Appendix D

Site Evaluation Matrix from Consensus Plan

Watershed	Kg/yr Removal Targets					Unattenuated Stormwater/Fertilizer			Kg/yr removals (for Orleans only)		
	MEP	CCC Tracker (% method)	CCC Tracker (kg method)	Tracker (% method) Difference[5,6]	Tracker (kg method) Difference[5,6]	Stormwater (MEP)	Fertilizer (MEP)	SW + Fert (MEP)	Traditional Bookend (kg/yr)[1]	Non-Traditional Bookend (kg/yr)	Notes
Pleasant Bay											
Arey's Pond	142	141	140	-1%	-1%	58	28	86	269	114	CWMP over sewering based on MEP and Tracker.
Lonnies Pond	297	193	89	-35%	-70%	87	68	155	291	303	CWMP over sewering based on Tracker.
Meetinghouse Pond	1876	1602	1602	-15%	-15%	193	139	332	1602	1416	Traditional Bookend requires all lots to be sewered and by definition meets both MEP and Tracker regardless of the kg/year figure.
Namequoit River	367	340	313	-7%	-15%	97	69	166	579	275	Traditional Bookend exceeds CWMP sewer area due to in-shed disposal.
Paw Wah Pond	414	400	396	-3%	-4%	50	45	95	457	423	CWMP over sewering based on MEP and Tracker.
Pleasant Bay**	3210	3628	4047	13%	26%	863	3035	3898	AM*	AM*	
Pochet Neck	1569	1434	1362	-9%	-13%	269	223	492	1148	1200	CWMP under sewering according to MEP.
Quanset Pond	256	186	116	-27%	-55%	71	46	117	228	150	CWMP under sewering according to MEP.
The River - lower	524	454	383	-13%	-27%	144	106	250	371	345	Traditional Bookend exceeds CWMP sewer area to meet Tracker TMDLs. CWMP under sewering according to MEP and Tracker.
The River - upper	378	417	456	10%	21%	87	75	162	448	360	CWMP over sewering based on MEP and Tracker.
Sub-Totals	**9033**	**8795**	**8904**	**-3%**	**-1%**	**1919**	**3834**	**5753**			
Nauset Harbor											
Town Cove**	6643	5739	5436	-14%	-18%	771	508	1279	4282	5240	Traditional Bookend as currently shown calls for sewering 25 more lots than the CWMP for the "Downtown" economic development area. This is due to the Traditional Bookend not excluding any specific lots within the overall sewered area until a more detailed analysis is completed during the preliminary and final design. CWMP under sewering according to MEP.
Nauset Marsh	0	0	0	#DIV/0!	#DIV/0!	355	293	648	9	0	CWMP over sewering based on MEP and Tracker.
Mill Pond	0	0	0	#DIV/0!	#DIV/0!	140	135	275	626	0	CWMP over sewering based on MEP and Tracker. However recent data indicates nitrogen levels are above the threshold.
Wood Cove	0	0	0	#DIV/0!	#DIV/0!	21	18	39	0	0	
Rachael Cove	0	0	0	#DIV/0!	#DIV/0!	6	5	11	0	0	
Sub-Totals	**6643**	**5739**	**5436**	**-14%**	**-18%**	**1293**	**959**	**2252**			
Cape Cod Bay											
Namskaket Main	Not Available	-7833		#REF!	#VALUE!			0	0	0	
Namskaket Stream	Not Available	-1516		#REF!	#VALUE!			0	0	0	
Little Namskaket Marsh	-1808.21	-1180		#REF!	35%	161	139	300		0	Traditional Bookend exceeds CWMP sewer area to incorporate all of "Downtown".
Little Namskaket Creek	-27.01	-17		#REF!	37%	8	17	25	0	0	
Rock Harbor**	1951	1576	1473	-19%	-24%	140	183	323	1270		
Cedar Pond	0	0	-115	#DIV/0!	#DIV/0!	38	26	64	77		
Sub-Totals	**116**	**-8970**		**#REF!**	**7852%**	**347**	**365**	**712**			
	15676	14534	14340	-7.3%	-8.5%						

General Notes:

1. Traditional Bookend areas were specifically developed to mirror the CWMP Phases 1-6 except when the CWMP (with the fertilizer and stormwater credit) did NOT meet load reductions specified in Tracker.
2. The Non-Traditional Bookend was intentionally developed to meet the load reductions specified in Tracker, with the fertilizer and stormwater credit. Feedback to date from Stakeholders is to not take this credit.
3. The purpose of the Traditional and Non-Traditional Bookends was to create a "straw man" to which the stakeholders could respond. Now that the Bookends have been presented, we need feedback for the Hybrid, specifically:
    a. Which removal target (MEP or Tracker) to apply in Hybrid? Remember that WQ and technology performance to be evaluated during AMP.
        i. One approach with the Hybrid is to look at areas where sewering is more costly in Phase I and maybe move it to Phase II, given the inherent uncertainty in the load targets.
    b. Should sewer plan remove MEP loads, Tracker loads or stick with CWMP which over-sewers in several areas?
    c. How to handle fertilizer credits?
    d. How to handle stormwater credits?
4. Kg/yr output based on (CCC 2009-2011) average daily drinking water usage records and scenarios ran through tracker.
5. CCC Tracker uses the threshold septic load from MEP.
6. CCC Tracker changes the present septic load by using more recent land use and water use data.
7. Highlighted in green = meets MEP target (within 5%) or exceeds MEP target.
8. Highlighted Orange = meets Tracker target (within 5%) or exceeds Tracker target.
9. Highlighted Blue = meets Tracker target (within 5%) with fertilizer/stormwater credit.
10. Highlighted yellow = Traditional Bookend area is greater than the CWMP proposed sewer area.

* AM - Adaptive Management

** Denotes a sub-watershed that has multiple towns sharing in the responsibility of meeting the TMDL goal.

both agree with goal net reduction
differs with the current load (based on 2014/present day water u
CCC uses the threshold septic load from MEP

CCC changes the present septic load

Areys Pond Subwatershed
Hybrid #1 Evaluation Tool

Arey's Pond Statistics:
(Orleans only)
Total acreage = 7.57 acres
Total Number of Parcels = 67
Total Wastewater Flow (MVP) = ~7,400
Total Nitrogen Load (kg from MVP) = 269

		Number of Lots Sewered or Area/Quantities of NT Technologies	Flow (GPD)	Nutrient Removal Certainty: Nitrogen (Saltwater) Phosphorus (Freshwater)		Implementation Certainty*		Other Benefits: Ecosystems, Economic, Social		Adaptability to Uncertainty in Nutrient-Reduction Goals and Buildout		CEC removal: Yes = 1 No = 0	Non-Quantitative Factors Total Score	Cost
				Score	Description	Score	Description	Score	Description	Score	Description	Score		
MEP Goal Reduction for Total Watershed (kg/year)	142													
Nitrogen Removal Method	**kg/year Removed**													
Fertilizer (25% of MEP att)	6													
Stormwater	0													
PRB														
Floating Constructed Wetlands														
Aquaculture	136	**0.5M oysters, ~ 1 acre floating bags;**	NA	**3**	**N uptake in shell and soft tissue is well-documented**	**2**	**oysters already growing (upweller); main risks: catastrophic event causing die-off, mismanagement**	**3**	**rapid N removal, filtering for water clarity, denitrification, product has revenue potential and can create local economic activity, scalable**	**3**	**scalable, rapid test of load reduction goal**	**0**	**11**	**$$**
Coastal Habitat Restoration														
Eco-Toilets														
UD Eco-Toilets														
I/A Septic Systems														
Sewers	0													
Sub-Total Removed =	142													
Total Remaining =	0													

KEY
1 = LOW
2 = MEDIUM
3 = HIGH
Higher scores indicate more positive attributes

DISCLAIMERS: These numbers and cost scores are planning level estimates.
The scores for non-quantitative factors are starting points for discussion.

KEY (Cost/kg-N Removed: 20-Yr Present Worth Capital and O&M&M)
$ = 0 - $5,000
$$ = $5,000 - $10,000
$$$ = $10,000 - $15,000
$$$$ = $15,000 - $20,000
$$$$$ = $20,000 - $40,000

Alternate Technologies

Floating Constructed Wetlands	150	**400 sf to 11,500 sf, cost based on 3/4 of MAX (8700 sf)**	NA	**1**	**actual N removal per sf needs field verification**	**2**	**many examples of successful installations. main risks: actual size required, permitting uncertainty and mismanagement**	**3**	**creates complex habitat, filtering for water clarity, rapid water quality improvements, attractive**	**3**	**scalable, rapid test of load reduction goal**	**0**	**9**	**$ - $$**

Sewering (see Traditional Bookend)

GOOD AQUA/FCW DEMO should run MEP model to plan demo and understand its water quality impacts relative to mixing in entire watershed

***Implementation Certainty includes**

- **Permitting/regulatory** (how likely can permits be obtained)
- **Community and Town acceptance** of mix of technologies at the anticipated level of implementation
- **Management** and operation of project
- **Potential unintended consequences** (what we don't know)

Kescayo Ganset (Lonnies) Pond Subwatershed
Hybrid #1 Evaluation Tool

Kescayo Ganset (Lonnies) Pond Statistics: (Orleans only)
Total acreage = 18.23 acres
Total Number of Parcels = 131
Total Wastewater Flow (MVP) = ~11,000
Total Nitrogen Load (kg from MVP) = 360

		Number of Lots Sewered or Area/Quantities of NT Technologies	Flow (GPD)	Nutrient Removal Certainty: Nitrogen (Saltwater) Phosphorus (Freshwater)		Implementation Certainty*		Other Benefits: Ecosystems, Economic, Social		Adaptability to Uncertainty in Nutrient-Reduction Goals and Buildout		CEC removal: Yes = 1 No = 0	Non-Quantitative Factors Total Score	Cost
				Score	Description	Score	Description	Score	Description	Score	Description	Score		
MEP Goal Reduction for Total Watershed (kg/year)	297													
Nitrogen Removal Method	**kg/year Removed**													
Fertilizer (25% of MEP att)	8													
Stormwater	0	credit once BMP is quantified												
PRB	150	700 feet, Herring Brook Way (56 properties)	NA	3	N-removal well-documented, local verification needed	2	site characterization needed for final determination on feasibility, unintended downstream chemistry	2	rapid water quality improvements, captures all present and future upstream N load to groundwater	3	scalable, rapid test of load reduction goal	1	11	$$ - $$$
Floating Constructed Wetlands	150	400 sf to 11,500 sf, cost based on 3/4 of MAX (8700 sf)	NA	1	actual N removal per sf needs field verification	2	many examples of successful installations. main risks: actual size required, permitting uncertainty and mismanagement	3	creates complex habitat, filtering for water clarity, rapid water quality improvements, attractive	3	scalable, rapid test of load reduction goal	0	9	$$
Aquaculture														
Coastal Habitat Restoration														
Eco-Toilets														
UD Eco-Toilets														
I/A Septic Systems														
Sewers	0													
Sub-Total Removed =	308													
Total Remaining =	-11													

KEY
1 = LOW
2 = MEDIUM
3 = HIGH
Higher scores indicate more positive attributes

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KEY (Cost/kg-N Removed: 20-Yr Present Worth Capital and O&M&M)
$ = 0 - $5,000
$$ = $5,000 - $10,000
$$$ = $10,000 - $15,000
$$$$ = $15,000 - $20,000
$$$$$ = $20,000 - $40,000

