

2008 PLAN

Cape Cod Area Wide Water Quality Management Plan Update

The Technical Methods and Application

**Tom Cambareri
Scott Michaud
Cape Cod Commission**

**NEWEA 2016 Annual Conference
Boston, Ma**

Cape Cod Sole Source Aquifer



**Replenished by
Precipitation**

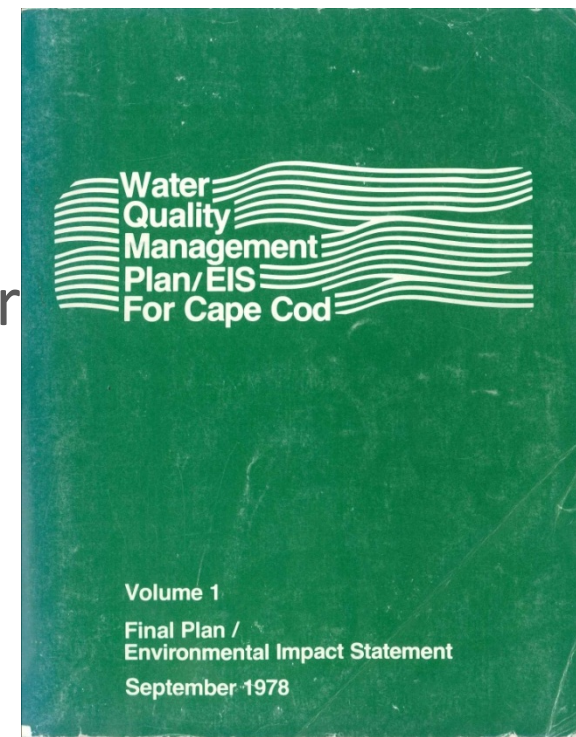
**Six Separate
Lenses**

**Sole Source of
Drinking Water**

**Watersheds are
defined by
groundwater flow**

1978 208 Plan

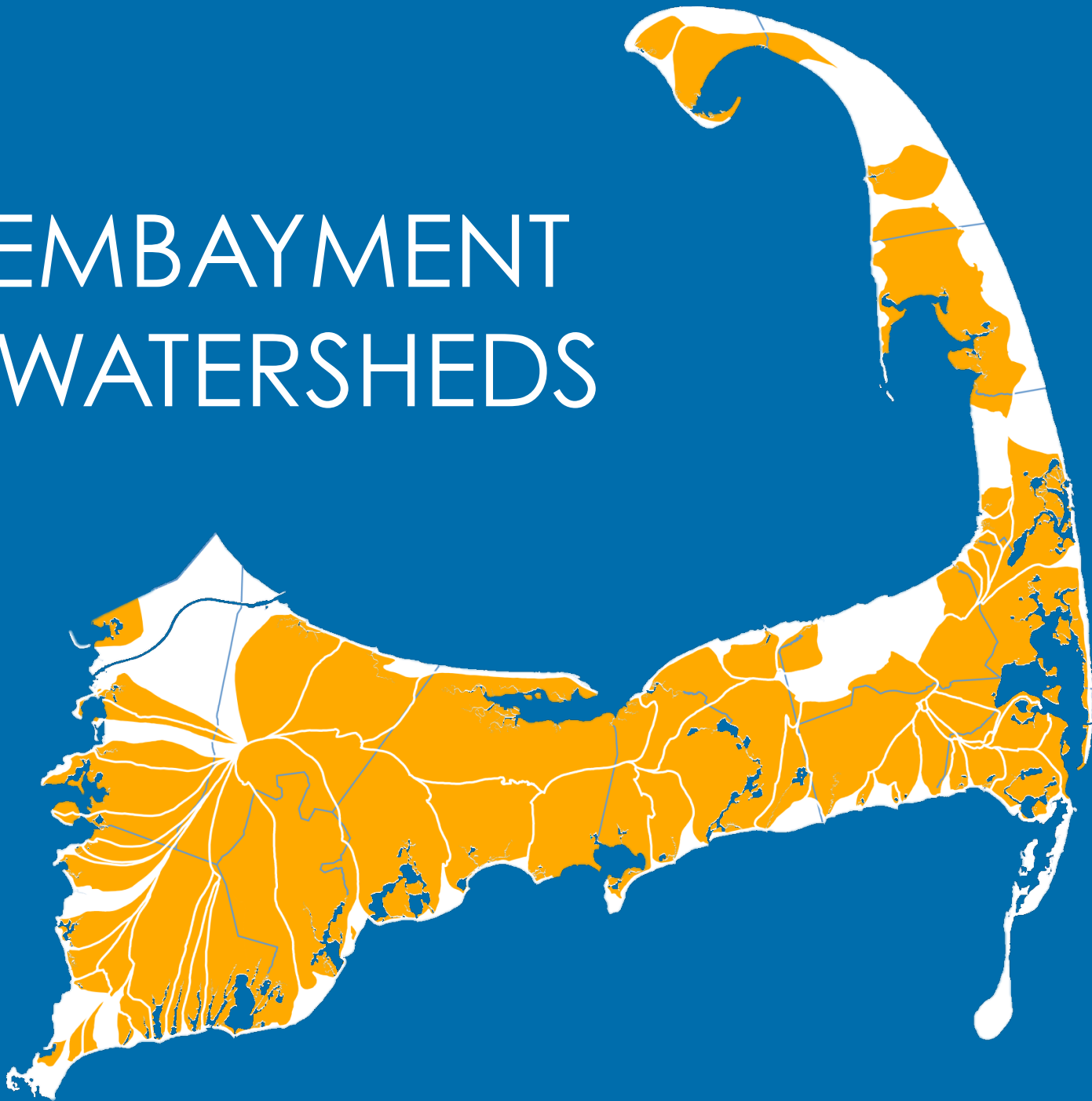
- Identification and Management of Major Contamination sources
 - Landfills
 - Septage lagoons
 - Road salt stock piles
 - Underground Storage Tanks
- Assessment and Management of Wastewater
 - Public health threats from septic systems
 - Drinking water as the primary focus
- Limited Sewering for high density failure areas
- Aggressive On-site Management and Land Use Controls
- Establish Regional Water Council with Technical Staff





