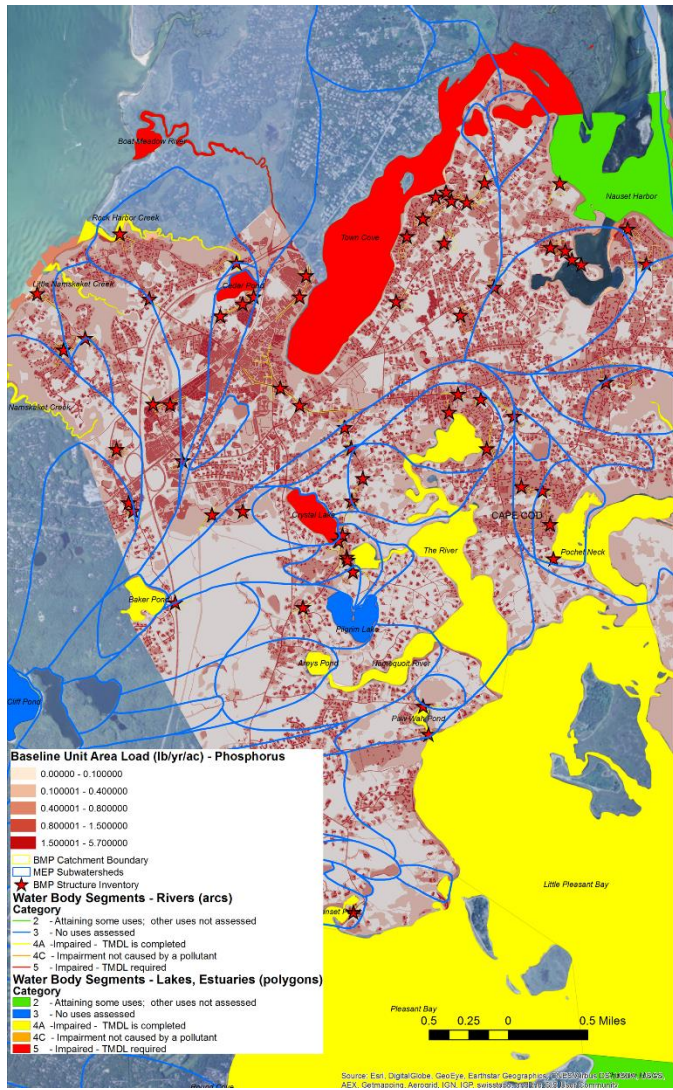




Decision Tool for Future Stormwater Projects



Integration of Watershed Planning Activities and Priorities



Fresh Water Pond Restoration Prioritization Criteria

- ▶ **Regulatory**
 - ▶ NPDES MS4 Permit and Integrated List
 - ▶ Herring runs
 - ▶ ACECs and Great Ponds
 - ▶ Beach closings
- ▶ **Public Use**
 - ▶ Swimming beaches
 - ▶ Boat ramps
- ▶ **Ecological**
 - ▶ WQ indicators and existing data
- ▶ **Past Projects Completed**
 - ▶ Invasive species management
 - ▶ Stormwater restoration
 - ▶ Watershed management activities
- ▶ **Planned Infrastructure Projects**
 - ▶ CWMP related projects
 - ▶ Road reconstruction
 - ▶ Other opportunities

Next Steps and Schedule

End of February 2017

- ▶ Complete delineation of all outfalls
- ▶ QA/QC all drainage catchments (desktop)
- ▶ QA/QC baseline pollutant loads
- ▶ Incorporate 2012 outfall inspection data
- ▶ Update GIS attribute data for infrastructure mapped by SMC

End of March 2017

- ▶ Incorporate costs for rehabilitation of existing BMPs
- ▶ Develop conceptual BMPs for priority watersheds and high pollutant loads
- ▶ Develop ALERT Tool dashboard
- ▶ Working meeting with Task Force