Alternate Technologies

Aquaculture/CHR	290	~ 1 acre reef with remote set and trays; 1M oysters or quahogs	NA	3	N uptake in shell and soft tissue is well-documented	1	remote set in trays proven method to minimize predation, need field verification; main risks: catastrophic event causing die-off, mismanagement	3	rapid N removal, filtering for water clarity, denitrification and other reef habitat, less economic benefit than aquaculture, scalable	3	scalable, rapid test of load reduction goal	0	10	$
Floating Constructed Wetlands	290	750 sf to 23,000 sf, cost based on 3/4 of MAX (17000 sf)	NA	1	actual N removal per sf needs field verification	2	many examples of successful installations, minimal management needs. main risks: actual size required, permitting uncertainty robustness over time	3	creates complex habitat, filtering for water clarity, rapid water quality improvements, attractive	3	scalable, rapid test of load reduction goal	0	9	$ - $$

Sewering (see Traditional Bookend)

GOOD PRB DEMO should run MEP model to plan demo and understand its water quality impacts relative to mixing in entire watershed

***Implementation Certainty includes**

- **Permitting/regulatory** (how likely can permits be obtained)
- **Community and Town acceptance** of mix of technologies at the anticipated level of implementation
- **Management** and operation of project
- **Potential unintended consequences** (what we don't know)

Meetinghouse Pond Subwatershed
Hybrid #1 Evalutaion Tool

Meetinghouse Pond Statistics:
(Orleans only)
Total acreage = 26.82 acres
Total Number of Parcels = 338
Total Wastewater Flow (MVP) = ~44,000
Total Nitrogen Load (kg from MVP) = 1876

		Number of Lots Sewered or Area/Quantities of NT Technologies	Flow (GPD)	Nutrient Removal Certainty: Nitrogen (Saltwater) Phosphorus (Freshwater)		Implementation Certainty*		Other Benefits: Ecosystems, Economic, Social		Adaptability to Uncertainty in Nutrient-Reduction Goals and Buildout		CEC removal: Yes = 1 No = 0	Non-Quantitative Factors Total Score	Cost
				Score	Description	Score	Description	Score	Description	Score	Description	Score		
MEP Goal Reduction for Total Watershed (kg/year)	1876													
Nitrogen Removal Method	**kg/year Removed**													
Fertilizer (25% of MEP att)	35													
Stormwater	0													
PRB														
Floating Constructed Wetlands														
Aquaculture														
Coastal Habitat Restoration	150	**~ 0.5 acre reef with remote set and trays; ~0.5 M oysters**	NA	**3**	**N uptake in shell and soft tissue is well-documented**	**2**	**remote set in trays proven method to minimize predation and maximize oysters per unit area, need field verification of viability; main risks: catastropic event causing die-off, mismanagement**	**3**	**rapid N removal, filtering for water clarity, denitrification and other reef habitat, less economic benefit than aquaculture**	**3**	**allows higher density areas to be sewered, scalable**	**0**	**11**	**$-$$**
Eco-Toilets														
UD Eco-Toilets														
I/A Septic Systems														
Sewers	1749	**311**	**40646**	**3**		**3**		**3**	**addresses sanitary needs, supports economic centers**	**3**	**areas of uncertainty can be delayed to future phases, scalable**	**1**	**13**	**$$$**
Sub-Total Removed =	1934													
Total Remaining =	-58													

KEY
1 = LOW
2 = MEDIUM
3 = HIGH
Higher scores indicate more positive attributes

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KEY (Cost/kg-N Removed: 20-Yr Present Worth Capital and O&M&M)
$ = 0 - $5,000
$$ = $5,000 - $10,000
$$$ = $10,000 - $15,000
$$$$ = $15,000 - $20,000
$$$$$ = $20,000 - $40,000

Alternate Technologies

PRB (overlaps sewer area)	260	**1500 feet, Loomis Lane (78 properties)**	NA	**3**	**N-removal well-documented, local verification needed**	**1**	**significant uncertainty regarding gw flow in this watershed. site characterization needed for final determination on feasibility, unintended downstream chemistry**	**2**	**rapid water quality improvements, captures all present and future upstream N load to groundwater**	**3**	**scalable, rapid test of load reduction goal**	**1**	**10**	**$$ - $$$**
Floating Constructed Wetland	150	**400 sf to 11,500 sf, cost based on 3/4 of MAX (8700 sf)**	NA	**1**	**actual N removal per sf needs field verification**	**2**	**many examples of successful installations, minimal management needs. main risks: actual size required, permitting unceratinty robustness over time**	**3**	**creates complex habitat, filtering for water clarity, rapid water quality improvements, attractive**	**3**	**scalable, rapid test of load reduction goal**	**0**	**9**	**$ - $$**
Innovative/Alternative Septic Systems	1749	**583**	NA	**3**	**Permitting and Monitoring**	**2**	**a few advanced systems available for single family installations, requires maintanance and management**	**2**	**addresses sanitary needs, supports economic centers**	**3**	**can install in more homes**	**0**	**10**	**$$$$**

***Implementation Certainty includes**

- **Permitting/regulatory** (how likely can permits be obtained)
- **Community and Town acceptance** of mix of technologies at the anticipated level of implementation
- **Management** and operation of project
- **Potential unintended consequences** (what we don't know)

Namequoit River Subwatershed
Hybrid #1 Evalutaion Tool

Namequoit River Statistics:
(Orleans only)
Total acreage = 26.35 acres
Total Number of Parcels = 209
Total Wastewater Flow (MVP)= ~23,000
Total Nitrogen Load (kg from MVP) = 716

		Number of Lots Sewered or Area/Quantities of NT Technologies	Flow (GPD)	Nutrient Removal Certainty: Nitrogen (Saltwater) Phosphorus (Freshwater)		Implementation Certainty*		Other Benefits: Ecosystems, Economic, Social		Adaptability to Uncertainty in Nutrient-Reduction Goals and Buildout		CEC removal: Yes = 1 No = 0	Non-Quantitative Factors Total Score	Cost
				Score	Description	Score	Description	Score	Description	Score	Description	Score		
MEP Goal Reduction for Total Watershed (kg/year)	367													
Nitrogen Removal Method	**kg/year Removed**													
Fertilizer (25% of MEP att)	15													
Stormwater	0													
PRB														
Floating Constructed Wetlands	350	**875 sf to 27,000 sf, cost based on 3/4 of MAX (20,000)**	NA	**1**	**actual N removal per sf needs field verification**	**2**	**many examples of successful installations, minimal management needs. main risks: actual size required, permitting unceratinty robustness over time**	**3**	**creates complex habitat, filtering for water clarity, rapid water quality improvements, attractive**	**3**	**scalable, rapid test of load reduction goal**	**0**	**9**	**$-$$**
Aquaculture														
Coastal Habitat Restoration														
Eco-Toilets														
UD Eco-Toilets														
I/A Septic Systems														
Sewers	0													
Sub-Total Removed =	365													
Total Remaining =	2													

KEY
1 = LOW
2 = MEDIUM
3 = HIGH
Higher scores indicate more positive attributes

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The scores for non-quantitative factors are starting points for discussion.

KEY (Cost/kg-N Removed: 20-Yr Present Worth Capital and O&M&M)
$ = 0 - $5,000
$$ = $5,000 - $10,000
$$$ = $10,000 - $15,000
$$$$ = $15,000 - $20,000
$$$$$ = $20,000 - $40,000

Alternate Technologies

Coastal Habitat Restoration	350	**~ 1.5 acre reef with remote set and trays; 1.5 M oysters or quahogs**	NA	**3**	**N uptake in shell and soft tissue is well-documented**	**2**	**remote set in trays proven method to minimize predation and maximize oysters per unit area, need field verification of viability; main risks: catastropic event causing die-off, mismanagement**	**3**	**rapid N removal, filtering for water clarity, denitrification and other reef habitat, less economic benefit than aquaculture, scalable**	**3**	**scalable, rapid test of load reduction goal**	**0**	**11**	**$**
PRB	200	**2000 feet, Namequoit Rd (70 properties)**	NA	**3**	**N-removal well-documented, local verification needed**	**2**	**site characterization needed for final determination on feasibility, unintended downstream chemistry**	**2**	**rapid water quality improvements, captures all present and future upstream N load to groundwater**	**3**	**scalable, rapid test of load reduction goal**	**1**	**11**	**$$ - $$$**

Sewering (see Traditional Bookend)

GOOD FCW DEMO should run MEP model to plan demo and understand its water quality impacts relative to mixing in entire watershed

***Implementation Certainty includes**

- **Permitting/regulatory** (how likely can permits be obtained)
- **Community and Town acceptance** of mix of technologies at the anticipated level of implementation
- **Management** and operation of project
- **Potential unintended consequences** (what we don't know)

Paw Wah Subwatershed
Hybrid #1 Evalutaion Tool

Paw Wah Statistics:
(Orleans only)
Total acreage = 15.93 acres
Total Number of Parcels = 127
Total Wastewater Flow (MVP)= ~14,700
Total Nitrogen Load (kg from MVP) = 534

		Number of Lots Sewered or Area/Quantities of NT Technologies	Flow (GPD)	Nutrient Removal Certainty: Nitrogen (Saltwater) Phosphorus (Freshwater)		Implementation Certainty*		Other Benefits: Ecosystems, Economic, Social		Adaptability to Uncertainty in Nutrient-Reduction Goals and Buildout		CEC removal: Yes = 1 No = 0	Non-Quantitative Factors Total Score	Cost
				Score	Description	Score	Description	Score	Description	Score	Description	Score		
MEP Goal Reduction for Total Watershed (kg/year)	414													
Nitrogen Removal Method	**kg/year Removed**													
Fertilizer (25% of MEP att)	11													
Stormwater	0													
PRB	323	**1200 feet, Lockwood Lane (87 properties)**	NA	**3**	**N-removal well-documented, local verification needed**	**2**	**site characterization needed for final determination on feasibility, unintended downstream chemistry**	**2**	**rapid water quality improvements, captures all present and future upstream N load to groundwater**	**3**	**scalable, rapid test of load reduction goal**	**1**	**11**	**$$**
Floating Constructed Wetlands														
Aquaculture														
Coastal Habitat Restoration	80	**~ 0.33 acre oyster reef or 0.3M quahogs**	NA	**3**	**N uptake in shell and soft tissue is well-documented**	**2**	**remote set in trays proven method to minimize predation and maximize oysters per unit area, need field verification of viability; main risks: catastropic event causing die-off, mismanagement**	**3**	**rapid N removal, filtering for water clarity, denitrification and other reef habitat, less economic benefit than aquaculture**	**3**	**scalable, rapid test of load reduction goal**	**0**	**11**	**$$**
Eco-Toilets														
UD Eco-Toilets														
I/A Septic Systems														
Sewers	0													
Sub-Total Removed =	414													
Total Remaining =	0													

KEY
1 = LOW
2 = MEDIUM
3 = HIGH
Higher scores indicate more positive attributes

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KEY (Cost/kg-N Removed: 20-Yr Present Worth Capital and O&M&M)
$ = 0 - $5,000
$$ = $5,000 - $10,000
$$$ = $10,000 - $15,000
$$$$ = $15,000 - $20,000
$$$$$ = $20,000 - $40,000

Alternate Technologies

Floating Constructed Wetlands	320	**800 sf to 25,000 sf, cost based on 3/4 of MAX (18,000 sf)**	NA	**1**	**actual N removal per sf needs field verification**	**2**	**many examples of successful installations, minimal management needs. main risks: actual size required, permitting unceratinty robustness over time**	**3**	**creates complex habitat, filtering for water clarity, rapid water quality improvements, attractive**	**3**	**scalable, rapid test of load reduction goal**	**0**	**9**	**$ - $$**

Sewering (see Traditional Bookend)

GOOD PRB DEMO should run MEP model to plan demo and understand its water quality impacts relative to mixing in entire watershed