Prince Cove, Barnstable

53 EMBAYMENT WATERSHEDS



WHAT IS THE 208 PLAN Update?

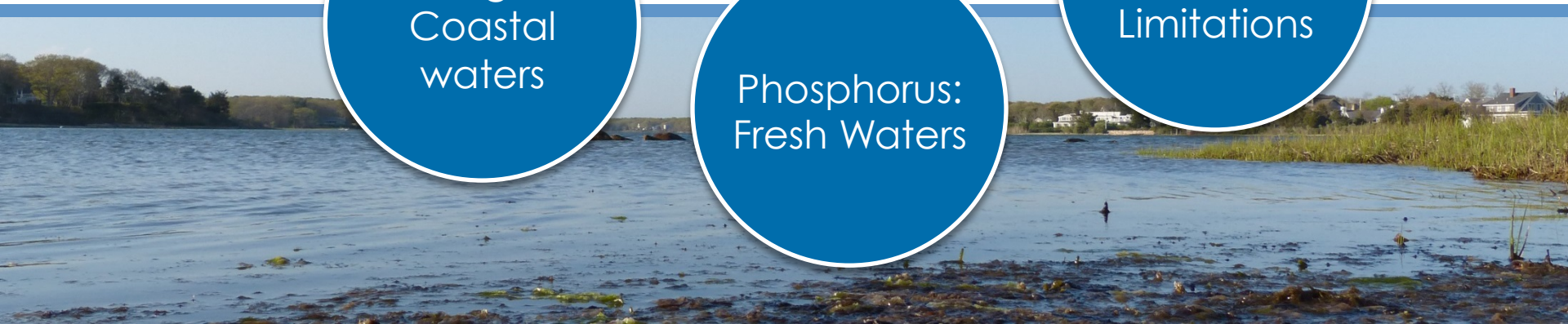


Focus on 21st
Century
Problems

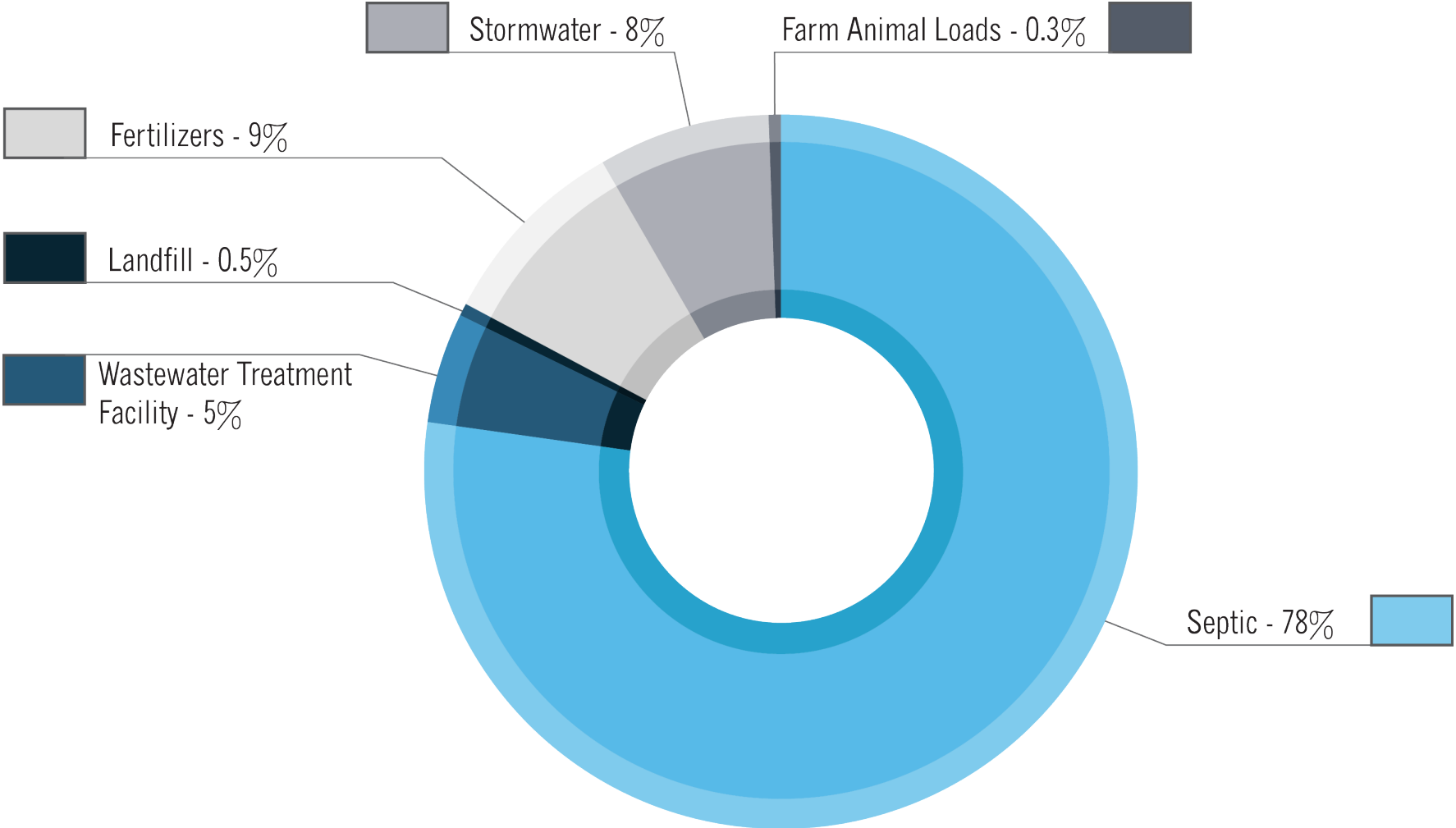
Nitrogen:
Coastal
waters

Phosphorus:
Fresh Waters

Growth and
Title 5
Limitations



Controllable Nitrogen



208 Watershed Planning Factors

- Update Land Use Codes**
- Septic Load from Water Use Records**
- Fertilizer/Stormwater Loads from MEP**
- Natural Attenuation of Nitrogen in GW**

- Watershed Thresholds**
- Subwatershed Thresholds for Targeted**
- Calculate Infrastructure Costs**