If sewered, this would import into LT 10, or Nameuoit depending on which returns

***Implementation Certainty includes**

- **Permitting/regulatory** (how likely can permits be obtained)
- **Community and Town acceptance** of mix of technologies at the anticipated level of implementation
- **Management** and operation of project
- **Potential unintended consequences** (what we don't know)

Pochet Neck Subwatershed
Hybrid #1 Evalutaion Tool

Pochet Neck Statistics:
(Orleans only)
Total acreage = 70.14 acres
Total Number of Parcels = 551
Total Wastewater Flow (MVP) = ~62,000
Total Nitrogen Load (kg from MVP) = 2,211

		Number of Lots Sewered or Area/Quantities of NT Technologies	Flow (GPD)	Nutrient Removal Certainty: Nitrogen (Saltwater) Phosphorus (Freshwater)		Implementation Certainty*		Other Benefits: Ecosystems, Economic, Social		Adaptability to Uncertainty in Nutrient-Reduction Goals and Buildout		CEC removal: Yes = 1 No = 0	Non-Quantitative Factors Total Score	Cost
				Score	Description	Score	Description	Score	Description	Score	Description	Score		
MEP Goal Reduction for Total Watershed (kg/year)	1569													
Nitrogen Removal Method	**kg/year Removed**													
Fertilizer (25% of MEP att)	60													
Stormwater	0													
PRB														
Floating Constructed Wetlands	440	1100 sf to 34,000 sf, cost based on 3/4 of MAX (25,000 sf)	NA	1	actual N removal per sf needs field verification	1	many examples of successful installations, minimal management needs. main risks: actual size required, permitting unceratinty robustness over time	3	creates complex habitat, filtering for water clarity, rapid water quality improvements, attractive	3	scalable, rapid test of load reduction goal	0	8	$
Aquaculture														
Coastal Habitat Restoration	520	~ 2 acre reef with remote set and trays initially, may lead to reef without trays; 2M oysters or quahogs (bottom planted)	NA	3	N uptake in shell and soft tissue is well-documented	2	remote set in trays proven method to minimize predation and maximize oysters per unit area, need field verification of viability; main risks: catastropic event causing die-off, mismanagement	3	rapid N removal, filtering for water clarity, denitrification and other reef habitat, less economic benefit than aquaculture	3	scalable, rapid test of load reduction goal	0	11	$
Eco-Toilets														
UD Eco-Toilets														
I/A Septic Systems														
Sewers	627	154	18331	3		3		3	addresses sanitary needs, supports economic centers	3	areas of uncertainty can be delayed to future phases, scalable	1	13	$$$
Sub-Total Removed =	1647													
Total Remaining =	-78													

KEY
1 = LOW
2 = MEDIUM
3 = HIGH
Higher scores indicate more positive attributes

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The scores for non-quantitative factors are starting points for discussion.

KEY (Cost/kg-N Removed: 20-Yr Present Worth Capital and O&M&M)
$ = 0 - $5,000
$$ = $5,000 - $10,000
$$$ = $10,000 - $15,000
$$$$ = $15,000 - $20,000
$$$$$ = $20,000 - $40,000

Alternate Technologies

PRB	238	1500', Briar Spring Road (77 properties)	NA	3	N-removal well-documented, local verification needed	2	site characterization needed for final determination on feasibility, unintended downstream chemistry	2	rapid water quality improvements, captures all present and future upstream N load to groundwater	3	scalable, rapid test of load reduction goal	1	11	$$$

Sewering (see Traditional Bookend)

***Implementation Certainty includes**

- **Permitting/regulatory** (how likely can permits be obtained)
- **Community and Town acceptance** of mix of technologies at the anticipated level of implementation
- **Management** and operation of project
- **Potential unintended consequences** (what we don't know)

Quanset Subwatershed
Hybrid #1 Evaluation Tool

Quanset Statistics:
(Orleans only)
Total acreage = 8.62 acres
Total Number of Parcels = 50
Total Wastewater Flow (MVP) = ~7,400
Total Nitrogen Load (kg from MVP) = 268

		Number of Lots Sewered or Area/Quantities of NT Technologies	Flow (GPD)	Nutrient Removal Certainty: Nitrogen (Saltwater) Phosphorus (Freshwater)		Implementation Certainty*		Other Benefits: Ecosystems, Economic, Social		Adaptability to Uncertainty in Nutrient-Reduction Goals and Buildout		CEC removal: Yes = 1 No = 0	Non-Quantitative Factors Total Score	Cost
				Score	Description	Score	Description	Score	Description	Score	Description	Score		
MEP Goal Reduction for Total Watershed (kg/year)	256													
Nitrogen Removal Method	**kg/year Removed**													
Fertilizer (25% of MEP att)	6													
Stormwater	0													
PRB														
Floating Constructed Wetlands	250	**625 sf to 19,200 sf, cost based on 3/4 of MAX (15,000)**	NA	**1**	**actual N removal per sf needs field verification**	**1**	**many examples of successful installations, minimal management needs. main risks: actual size required, permitting uncertainty robustness over time**	**3**	**creates complex habitat, filtering for water clarity, rapid water quality improvements, attractive**	**3**	**scalable, rapid test of load reduction goal**	**0**	**8**	**$-$$**
Aquaculture														
Coastal Habitat Restoration														
Eco-Toilets														
UD Eco-Toilets														
I/A Septic Systems														
Sewers	21	**19**	**2334**	**3**		**3**		**3**	**addresses sanitary needs, supports economic centers**	**3**	**areas of uncertainty can be delayed to future phases, scalable**	**1**	**13**	**$**
Sub-Total Removed =	277													
Total Remaining =	-21													

KEY
1 = LOW
2 = MEDIUM
3 = HIGH
Higher scores indicate more positive attributes

DISCLAIMERS: These numbers and cost scores are planning level estimates.
The scores for non-quantitative factors are starting points for discussion.

KEY (Cost/kg-N Removed: 20-Yr Present Worth Capital and O&M&M)
$ = 0 - $5,000
$$ = $5,000 - $10,000
$$$ = $10,000 - $15,000
$$$$ = $15,000 - $20,000
$$$$$ = $20,000 - $40,000

DEMO site for FCW should run MEP model to plan demo and understand its water quality impacts relative to mixing in entire watershed

Alternate Technologies

Coastal Habitat Restoration	250	**~ 1 acre reef with remote set and trays initially, may lead to reef without trays**	NA	**3**	**N uptake in shell and soft tissue is well-documented**	**2**	**remote set in trays proven method to minimize predation and maximize oysters per unit area, need field verification of viability; main risks: catastrophic event causing die-off, mismanagement**	**3**	**rapid N removal, filtering for water clarity, denitrification and other reef habitat, less economic benefit than aquaculture, scalable**	**3**	**scalable, rapid test of load reduction goal**	**0**	**11**	**$**

Sewering (see Traditional Bookend)

***Implementation Certainty includes**

- **Permitting/regulatory** (how likely can permits be obtained)
- **Community and Town acceptance** of mix of technologies at the anticipated level of implementation
- **Management** and operation of project
- **Potential unintended consequences** (what we don't know)

The River Upper Subwatershed
Hybrid #1 Evaluation Tool

The River Upper Statistics:
(Orleans only)
Total acreage = 24.5 acres
Total Number of Parcels = 200
Total Wastewater Flow (MVP) = ~21,000
Total Nitrogen Load (kg from MVP) = 664

		Number of Lots Sewered or Area/Quantities of NT Technologies	Flow (GPD)	Nutrient Removal Certainty: Nitrogen (Saltwater) Phosphorus (Freshwater)		Implementation Certainty*		Other Benefits: Ecosystems, Economic, Social		Adaptability to Uncertainty in Nutrient-Reduction Goals and Buildout		CEC removal: Yes = 1 No = 0	Non-Quantitative Factors Total Score	Cost
				Score	Description	Score	Description	Score	Description	Score	Description	Score		
MEP Goal Reduction for Total Watershed (kg/year)	378													
Nitrogen Removal Method	**kg/year Removed**													
Fertilizer (25% of MEP att)	16													
Stormwater	0													
PRB														
Floating Constructed Wetlands	175	**400 sf to 13,000 sf, cost based on 3/4 of MAX (10,000)**	NA	**1**	**actual N removal per sf needs field verification**	**1**	**many examples of successful installations, minimal management needs. main risks: actual size required, permitting uncertainty robustness over time**	**3**	**creates complex habitat, filtering for water clarity, rapid water quality improvements, attractive**	**3**	**scalable, rapid test of load reduction goal**	**0**	**8**	**$-$$**
Aquaculture														
Coastal Habitat Restoration	0													
Eco-Toilets														
UD Eco-Toilets														
I/A Septic Systems														
Sewers	188	**47**	**4765**	**3**		**3**		**3**	**addresses sanitary needs, supports economic centers**	**3**	**areas of uncertainty can be delayed to future phases, scalable**	**1**	**13**	**$$$**
Sub-Total Removed =	379													
Total Remaining =	-1													

KEY
1 = LOW
2 = MEDIUM
3 = HIGH
Higher scores indicate more positive attributes

DISCLAIMERS: These numbers and cost scores are planning level estimates.
The scores for non-quantitative factors are starting points for discussion.

KEY (Cost/kg-N Removed: 20-Yr Present Worth Capital and O&M&M)
$ = 0 - $5,000
$$ = $5,000 - $10,000
$$$ = $10,000 - $15,000
$$$$ = $15,000 - $20,000
$$$$$ = $20,000 - $40,000

GOOD FCW DEMO should run MEP model to plan demo and understand its water quality impacts relative to mixing in entire watershed

Alternate Technologies

Aquaculture	175	**0.75M oysters, ~ 2 acre floating bags;**	NA	**3**	**N uptake in shell and soft tissue is well-documented**	**2**	**field test of viability needed. main risks: catastrophic event causing die-off, mismanagement**	**3**	**rapid N removal, filtering for water clarity, denitrification, product has revenue potential and can create local economic activity, scalable**	**3**	**scalable, rapid test of load reduction goal**	**0**	**11**	**$$**
Coastal Habitat Restoration	175	**~ 3/4 acre reef with remote set and trays; .75M oysters or quahogs**	NA	**3**	**N uptake in shell and soft tissue is well-documented**	**2**	**remote set in trays proven method to minimize predation and maximize oysters per unit area, need field verification of viability; main risks: catastrophic event causing die-off, mismanagement**	**3**	**rapid N removal, filtering for water clarity, denitrification and other reef habitat, less economic benefit than aquaculture, scalable**	**3**	**scalable, rapid test of load reduction goal**	**0**	**11**	**$$**

Sewering (see Traditional Bookend)

NOTES:
less room in upper river
If sewer in all of Meetinghouse Pond, Upper River should be sewered

***Implementation Certainty includes**

- **Permitting/regulatory** (how likely can permits be obtained)
- **Community and Town acceptance** of mix of technologies at the anticipated level of implementation
- **Management** and operation of project
- **Potential unintended consequences** (what we don't know)

The River Lower Subwatershed
Hybrid #1 Evaluation Tool

The River Lower Statistics:
(Orleans only)
Total acreage = 34.34 acres
Total Number of Parcels = 226
Total Wastewater Flow (MVP) = ~25,000
Total Nitrogen Load (kg from MVP) = 907

		Number of Lots Sewered or Area/Quantities of NT Technologies	Flow (GPD)	Nutrient Removal Certainty: Nitrogen (Saltwater) Phosphorus (Freshwater)		Implementation Certainty*		Other Benefits: Ecosystems, Economic, Social		Adaptability to Uncertainty in Nutrient-Reduction Goals and Buildout		CEC removal: Yes = 1 No = 0	Non-Quantitative Factors Total Score	Cost
				Score	Description	Score	Description	Score	Description	Score	Description	Score		
MEP Goal Reduction for Total Watershed (kg/year)	524													
Nitrogen Removal Method	**kg/year Removed**													
Fertilizer (25% of MEP att)	23													
Stormwater	0													
PRB														
Floating Constructed Wetlands														
Aquaculture														
Coastal Habitat Restoration	530	**~ 2 acre reef with remote set and trays initially; 2M oysters or quahogs (which would be bottom planted)**	NA	**3**	**N uptake in shell and soft tissue is well-documented**	**2**	**remote set in trays proven method to minimize predation and maximize oysters per unit area, need field verification of viability; main risks: catastrophic event causing die-off, mismanagement**	**3**	**rapid N removal, filtering for water clarity, denitrification and other reef habitat, less economic benefit than aquaculture**	**3**	**scalable, rapid test of load reduction goal**	**0**	**11**	**$**
Eco-Toilets														
UD Eco-Toilets														
I/A Septic Systems														
Sewers	25	**8**	**676**	**3**		**3**		**3**	**addresses sanitary needs, supports economic centers**	**3**	**areas of uncertainty can be delayed to future phases, scalable**	**1**	**13**	**$**
Sub-Total Removed =	578													
Total Remaining =	-54													

KEY
1 = LOW
2 = MEDIUM
3 = HIGH
Higher scores indicate more positive attributes

DISCLAIMERS: These numbers and cost scores are planning level estimates.
The scores for non-quantitative factors are starting points for discussion.

KEY (Cost/kg-N Removed: 20-Yr Present Worth Capital and O&M&M)
$ = 0 - $5,000
$$ = $5,000 - $10,000
$$$ = $10,000 - $15,000
$$$$ = $15,000 - $20,000
$$$$$ = $20,000 - $40,000

Alternate Technologies

Floating Constructed Wetlands	530	**1300 sf to 41,000 sf, cost based on 3/4 of MAX (31,000 sf)**	NA	**1**	**actual N removal per sf needs field verification**	**1**	**many examples of successful installations, minimal management needs. main risks: actual size required, permitting uncertainty robustness over time**	**3**	**creates complex habitat, filtering for water clarity, rapid water quality improvements, attractive**	**3**	**scalable, rapid test of load reduction goal**	**0**	**8**	**$-$$**

Sewering (see Traditional Bookend)

***Implementation Certainty includes**

- **Permitting/regulatory** (how likely can permits be obtained)
- **Community and Town acceptance** of mix of technologies at the anticipated level of implementation
- **Management** and operation of project
- **Potential unintended consequences** (what we don't know)

Pleasant Bay Subwatershed
Hybrid #1 Evaluation Tool

Pleasant Bay Main Basin Statistics: (Orleans only)
Total acreage = 161 acres
Total Number of Parcels = 638
Total Wastewater Flow (MVP) = ~71,500
Total Nitrogen Load (kg from MVP) = 2,325

MEP Goal Reduction for Total Watershed (kg/year)	3210
Nitrogen Removal Method	**kg/year Removed**
Fertilizer (25% of MEP att)	751
Stormwater	0
PRB	
Floating Constructed Wetlands	
Aquaculture	620
Coastal Habitat Restoration	
Eco-Toilets	
UD Eco-Toilets	
I/A Septic Systems	
Removal by Other Town(s)	995
Sewers	868
Sub-Total Removed =	3234
Total Remaining =	-24

	Number of Lots Sewered or Area/Quantities of NT Technologies	Flow (GPD)	Nutrient Removal Certainty: Nitrogen (Saltwater) Phosphorus (Freshwater)		Implementation Certainty*		Other Benefits: Ecosystems, Economic, Social		Adaptability to Uncertainty in Nutrient-Reduction Goals and Buildout		CEC removal: Yes = 1 No = 0	Non-Quantitative Factors Total Score	Cost
			Score	Description	Score	Description	Score	Description	Score	Description	Score		
Aquaculture	Program to ensure that ~2.5 M oysters or quahogs are grown within existing grants annually	NA	3	N uptake in shell and soft tissue is well-documented	2	oysters already growing (grants); main risks: catastrophic event causing die-off, industry cooperation	3	rapid N removal, filtering for water clarity, denitrification, product has revenue potential and can create local economic activity	3	scalable, rapid test of load reduction goal	0	11	$
Sewers	290	34,551	3		3		3	addresses sanitary needs, supports economic centers	3	areas of uncertainty can be delayed to future phases, scalable	1	13	$$$$

KEY
1 = LOW
2 = MEDIUM
3 = HIGH
Higher scores indicate more positive attributes

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The scores for non-quantitative factors are starting points for discussion.

KEY (Cost/kg-N Removed: 20-Yr Present Worth Capital and O&M&M)
$ = 0 - $5,000
$$ = $5,000 - $10,000
$$$ = $10,000 - $15,000
$$$$ = $15,000 - $20,000
$$$$$ = $20,000 - $40,000

Alternate Technologies

Innovative/Alternative Septic Systems	868	289	NA	3	Permitting and Monitoring	2	a few advanced systems available for single family installations, requires maintanance and management	2	addresses sanitary needs, supports economic centers	3	can install in more homes	0	10	$$$$

***Implementation Certainty includes**

- **Permitting/regulatory** (how likely can permits be obtained)
- **Community and Town acceptance** of mix of technologies at the anticipated level of implementation
- **Management** and operation of project
- **Potential unintended consequences** (what we don't know)

Town Cove Subwatershed
Hybrid #1 Evaluation Tool

Town Cove Statistics:
(Orleans only)
Total acreage = 98.65 acres
Total Number of Parcels = 1024
Total Wastewater Flow (MVP) = ~155,000
Total Nitrogen Load (kg from MVP) = 5550

		Number of Lots Sewered or Area/Quantities of NT Technologies	Flow (GPD)	Nutrient Removal Certainty: Nitrogen (Saltwater) Phosphorus (Freshwater)		Implementation Certainty*		Other Benefits: Ecosystems, Economic, Social		Adaptability to Uncertainty in Nutrient-Reduction Goals and Buildout		CEC removal: Yes = 1 No = 0	Non-Quantitative Factors Total Score	Cost
				Score	Description	Score	Description	Score	Description	Score	Description	Score		
MEP Goal Reduction for Total Watershed (kg/year)	6643													
Nitrogen Removal Method	**kg/year Removed**													
Fertilizer (25% of MEP att)	126													
Stormwater	0													
PRB	900	**3600 feet, Gibson Road (~250 properties)**	NA	**3**	**N-removal well-documented, local verification needed**	**2**	**site characterization needed for final determination on feasibility, unintended downstream chemistry**	**2**	**rapid water quality improvements, captures all present and future upstream N load to groundwater**	**3**	**scalable, rapid test of load reduction goal**	**1**	**11**	**$$**
Floating Constructed Wetlands														
Aquaculture	600	**~ 2.5 acre reef/remote set with trays and/or mix with quahogs; 3M oysters or quahogs total**	NA	**3**	**N uptake in shell and soft tissue is well-documented**	**2**	**remote set in trays proven method to minimize predation, need field verification; main risks: catastrophic event causing die-off, mismanagement**	**3**	**rapid N removal, filtering for water clarity, denitrification and other reef habitat, less economic benefit than aquaculture**	**3**	**scalable, rapid test of load reduction goal**	**0**	**11**	**$**
Coastal Habitat Restoration														
Eco-Toilets														
UD Eco-Toilets														
I/A Septic Systems														
Removal by Other Town(s)	1827													
Sewers	3226	**504**	**97,162**	**3**		**3**		**3**	**addresses sanitary needs, supports economic centers**	**3**	**areas of uncertainty can be delayed to future phases, scalable**	**1**	**13**	**$$$**
Sub-Total Removed =	6679													
Total Remaining =	-36													

KEY
1 = LOW
2 = MEDIUM
3 = HIGH
Higher scores indicate more positive attributes

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The scores for non-quantitative factors are starting points for discussion.

KEY (Cost/kg-N Removed: 20-Yr Present Worth Capital and O&M&M)
$ = 0 - $5,000
$$ = $5,000 - $10,000
$$$ = $10,000 - $15,000
$$$$ = $15,000 - $20,000
$$$$$ = $20,000 - $40,000

Alternate Technologies

PRB	1030	**1000 feet, Main St (~180 properties)**	NA	**3**	**N-removal well-documented, local verification needed**	**2**	**site characterization needed for final determination on feasibility, unintended downstream chemistry**	**2**	**rapid water quality improvements, captures all present and future upstream N load to groundwater**	**3**	**scalable, rapid test of load reduction goal**	**1**	**11**	**$**
Floating Constructed Wetlands	600	**1500 sf to 46,000 sf, cost based on 3/4 of MAX (35,000)**	NA	**1**	**actual N removal per sf needs field verification**	**1**	**many examples of successful installations, minimal management needs. main risks: actual size required, permitting uncertainty robustness over time**	**3**	**creates complex habitat, filtering for water clarity, rapid water quality improvements, attractive**	**3**	**scalable, rapid test of load reduction goal**	**0**	**8**	**$-$$**
Innovative/Alternative Septic Systems	3226	**1075**	NA	**3**	**Permitting and Monitoring**	**2**	**a few advanced systems available for single family installations, requires maintanance and management**	**2**	**addresses sanitary needs, supports economic centers**	**3**	**can install in more homes**	**0**	**10**	**$$$$**

***Implementation Certainty includes**

- **Permitting/regulatory** (how likely can permits be obtained)
- **Community and Town acceptance** of mix of technologies at the anticipated level of implementation
- **Management** and operation of project
- **Potential unintended consequences** (what we don't know)

Mill Pond Subwatershed
Hybrid #1 Evaluation Tool

Mill Pond Statistics:
(Orleans only)
Total acreage = 27.7 acres
Total Number of Parcels = 318
Total Wastewater Flow (MVP) = ~35,000
Total Nitrogen Load (kg from MVP) = 1,278

		Number of Lots Sewered or Area/Quantities of NT Technologies	Flow (GPD)	Nutrient Removal Certainty: Nitrogen (Saltwater) Phosphorus (Freshwater)		Implementation Certainty*		Other Benefits: Ecosystems, Economic, Social		Adaptability to Uncertainty in Nutrient-Reduction Goals and Buildout		CEC removal: Yes = 1 No = 0	Non-Quantitative Factors Total Score	Cost
				Score	Description	Score	Description	Score	Description	Score	Description	Score		
MEP Goal Reduction for Total Watershed (kg/year)	626													
Nitrogen Removal Method	**kg/year Removed**													
Fertilizer (25% of MEP att)	34													
Stormwater	0													
PRB														
Floating Constructed Wetlands	370	**900 sf to 29,000 sf, cost based on 3/4 of MAX (21,000)**	NA	**1**	**actual N removal per sf needs field verification**	**1**	**many examples of successful installations. main risks: actual size required, permitting uncertainty and mismanagement**	**3**	**creates complex habitat, filtering for water clarity, rapid water quality improvements, attractive**	**3**	**scalable, rapid test of load reduction goal**	**0**	**8**	**$-$$**
Aquaculture														
Coastal Habitat Restoration	260	**~ 1 acre reef with remote set and trays initially; 1M oysters or quahogs**	NA	**3**	**N uptake in shell and soft tissue is well-documented**	**2**	**remote set in trays proven method to minimize predation, need field verification; main risks: catastrophic event causing die-off, mismanagement**	**3**	**rapid N removal, filtering for water clarity, denitrification and other reef habitat, less economic benefit than aquaculture**	**3**	**scalable, rapid test of load reduction goal**	**0**	**11**	**$$**
Eco-Toilets														
UD Eco-Toilets														
I/A Septic Systems														
Removal by Other Town(s)	0													
Sewers	0													

Sub-Total Removed = 664
Total Remaining = -38

KEY
1 = LOW
2 = MEDIUM
3 = HIGH
Higher scores indicate more positive attributes

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The scores for non-quantitative factors are starting points for discussion.