- Applying Method to 53 Watersheds**

Public Water Supply Data



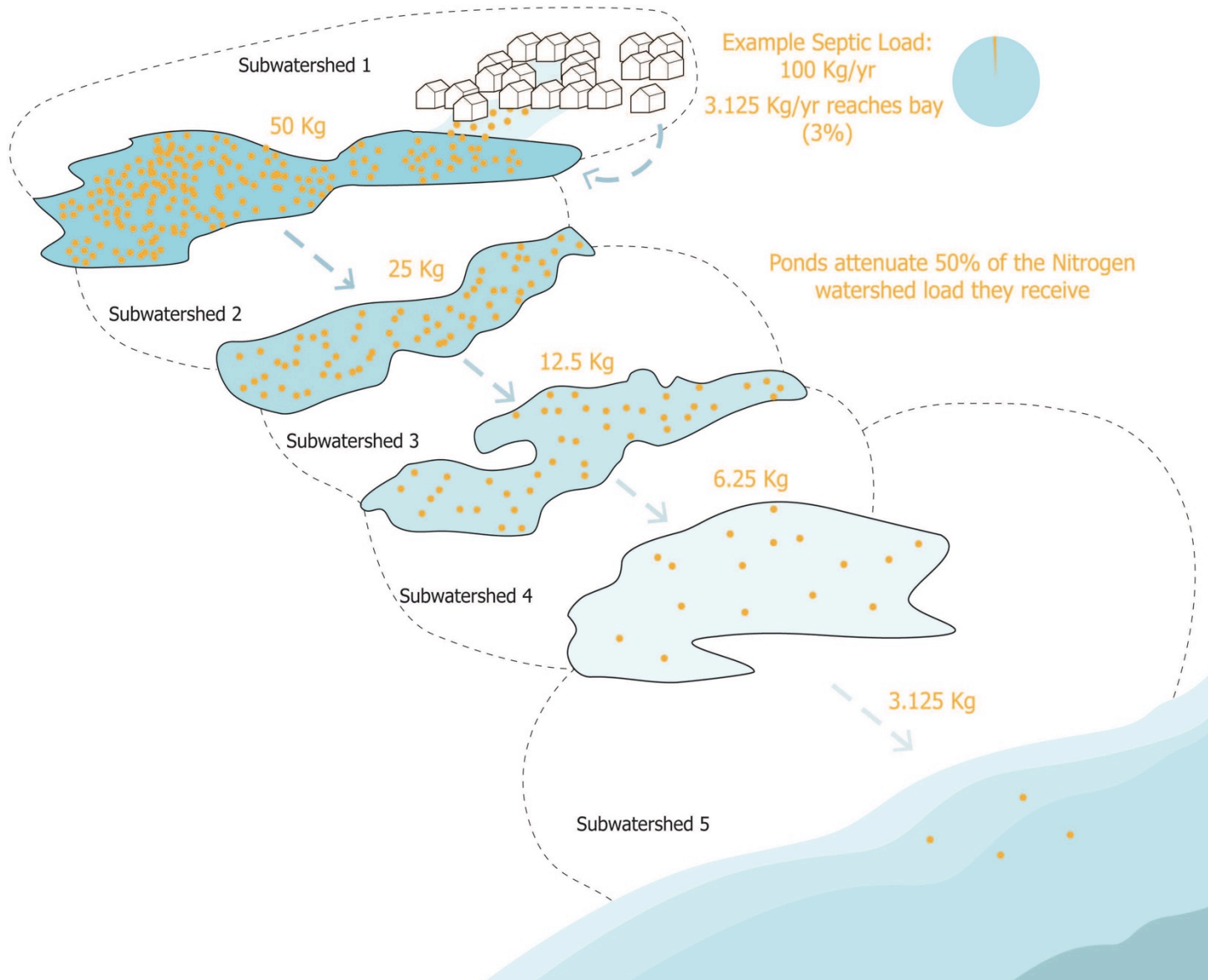
CAPE COD
COMMISSION

- **17 Water Districts**
- **133,516 water services**
- **113,378 Parcels with Town Water**
- **20,138 Parcels with Private Wells 17%**
- **10.5 Billion Gallons per year Cape-Wide Use**
- **169 gpd residential**
- **884 gpd commercial**