KEY (Cost/kg-N Removed: 20-Yr Present Worth Capital and O&M&M)
$ = 0 - $5,000
$$ = $5,000 - $10,000
$$$ = $10,000 - $15,000
$$$$ = $15,000 - $20,000
$$$$$ = $20,000 - $40,000

Alternate Technologies

PRB	285	**2000 feet, Brick Hill Road (87 properties)**	NA	**3**	**N-removal well-documented, local verification needed**	**2**	**site characterization needed for final determination on feasibility, unintended downstream chemistry**	**2**	**rapid water quality improvements, captures all present and future upstream N load to groundwater**	**3**	**scalable, rapid test of load reduction goal**	**1**	**11**	**$$$**

Sewering (see Traditional Bookend)

***Implementation Certainty includes**

- **Permitting/regulatory** (how likely can permits be obtained)
- **Community and Town acceptance** of mix of technologies at the anticipated level of implementation
- **Management** and operation of project
- **Potential unintended consequences** (what we don't know)

Rock Harbor Subwatershed
Hybrid #1 Evaluation Tool

Rock Harbor Statistics:
(Orleans only)
Total acreage = 105.34 acres
Total Number of Parcels = 334
Total Wastewater Flow (MVP) = ~65,500
Total Nitrogen Load (kg from MVP) = 1,855

		Number of Lots Sewered or Area/Quantities of NT Technologies	Flow (GPD)	Nutrient Removal Certainty: Nitrogen (Saltwater) Phosphorus (Freshwater)		Implementation Certainty*		Other Benefits: Ecosystems, Economic, Social		Adaptability to Uncertainty in Nutrient-Reduction Goals and Buildout		CEC removal: Yes = 1 No = 0	Non-Quantitative Factors Total Score	Cost
				Score	Description	Score	Description	Score	Description	Score	Description	Score		
MEP Goal Reduction for Total Watershed (kg/year)	1951													
Nitrogen Removal Method	**kg/year Removed**													
Fertilizer (25% of MEP att)	46													
Stormwater	0													
PRB														
Floating Constructed Wetlands	150	**400 sf to 11,500 sf, cost based on 3/4 of MAX (8700 sf)**	NA	**1**	**actual N removal per sf needs field verification**	**2**	**many examples of successful installations. main risks: actual size required, permitting uncertainty and mismanagement**	**3**	**creates complex habitat, filtering for water clarity, rapid water quality improvements, attractive**	**3**	**scalable, rapid test of load reduction goal**	**0**	**9**	**$ - $$**
Aquaculture														
Coastal Habitat Restoration														
Eco-Toilets														
UD Eco-Toilets														
I/A Septic Systems														
Removal by Other Town(s)	488													
Sewers	1270	**279**	**63720**	**3**		**3**		**3**	**addresses sanitary needs, supports economic centers**	**3**	**areas of uncertainty can be delayed to future phases, scalable**	**1**	**13**	**$$$**
Sub-Total Removed =	1954													
Total Remaining =	-3													

KEY
1 = LOW
2 = MEDIUM
3 = HIGH
Higher scores indicate more positive attributes

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KEY (Cost/kg-N Removed: 20-Yr Present Worth Capital and O&M&M)
$ = 0 - $5,000
$$ = $5,000 - $10,000
$$$ = $10,000 - $15,000
$$$$ = $15,000 - $20,000
$$$$$ = $20,000 - $40,000

Alternate Technologies

Sewer mid section 473
NO room for Aquaculture
NO efficacious PRB location
Floating Wetlands only work at minimum square foot requirements

Innovative/Alternative Septic Systems	1270	**423**	NA	**3**	**Permitting and Monitoring**	**2**	**a few advanced systems available for single family installations, requires maintanance and management**	**2**	**addresses sanitary needs, supports economic centers**	**3**	**can install in more homes**	**0**	**10**	**$$$$**

***Implementation Certainty includes**

- **Permitting/regulatory** (how likely can permits be obtained)
- **Community and Town acceptance** of mix of technologies at the anticipated level of implementation
- **Management** and operation of project
- **Potential unintended consequences** (what we don't know)

Subwatershed	Capital	Annual O+M	Annual Monitoring**	Total Annual	Present Worth -Capital	Present Worth -O&M	Total Present Worth
Areys	$27,354.00	$28,400.00	$18,450.00	$46,850.00	$54,708.00	$937,000.00	$991,708.00
Lonnies	$1,337,100.00	$16,900.00	$73,450.00	$90,350.00	$1,624,200.00	$1,807,000.00	$3,431,200.00
Meetinghouse	$17,718,542.79	$772,804.86	$18,450.00	$791,254.86	$7,975,544.25	$15,825,097.22	$23,800,641.48
Namequoit	$660,000.00	$5,200.00	$18,450.00	$23,650.00	$1,320,000.00	$473,000.00	$1,793,000.00
Paw Wah	$1,802,667.00	$32,033.00	$73,450.00	$105,483.00	$1,802,667.00	$2,109,660.00	$3,912,327.00
Pochet Neck	$7,909,164.97	$434,046.17	$36,900.00	$470,946.17	$4,846,674.24	$9,418,923.31	$14,265,597.55
Quanset	$980,978.38	$48,256.39	$18,450.00	$66,706.39	$1,208,690.27	$1,334,127.82	$2,542,818.08
River Upper	$1,633,609.37	$94,394.88	$18,450.00	$112,844.88	$1,246,624.22	$2,256,897.54	$3,503,521.76
River Lower	$207,086.54	$102,447.05	$18,450.00	$120,897.05	$101,988.94	$2,417,941.02	$2,519,929.96
Pleasant Bay	$12,767,353.89	$638,645.27	$18,450.00	$657,095.27	$5,745,309.25	$13,141,905.33	$18,887,214.58
Town Cove	$41,127,536.62	$1,263,898.25	$73,450.00	$1,337,348.25	$21,570,391.48	$26,746,964.93	$48,317,356.41
Mill Pond	$709,000.00	$94,800.00	$36,900.00	$131,700.00	$1,402,000.00	$2,634,000.00	$4,036,000.00
Rockharbor	$17,701,231.94	$759,911.75	$18,450.00	$778,361.75	$8,410,559.38	$15,567,235.07	$23,977,794.44
Totals	$104,581,625.50	$4,291,737.61	$441,750.00	$4,733,487.61	$57,309,357.02	$94,669,752.23	$151,979,109.26
Tri-Town WWTP							
Atlantic Ocean WWTP							
S. Orleans WWTP							
Contingency (30%)	$31,374,487.65				$17,192,807.11		
Grand Totals	**$135,956,113.14**	**$4,291,737.61**	**$441,750.00**	**$4,733,487.61**	**$74,502,164.13**	**$94,669,752.23**	**$169,171,916.36**
CWMP (2008)	$148,500,000.00	$1,370,000.00	$0.00	$1,370,000.00			
CWMP (2014 - 25%)	**$176,700,000.00**	$1,630,540.00	$0.00	$1,630,540.00			
CWMP (2008 no contingencies)	$122,900,000.00						
CWMP (2014 no contingencies)	$146,275,580.00						

Notes: The CWMP full core program estimated $9.7M (30-year financing at 3.75%)
The Hybrid Plan does not include contingencies.

Traditional Bookend (30%)	**$187,400,000.00**	**$4,000,925.00**	**$0.00**	**$4,000,925.00**			
NT Bookend	$64,757,321.00	$611,333.00	$552,100.00	$1,163,433.00	$119,697,975.00	$23,268,660.00	$142,966,635.00
Contingency (30%)	$19,427,196.30				$35,909,392.50		
NT Bookend Total	**$84,184,517.30**	**$611,333.00**	**$552,100.00**	**$1,163,433.00**	**$155,607,367.50**	**$23,268,660.00**	**$178,876,027.50**

Watershed			Kg/yr Removal Targets						
	MEP	Hybrid 1 12-17-14	$/Kg-N Removal PRB - HIGH	$/Kg-N Removal PRB - LOW	$/Kg-N Removal HIGH Floating Constr Wetland	$/Kg-N Removal LOW Floating Constr Wetland	$/Kg-N Removal Costal Habitat Restoration	$/Kg-N Removal Aquaculture	$/Kg-N Removal Sewers & Treatmet
Pleasant Bay									
Arey's Pond	142	142			$ 6,981	$ 3,329		$ 7,292	
Lonnies Pond	297	314	$ 15,899	$ 10,033	$ 6,981	$ 3,329		$ 4,803	
Meetinghouse Pond	1876	1934	$ 13,785	$ 10,708	$ 6,981	$ 3,329	$ 5,820		$ 12,928
Namequoit River	367	365	$ 11,920	$ 7,920	$ 5,123	$ 1,516	$ 4,434		
Paw Wah Pond	414	414	$ 9,703	$ 7,226	$ 6,634	$ 1,643	$ 9,729		
Pleasant Bay**	3210	3234						$ 975	$ 21,086
Pochet Neck	1569	1647	$ 15,059	$ 11,693	$ 4,825	$ 1,240	$ 4,187		$ 15,718
Quanset Pond	256	277			$ 5,852	$ 2,057	$ 5,540		$ 51,298
The River - lower	524	578			$ 4,753	$ 1,054	$ 4,108		$ 13,660
The River - upper	378	379			$ 6,474	$ 2,854	$ 7,103	$ 5,465	$ 12,554
Sub-Totals	**9033**	**9284**							
Nauset Harbor									
Town Cove**	6643	6679	$ 7,482	$ 6,593	$ 4,638	$ 953	$ 3,185		$ 11,971
Nauset Marsh	0	0							
Mill Pond	626	664	$ 15,207	$ 12,400	$ 5,024	$ 1,439	$ 8,373		
Wood Cove	0	0							
Rachael Cove	0	0							
Sub-Totals	**7269**	**7343**							
Cape Cod Bay									
Namskaket Main	Not Available	0							
Namskaket Stream	Not Available	0							
Little Namskaket Mars	-1808.21	0							
Little Namskaket Cree	-27.01	0							
Rock Harbor**	1951	1954			$ 6,981	$ 3,329			$ 12,905
Cedar Pond	0	0							
Sub-Totals	**116**	**1954**							

Costs amplify several facts:

high CHR because low kg N removal value, but monitoring costs same. Mortality high compared to aquaculture, so cost of seed is higher than aquaculture

Aqua very low because private growers with existing grants in Pleasant Bay produce shellfish

PRB costs low per kg because of significant upstream load

PRB costs ery high because of low density upstream

General Cost Nomincl		Low	High	alternate	
1	$	1,000	5,000		
2	$$	5,000	10,000		
3	$$$	10,000	20,000		
4	$$$$	20,000	40,000	20,000	45,000
5	$$$$$	40,000	55,000	45,000	55,000

KEY
$ = 0 - $5,000
$$ = $5,000 - $10,000
$$$ = $10,000 - $15,000
$$$$ = $15,000 - $20,000
$$$$$ = $20,000 - $40,000

General Cost Nomincl		Low	High	
1	$	1,000	10,000	Aquaculture and CHR (with exeption of Paw Wah, as explained above)
2	$$	10,000	20,000	Sewer
3	$$$	20,000	55,000	PRB and FCW (due to large uncertainty in cost numbers and sizing)

From Pleasant Bay Calculator:

d/Embay	Quantity		Technology	Meet Target	Life Cycle Cost	Life Cycle Cost*	(5% interest)
A) Permeable Reactive	1,000	linear feet	430	15,684	$10,233	$821	$4,400,000
B) Constructed Wetlan	0	acres	0	15,684	$1,371	$110	$0
C) Constructed Wetlan	0	acres	0	15,684	$0	$0	$0
D) Phytoirrigation	0	acres	0	15,684	$32,197	$2,584	$0
E) Phytobuffers	0	acres	0	15,684	$70,349	$5,646	$0
F) Fertigation - Turf	150	acres	600	15,084	$2,978	$239	$1,786,764
G) Fertigation - Cranb	10	acres	120	14,964	$2,604	$209	$312,497
H) Surface Water Rem	0	acres	0	14,964	$12,560	$1,008	$0
I) Dredging/Inlet Wide	0	cu. yard	2,076	12,888	$0	$0	$0
J) Phytoremediation	0	acres	0	12,888	$4,249	$341	$0
K) Aquaculture/Oyste	11	acres	2,750	10,138	$897	$72	$2,467,080
L) Coastal Habitat Res	16	acres	1,862	8,276	$2,280	$183	$4,245,695
M) Floating Construct	9,438	cu feet	3,775	4,501	$162	$13	$611,475

		Pleasant Bay N Loads by Input:								Present N Loads			Buildout N Loads				
Name	Watershed ID#	Wastewater	From WWTF	Fertilizers	Impervious Surfaces	Water Body Surface Area	"Natural" Surfaces	Buildout	% of Pond Outflow	UnAtten N Load	Atten %	Atten N Load	UnAtten N Load	Atten %	Atten N Load		0.93%
Pleasant Bay Whole System		**34290**	**0**	**7117**	**4074**	**33403**	**2283**	**14636**		**81167**		**78001**	**95803**		**91924**	**81167**	**18%**
Pleasant Bay Main Basin	**27, 29, 31, 49, 50, 51, 52, 53, 95 + Ponds**	**12043**	**0**	**3443**	**1344**	**27829**	**882**	**5335**		**45542**		**44955**	**50877**		**50091**		**135**
Pleasant Bay GT 10_BREHAR	49	526	0	1117	61	0	43	157		1747		1747	1904		1904	36111	136
Pleasant Bay GT 10_HAR	50	423	0	56	81	0	33	177		592		592	769		769		
Pleasant Bay GT 10_ORL	51	531	0	58	101	0	79	386		770		770	1156		1156		
Pleasant Bay GT 10_ORLBRE	52	493	0	80	52	0	68	413		692		692	1106		1106		
Pleasant Bay LT 10	53	2745	0	1515	291	31	311	2709		4893		4893	7602		7602		
Chatham Harbor	95	5182	0	408	481	34	137	711		6242		6242	6953		6953		
Freeman's Way WELL_BRE	27	801	0	83	98	0	80	140		1063		1063	1203		1203		
Pleasant Bay Rd WELL_HAR	29	284	0	20	20	0	7	6		331		331	337		337		
WELL 7 WELL_ORL	31	310	0	27	40	0	29	171		407		407	577		577		
Silas Rd Well_BRE	30	127	0	15	26	0	36	47	84%	203		203	250		250		
Bassing Pond (BSP)	BSP	78	0	9	9	34	4	19	84%	135	50%	67	153	50%	77		
Uncle Seths Pond (USP)	USP	136	0	11	16	24	14	53	100%	202	50%	101	255	50%	127		
Quanset Pond Bog (QPB)	QPB	101	0	11	18	14	9	60	81%	154	50%	86	213	50%	126		
Shoal Pond (SHP)	SHP	182	0	16	19	29	9	54	62%	255	50%	127	309	50%	154		
Rafe Pond (RFP)	RFP	14	0	2	3	24	5	5	59%	47	50%	23	52	50%	26		
Mud Pond (MP)	MP	0	0	0	3	47	4	0	76%	54	50%	24	54	50%	24		
Grassy Pond (GP)	GP	2	0	0	8	153	3	5	91%	167	50%	83	172	50%	86		
Deep Pond (DP)	DP	110	0	13	17	23	12	221	100%	174	50%	87	395	50%	198		
Pleasant Bay Main Basin Estuary surface deposition						27417				27417		27417	27417		27417		
Pochet Neck	**23, 35, 36, 54, 55, 56, 57**	**2449**	**0**	**223**	**269**	**681**	**157**	**1276**		**3779**		**3718**	**5056**		**4980**		
Uncle Harvey Pond (UHP)	23	72	0	6	9	32	4	28	100%	123	50%	61	151	50%	75		
Barley Neck	35,36	713	0	73	75	0	28	210		889		889	1099		1099		
Barley Neck GT 10	35	358	0	35	28	0	11	84		433		433	517		517		
Barley Neck LT 10	36	355	0	38	47	0	17	126		456		456	582		582		
Pochet Neck	54,55	980	0	80	103	0	90	417		1253		1253	1670		1670		
Pochet Neck GT 10	54	642	0	53	69	0	22	249		787		787	1037		1037		
Pochet Neck LT 10	55	337	0	27	34	0	67	168		465		465	633		633		
Pochet Neck Stream	56,57	685	0	64	82	4	35	621		870		870	1492		1492		
Pochet Neck Stream GT 10	56	298	0	32	35	0	11	101		377		377	478		478		
Pochet Neck Stream LT 10	57	386	0	32	47	4	24	521		493		493	1014		1014		
Barley Neck Estuary surface deposition						177				177		177	177		177		
Pochet Neck Estuary surface deposition						467				467		467	467		467		

River System	32,33,34,37,38,39,40,41,42,43,44,45,66,67 + BP, PL, CL, HP, LCP + CPW	5844	0	486	667	2322	484	3648		9802		8536	13449		11887	9802
Meetinghouse Pond	42,43	1871	0	139	193	0	53	752		2256		2256	3008		3008	
Meetinghouse Pond GT 10	42	763	0	69	94	0	28	325		953		953	1278		1278	
Meetinghouse Pond LT 10	43	1108	0	70	100	0	25	427		1303		1303	1730		1730	
Kescayo Gansett Pond	37,38,40 + BP,PL,CL	567	0	49	63	214	71	417		965		649	1382		983	
Kescayo Gansett Pond GT 10	37	78	0	4	6	0	15	101		103		103	204		204	
Kescayo Gansett Pond LT 10	38	214	0	19	22	0	13	137		268		268	405		405	
Baker Pond (BP)	BP	32	0	3	3	52	7	20	19%	97	50%	36	117	50%	46	
Crystal Lake (CL)	CL	87	0	7	11	74	13	80	29%	193	50%	85	273	50%	123	
Kescayo Gansett Stream	40 + PL	156	0	15	21	89	23	79		303		157	383		205	
Kescayo Gansett Stream	40	31	0	4	6	1	3	20		45		45	65		65	
Pilgrim Lake (PL)	PL	125	0	11	15	87	19	59	22%	258	50%	111	318	50%	140	
Kescayo Gansett River	39 + PL	244	0	19	24	98	27	106		411		247	516		319	
Kescayo Gansett River	39	104	0	6	7	0	5	39		122		122	162		162	
Pilgrim Lake (PL)	PL	140	0	13	17	98	22	66	25%	288	50%	125	355	50%	157	
Arey's Pond	32,33,34 + HP + CPW	343	0	28	58	144	77	273		650		475	922		745	
Arey's Pond GT 10N	32	0	0	0	4	0	14	6		18		18	24		24	
Arey's Pond GT 10S	33	0	0	0	0	0	2	0		2		2	2		2	
Arey's Pond LT 10	34	263	0	21	36	0	30	263		351		351	614		614	
Higgins Pond (HP)	HP	35	0	3	4	77	6	2	24%	125	50%	40	127	50%	40	
Cliff Pond WELL_ORL (CPW)	26 + HP,LCP	45	0	4	14	66	25	2		154		66	156		66	
Cliff Pond WELL_ORL	26	0	0	0	9	0	18	0		27		27	27		27	
Higgins Pond (HP)	HP	7	0	1	1	16	1	0	5%	27	50%	8	27	50%	8	
Little Cliff Pond (LCP)	LCP	37	0	4	4	50	5	2	13%	101	50%	30	103	50%	31	
Namequoit River	44,45 + PL	807	0	69	97	92	89	511		1155		1001	1666		1479	
Namequoit River GT 10	44	80	0	8	21	0	33	62		143		143	204		204	
Namequoit River LT 10	45	595	0	49	60	0	36	386		741		741	1127		1127	
Pilgrim Lake (PL)	PL	132	0	12	16	92	20	63	24%	272	50%	118	335	50%	148	
Upper River	66,67 + CL	854	0	75	87	152	66	526		1234		1013	1759		1452	
Upper River GT 10	66	192	0	18	19	0	9	90		238		238	327		327	
Upper River LT 10	67	484	0	43	46	0	29	272		601		601	872		872	
Crystal Lake (CL)	CL	179	0	14	22	152	28	165	59%	395	50%	175	560	50%	252	
Lower River	41 + CL,PL	1158	0	106	144	146	101	1064		1655		1418	2719		2424	
Lower River LT 10	41	958	0	88	120	0	70	952		1237		1237	2188		2188	
Crystal Lake (CL)	CL	39	0	3	5	33	6	36	13%	86	50%	38	122		55	
Pilgrim Lake (PL)	PL	161	0	15	19	112	25	77	29%	332	50%	144	409		181	100

Meetinghouse Pond Estuary surface deposition						213				213		213	213		213
Kescayo Gansett Pond Estuary surface deposition						73				73		73	73		73
Kescayo Gansett River Estuary surface deposition						9				9		9	9		9
Arey's Pond Estuary surface deposition						66				66		66	66		66
Namequoit River Estuary surface deposition						191				191		191	191		191
Upper River Estuary surface deposition						105				105		105	105		105
Lower River Estuary surface deposition						818				818		818	818		818
Pah Wah Pond	**46,47,48**	**551**	**0**	**45**	**50**	**30**	**33**	**344**		**709**		**709**	**1053**		**1053**
Pah Wah Pond Bog	46	35	0	3	3	0	7	8		48		48	56		56
Pah Wah Pond GT 10	47	325	0	24	27	0	10	98		386		386	484		484
Pah Wah Pond LT 10	48	191	0	17	21		16	238		246		246	483		483
Pah Wah Pond Estuary surface deposition						30				30		30	30		30
Quanset Pond	**59,60 + RFP, SHP, TP, QPB**	**652**	**0**	**46**	**71**	**121**	**36**	**276**		**927**		**713**	**1203**		**936**
Quanset Pond GT 10	59	0	0	0	2	0	4	0		6		6	6		6
Quanset Pond LT 10	60	370	0	17	28	0	12	165		427		427	592		592
Rafe Pond (RFP)	RFP	10	0	1	2	16	3	4	41%	32	50%	16	36	50%	18
Shoal Pond (SHP)	SHP	110	0	10	12	17	5	33	38%	154	50%	77	186	50%	93
Twinings Pond (TP)	TP	141	0	16	23	22	10	61	56%	211	50%	105	272	50%	136
Quanset Pond Bog (QPB)	QPB	23	0	3	4	3	2	14	19%	35		19	48		29
Quanset Pond Estuary surface deposition						62				62		62	62		62
Tar Kiln Stream	**63,34**	**655**	**0**	**1485**	**52**	**24**	**43**	**316**		**2259**		**2259**	**2575**		**2575**
Tar Kiln Stream GT 10	63	95	0	1285	11	0	23	50		1413		1413	1464		1464
Tar Kiln Stream LT 10	64	560	0	200	42	0	21	266		822		822	1088		1088
Tar Kiln Estuary surface deposition						24				24		24	24		24
Round Cove	**61,62 + MP**	**1157**	**0**	**175**	**154**	**77**	**54**	**347**		**1616**		**1607**	**1963**		**1954**
Round Cove GT 10	61	600	0	78	74	0	20	129		772		772	900		900
Round Cove LT 10	62	557	0	97	79	0	33	218		766		766	984		984
Mud Pond (MP)	MP	0	0	0	1	15	1	0	24%	17	50%	7	17	50%	8
Round Cove Estuary surface deposition						62				62		62	62		62
The Horseshoe	**65 + SP**	**322**	**0**	**24**	**33**	**52**	**24**	**224**		**454**		**256**	**678**		**385**
The Horseshoe	65	24	0	2	3	0	5	34		35		35	68		68
Sarahs Pond (SP)	SP	298	0	23	29	29	18	190	100%	397	50%	198	587	50%	293
The Horseshoe Estuary surface deposition						23				23		23	23		23
Muddy Creek	**77, 78, 79, 80, 81, 82, 83 + MPF, GOP, HWP, TTP**	**5275**	**0**	**612**	**776**	**400**	**332**	**1946**		**7395**		**7027**	**9341**		**8946**
Upper Muddy Creek	81,82,83 + MPF,GOP, HWP	2839	0	344	395	247	189	1322		4014		3860	5336		5156
Upper Muddy Crk	81	1997	0	267	286	13	88	529		2651		2651	3180		3180
Upper Muddy Crk 10E	82	93	0	10	16	0	4	34		123		123	157		157
Upper Muddy Crk 10W	83	614	0	48	70	63	84	710		881		881	1591		1591
Mill Pond Fresh (MPF)	MPF	88	0	13	16	28	9	44	23%	154	50%	76	197	50%	98
Goose Pond (GOP)	GOP	47	0	6	5	59	4	5	32%	120	50%	57	125	50%	59
Hawksnest Pond (HWP)	HWP	0	0	0	1	24	1	0	20%	26	50%	13	26	50%	13
Upper Muddy Creek Estuary surface deposition						59				59		59	59		59

Lower Muddy Creek	77,78,79,80 + TTP	2436	0	268	381	153	143	624		3381		3167	4006		3789	
Muddy Crk WELL	77	428	0	58	75	0	28	146		589		589	734		734	
Lower Muddy Crk	78	1026	0	109	144	0	54	308		1334		1334	1641		1641	
Lower Muddy Crk 10E	79	127	0	15	19	0	4	11		164		164	175		175	
Lower Muddy Crk 10W	80	621	0	61	99	0	47	157		828		828	984		984	
Trout Pond (TTP)	TTP	234	0	25	45	78	10	3	100%	393	50%	178	396		179	
Lower Muddy Creek Estuary surface deposition						75				75		75	75		75	
Ryder Cove System		**5340**		**577**	**659**	**1868**	**239**	**923**		**8683**		**8221**	**9606**		**9117**	
Ryder Cove	**84, 85, 86, 87 + SCP, LL, EP, SWP**	**2808**	**0**	**308**	**357**	**922**	**133**	**505**		**4527**		**4083**	**5032**		**4562**	
Ryder Cove	84	1463	0	139	170	0	61	285		1833		1833	2118		2118	3325
Ryder Cove 10S	85	380	0	37	54	0	13	73		485		485	558		558	
Ryder Cove 10E	86	139	0	7	15	0	6	61		167		167	228		228	
Ryder Cove 10W	87	308	0	10	36	0	13	11		367		367	378		378	
Schoolhouse Pond (SCP)	SCP	16	0	2	2	29	1	1	26%	50	50%	25	52	50%	26	
Lovers Lake (LL)	LL	0	0	0	0	0	0	0	0%	0	50%	0	0	50%	0	
Emery Pond (EP)	EP	17	0	11	2	39	2	7	62%	71	50%	36	78	50%	39	
Stillwater Pond (SWP)	SWP	484	0	101	79	380	38	65	100%	1081	50%	697	1146	50%	741	
Ryder Cove Estuary surface deposition						473				473		473	473		473	
Crows Pond	**88,89 + SCP**	**1212**	**0**	**138**	**147**	**512**	**39**	**157**		**2049**		**2044**	**2206**		**2201**	
Crows Pond	88	683	0	90	80	0	28	123		882		882	1005		1005	
Crows Pond 10	89	526	0	48	67	0	10	34		651		651	685		685	
Schoolhouse Pond (SCP)	SCP	3	0	0	0	5	0	0	5%	9	50%	5	9	50%	5	
Crows Pond Estuary surface deposition						507				507		507	507		507	
Bassing Harbor	**90,91 + BSP**	**518**	**0**	**14**	**51**	**399**	**30**	**110**		**1012**		**999**	**1123**		**1108**	
Bassing Harbor	90	309	0	7	26	1	19	34		362		362	395		395	987
Bassing Harbor 10	91	194	0	6	23	0	10	73		234		234	307		307	
Bassing Pond (BSP)	BSP	15	0	2	2	6	1	4	16%	26	50%	13	29	50%	15	
Bassing Harbor Estuary surface deposition						391				391		391	391		391	
Frostfish Creek	**92,93,94**	**802**	**0**	**117**	**104**	**35**	**37**	**151**		**1095**		**1095**	**1246**		**1246**	
Frostfish Creek	92	351	0	30	32	0	18	78		432		432	510		510	830
Frostfish Creek 10	93	282	0	32	40	0	9	34		363		363	397		397	
Upper Frostfish Crk	94	170	0	54	31	0	9	39		264		264	304		304	
Frostfish Creek Estuary surface deposition						35				35		35	35		35	

																measured atten	n
Baker Pond (BP)		164	0	18	17	268	36	103		502	50%	**186**	**605**	50%	**236**	65%	53
Baker Pond GT 10	1	19	0	2	2	0	11	22		35		35	57		57		
Baker Pond LT 10	2	57	0	7	5	127	12	76		208		208	284		284		
Little Cliff Pond (LCP)	LCP	61	0	6	7	82	8	3	21%	165	50%	82	168	50%	84		
Higgins Pond (HP)	HP	26	0	3	3	58	5	1	18%	95	50%	47	96	50%	48		
Cliff Pond (CP)		1178	0	116	133	938	124	62		2490	50%	**1178**	2551	50%	**1209**	73%	27
Cliff Pond GT 10	3	991	0	97	121	0	53	62		1262		1262	1324		1324		
Cliff Pond LT 10	4	0	0	0	0	905	56	0		960		960	960		960		
Ruth Pond	RP	187	0	19	12	34	15	0	100%	267	50%	134	267	50%	134		
Crystal Lake (CL)		305	0	24	38	260	47	281		674	50%	**298**	955	50%	**430**	68%	41
Crystal Lake GT 10	5	83	0	4	15	0	26	111		128		128	239		239		
Crystal Lake LT 10	6	171	0	14	18	176	10	138		388		388	527		527		
Baker Pond (BP)	BP	51	0	6	5	84	11	32	31%	157	50%	79	189	50%	95		
Deep Pond (DP)		110	0	13	17	23	12	221		174	50%	**87**	395	50%	**198**		
Deep Pond GT 10	7	0	0	0	0	0	5	168		5		5	173		173		
Deep Pond LT 10	8	110	0	13	17	23	7	53		170		170	223		223		
Grassy Pond (GP)	9	2	0	0	9	168	3	6		183	50%	92	189	50%	94		
Higgins Pond (HP)		141	0	14	16	317	26	7		514	50%	**162**	521	50%	**164**	72%	48
Higgins Pond	10	0	0	0	0	128	7	0		134		134	134		134		
Little Cliff Pond (LCP)	LCP	141	0	14	16	189	19	7	49%	379	50%	190	387	50%	193		
Little Cliff Pond (LCP)		286	0	28	32	383	39	15		769	50%	**233**	784	50%	**237**	77%	24
Little Cliff Pond	11	0	0	0	0	155	9	0		163		163	163		163		
Cliff Pond	CP	286	0	28	32	228	30	15	24%	605	50%	303	620	50%	310		
Mud Pond (MP)		0	0	0	3	62	5	1		71	50%	**31**	71	50%	**31**		
Mud Pond (MP)	12	0	0	0	3	47	5	0		54		54	54		54		
Grassy Pond (GP)	GP	0	0	0	1	15	0	1	9%	17	50%	8	17	50%	9		
Pilgrim Lake (PL)		557	0	51	67	389	86	265		1151	50%	**497**	1416	50%	**626**	37%	21
Pilgrim Lake	13	287	0	21	28	200	25	168		562		562	730		730		
Higgins Pond (HP)	HP	74	0	7	8	165	13	4	52%	267	50%	134	271	50%	136		
Baker Pond (BP)	BP	15	0	2	2	25	3	9	9%	46	50%	23	56	50%	28		
Gould Pond WELL_ORL	28	181	0	21	29	0	44	84		276		276	360		360		
Rafe Pond (RFP)	14,30	23	0	3	5	40	8	9		79	50%	**40**	88	50%	**44**		
Rafe Pond (RFP)	14	0	0	0	0	40	2	0		42		42	42		42		
Silas Rd Well_BRE	30	23	0	3	5	0	7	9	16%	37		37	46		46		

Ruth Pond (RP)		187	0	19	12	34	15	0		267	50%	**134**	267	50%	**134**		
Ruth Pond GT 10	15	187	0	19	12	0	8	0		226		226	226		226		
Ruth Pond LT 10	16	0	0	0	0	34	7	0		41		41	41		41		
Sarahs Pond (SP)		298	0	23	29	29	18	190		397	50%	**198**	587	50%	**293**		
Sarahs Pond GT 10	17	255	0	20	24	4	9	109		311		311	420		420		
Sarahs Pond LT 10	18	43	0	3	5	25	10	81		85		85	166		166		
Shoal Pond (SHP)		291	0	26	31	46	14	87		409	50%	**204**	495	50%	**248**		
Shoal Pond GT 10	19	0	0	0	0	0	4	0		4		4	4		4		
Shoal Pond LT 10	20	291	0	26	31	46	10	87		405		405	491		491		
Twinings Pond (TP)		252	0	28	42	39	18	109		378	50%	**189**	487	50%	**244**	71%	23
Twinings Pond GT 10	21	55	0	6	11	0	8	45		80		80	125		125		
Twinings Pond LT 10	22	196	0	22	31	39	10	64		298		298	362		362		
Uncle Seths Pond (USP)		136	0	11	16	24	14	53		202	50%	**101**	255	50%	**127**		
Uncle Seths Pond GT 10	24	0	0	0	0	0	5	0		6		6	6		6		
Uncle Seths Pond LT 10	25	136	0	11	16	24	9	53		196		196	249		249		
Mill Pond Fresh (MPF)		382	0	57	69	123	39	190		669	50%	**330**	859	50%	**425**		
Mill Pond Fresh (MPF)	68	382	0	57	68	105	38	190		650		650	840		840		
Hawksnest Pond (HWP)	HWP	0	0	0	1	18	1	0	14%	19	50%	10	19	50%	10		
Goose Pond (GOP)		148	0	18	17	186	12	16		381	50%	**181**	397	50%	**186**		
Goose Pond (GOP)	69	126	0	15	13	179	10	6		343		343	349		349		
Mill Pond Fresh (MPF)	MPF	21	0	3	4	7	2	11	6%	38	50%	19	48	50%	24		
Trout Pond (TTP)		234	0	25	45	78	10	3		393	50%	**178**	396	50%	**179**		
Trout Pond (TTP)	70	206	0	22	41	43	8	0		320		320	320		320		
Goose Pond (GOP)	GOP	28	0	3	3	35	2	3	19%	72	50%	36	75	50%	38		
Schoolhouse Pond (SCP)	71	63	0	9	8	112	3	6		195	50%	97	200	50%	100		
Stillwater Pond (SWP)		484	0	101	79	380	38	65		1081	5%	**697**	1146	5%	**741**		
Stillwater Pond (SWP)	72	197	0	24	38	105	23	28		387		387	415		415		
Schoolhouse Pond (SCP)	SCP	44	0	6	5	78	2	4	69%	135	50%	68	139	50%	70		
Lovers Lake (LL)	LL	243	0	71	36	197	13	34	100%	559	50%	279	592	50%	296		
Lovers Lake (LL)	73	243	0	71	36	197	13	34		559	50%	279	592	50%	296		
Emery Pond (EP)	74	27	0	18	3	63	3	11		114	50%	57	126	50%	63		
Bassing Pond (BSP)	75	93	0	11	11	41	5	22		160	50%	80	182	50%	91		
Hawksnest Pond (HWP)	76	0	0	0	5	124	4	0		133	50%	67	133	50%	67		
Silas Rd Well_BRE	30	150	0	18	30	0	42	56		240		240	296		296		
Quanset Pond Bog (QPB)	58 + TP	124	0	14	22	17	12	73		188		105	262		154		
Quanset Pond Bog	58	13	0	1	3	0	4	25		21		21	47		47		
Twinings Pond (TP)	TP	111	0	12	18	17	8	48	44%	167	50%	83	215	50%	108		

		Nauset Marsh N Loads by Input (kg/y):								Present N Loads			Buildout N Loads			
Name	Watershed ID#	Wastewater	Landfills	Fertilizers	Impervious Surfaces	Water Body Surface Area	"Natural" Surfaces	Buildout	% of Pond Outflow	UnAtten N Load	Atten %	Atten N Load	UnAtten N Load	Atten %	Atten N Load	
Nauset Marsh S		16677	408	1262	1704	7064	775	2305		27891		26080	30196		28390	8%
uset Marsh	1	2805	0	293	355	3	315	586		3770		3770	4356		4356	
l Pond Salt	8	1468	0	135	140	0	57	354		1800		1800	2154		2154	
oods Cove	6	220	0	18	21	0	13	34		272		272	305		305	
uddy Pond	12	174	0	18	22	49	6	39		269	70%	81	308	70%	92	
epot Pond	11	136	0	16	15	88	7	35	70%	262	75%	66	298	75%	74	
Nauset Marsh Estuary Surface						4107				4107		4107	4107		4107	
Mill Pond Salt Estuary Surface						390				390		390	390		390	
Woods Cove Estuary Surface						88				88		88	88		88	
wn Cove Total		10198	119	641	934	2100	310	1297		14301		13566	18942		14780	
Town Cove	5	8724	119	501	757	2	239	1087		10340		10340	11427		11427	
achel Cove	7	51	0	5	6	0	3	6		65		65	70		70	
oland Pond	13	182	0	7	14	22	7	11		232	50%	116	243	50%	122	
Rd Gauge	3	1065	0	110	131	0	38	146		1344	35%	874	1490	35%	968	
set Stream	4	111	0	11	19	0	8	6		150		150	156		156	
Baker Pond	BP	66	0	7	7	108	15	41	40%	202	65%	53	243	65%	67	
Town Cove Estuary Surface						1909				1909		1909	1909		1909	
Rachel Cove Estuary Surface						59				59		59	59		59	
Nauset Stream Estuary Surface						1				1		1	1		1	
Salt Pond		1677	290	142	217	238	67	-40		2631		1940	2591		2043	
Salt Pond	2	1130	0	99	161	0	44	191		1435		1435	1626		1626	
nister Pond	MP	412	247	30	41	52	16	-209	67%	799	65%	280	590	65%	206	
Pond Total	SP	76	43	6	7	39	4	-36		175	50%	88	139	50%	70	
epot Pond	11	58	0	7	7	38	3	15	30%	112	75%	28	127	75%	32	
Salt Pond Estuary Surface						109				109		109	109		109	

a. Nauset Marsh Estuary System

Ponds																
epot Pond	11	194	0	23	22	126	10	51		374	75%	94	425	75%	106	
nister Pond	9	617	369	45	62	78	24	-313		1195	65%	418	882	65%	309	
ouse Total	SP	76	43	6	7	39	4	-36		175	50%	88	139	50%	70	
ouse Pond	10	5	0	0	0	30	1	0		37		37	37		37	
nister Pond	MP	71	43	5	7	9	3	-36	33%	139		139	102		102	
												139				
									138.5128	-27753		-25941				
										28127		26035				

b. Town Cove Estuary System

from PleasantBay_summDEP031606.xls

measured atten: 65% n: 53

Baker Pond (BP) TOTA	164	0	18	17	268	36	103		502	65%	132	605	65%	168		
Baker Pond	1	19	0	2	2	0	11	22		35		35	57		57	
Baker Pond	2	57	0	7	5	127	12	76		208		208	284		284	
Little Cliff P	LCP	61	0	6	7	82	8	3	21%	165	50%	82	168	50%	84	
Higgins Po	HP	26	0	3	3	58	5	1	18%	95	50%	47	96	50%	48	

c. Salt Pond Estuary System

		Rock Harbor N Loads by Input (kg/y):								Present N Loads			Buildout N Loads				
Name	Watershed ID#	Wastewater	From WWTF	Fertilizers	Impervious Surfaces	Water Body Surface Area	"Natural" Surfaces	Buildout	% of Pond Outflow	UnAtten N Load	Atten %	Atten N Load	UnAtten N Load	Atten %	Atten N Load		
Rock Harbor Sy		3278	24	208	178	129	109	3973		3926		3299	7899		5325	101%	
Rock Harbo	3	2476	24	182	136	29	86	984		2933		2933	3916		3916		
arbor Main	3	1224	24	149	102		64	271		1563		1563	1833		1833		
nd Wetland	1a + 1c	1252	0	33	34	0	22	713		1341		1341	2054		2054		
Rock Harbor Estuary surface deposition						29				29		29	29		29		
Rock Harbo	1+CP	802	0	27	42	70	24	2989		965	17%	337	3954	17%	1380		
bor Stream	1	1	0	1	4	0	2	23		8		8	31		31		
ar Pond TOTAL		801	0	26	38	70	22	2966		957	58%	398	3923	58%	1632		
Cedar Pond	CP	801	0	26	38		22	2966		886		886	3853		3853		
Cedar Pond Estuary surface deposition						70				70		70	70		70		

a. Rock Harbor System Overall

b. Rock Harbor Stream Total Subwatershed

Watershed	Kg/yr Removal Targets			CWMP vs. Traditional Bookend (Lot Comparison)		Kg/yr removals (for Orleans only)		
	MEP	CCC Tracker (% method)	Tracker Difference[5,6]	CWMP Phases 1-6 (Lots)	Traditional Bookend (Lots)	Traditional Bookend (kg/yr)[1]	Non-Traditional Bookend (kg/yr)	Notes
Pleasant Bay								
Arey's Pond	142	141	-1%	65	65	269	114	CWMP over sewering based on MEP and Tracker.
Lonnies Pond	297	193	-54%	188	188	291	303	CWMP over sewering based on Tracker.
Meetinghouse Pond	1876	1602	-17%	338	338	1602	1416	Traditional Bookend requires all lots to be sewered and by definition meets both MEP and Tracker regardless of the kg/year figure.
Namequoit River	367	340	-8%	185	198	579	275	Traditional Bookend exceeds CWMP sewer area due to in-shed disposal.
Paw Wah Pond	414	396	-4%	104	104	457	423	CWMP over sewering based on MEP and Tracker.
Pleasant Bay**	2387	3628	34%	AM*	AM*	AM*	AM*	
Pochet Neck	1569	1434	-9%	280	280	1148	1200	CWMP under sewering according to MEP.
Quanset Pond	256	186	-38%	115	115	228	150	CWMP under sewering according to MEP.
The River - lower	524	454	-15%	72	91	371	345	Traditional Bookend exceeds CWMP sewer area to meet Tracker TMDLs. CWMP under sewering according to MEP and Tracker.
The River - upper	378	417	9%	189	189	448	360	CWMP over sewering based on MEP and Tracker.
Sub-Totals	**8210**	**8791**	**7%**	**1536**	**1568**			
Nauset Harbor								
Town Cove**	6643	5739	-16%	730	755	4282	5240	Traditional Bookend as currently shown calls for sewering 25 more lots than the CWMP for the "Downtown" economic development area. This is due to the Traditional Bookend not excluding any specific lots within the overall sewered area until a more detailed analysis is completed during the preliminary and final design. CWMP under sewering according to MEP.
Nauset Marsh	0	0	0%	3	3	9	0	CWMP over sewering based on MEP and Tracker.
Mill Pond	0	0	0%	147	147	626	0	CWMP over sewering based on MEP and Tracker. However recent data indicates nitrogen levels are above the threshold.
Wood Cove	0	0	0%	0	0	0	0	
Rachael Cove	0	0	0%	0	0	0	0	
Sub-Totals	**6643**	**5739**	**-16%**	**880**	**905**			
Cape Cod Bay								
Namskaket Main	Not Available	-7833	#VALUE!	0	0	0	0	
Namskaket Stream	Not Available	-1516	#VALUE!	0	0	0	0	
Little Namskaket Marsh	Not Available	-1180	#VALUE!	1	25		0	Traditional Bookend exceeds CWMP sewer area to incorporate all of "Downtown".
Little Namskaket Creek	Not Available	-17	#VALUE!	0	0	0	0	
Rock Harbor**	1950	1576	-24%	191	191			
Cedar Pond	0	0	0%	78	78			
Sub-Totals	**1950**	**-8970**	**560%**	**270**	**294**			

General Notes:

1. Traditional Bookend areas were specifically developed to mirror the CWMP Phases 1-6 except when the CWMP (with the fertilizer and stormwater credit) did NOT meet load reductions specified in Tracker.
2. The Non-Traditional Bookend was intentionally developed to meet the load reductions specified in Tracker, with the fertilizer and stormwater credit. Feedback to date from Stakeholders is to not take this credit.
3. The purpose of the Traditional and Non-Traditional Bookends was to create a "straw man" to which the stakeholders could respond. Now that the Bookends have been presented, we need feedback for the Hybrid, specifically:
    a. Which removal target (MEP or Tracker) to apply in Hybrid? Remember that WQ and technology performance to be evaluated during AMP.
        i. One approach with the Hybrid is to look at areas where sewering is more costly in Phase I and maybe move it to Phase II, given the inherent uncertainty in the load targets.
    b. Should sewer plan remove MEP loads, Tracker loads or stick with CWMP which over-sewers in several areas?
    c. How to handle fertilizer credits?
    d. How to handle stormwater credits?
4. Kg/yr output based on (CCC 2009-2011) average daily drinking water usage records and scenarios ran through tracker.
5. CCC Tracker uses the threshold septic load from MEP.
6. CCC Tracker changes the present septic load by using more recent land use and water use data.
7. Highlighted in green = meets MEP target (within 5%) or exceeds MEP target.
8. Highlighted Orange = meets Tracker target (within 5%) or exceeds Tracker target.
9. Highlighted Blue = meets Tracker target (within 5%) with fertilizer/stormwater credit.
10. Highlighted yellow = Traditional Bookend area is greater than the CWMP proposed sewer area.

* AM - Adaptive Management

** Denotes a sub-watershed that has multiple towns sharing in the responsibility of meeting the TMDL goal.