NATURAL ATTENUATION



CAPE COD
COMMISSION

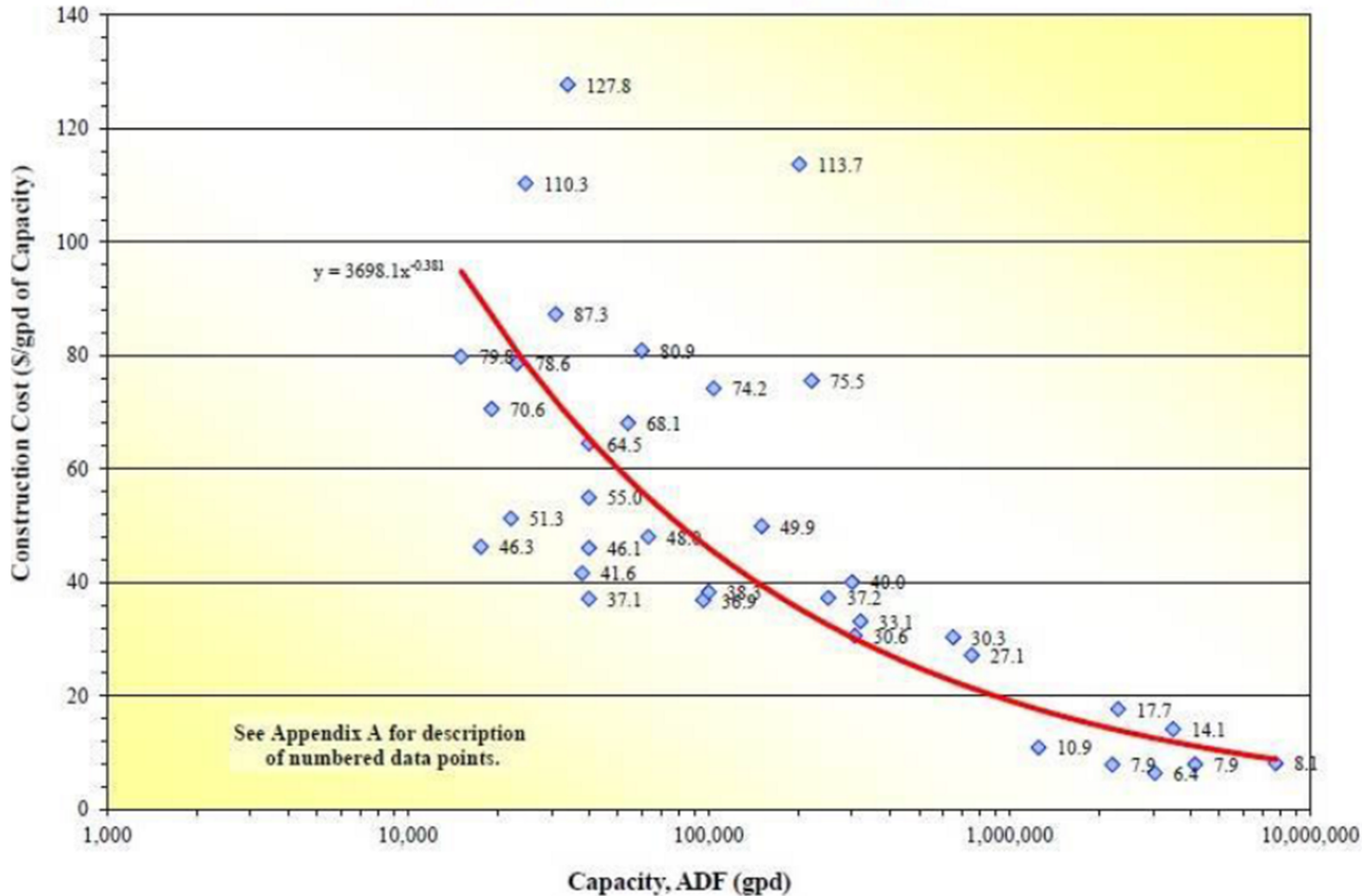


W/MVP Treatment Costs/ GPD



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FIGURE 3
RESULTS OF PROJECT COST SURVEY

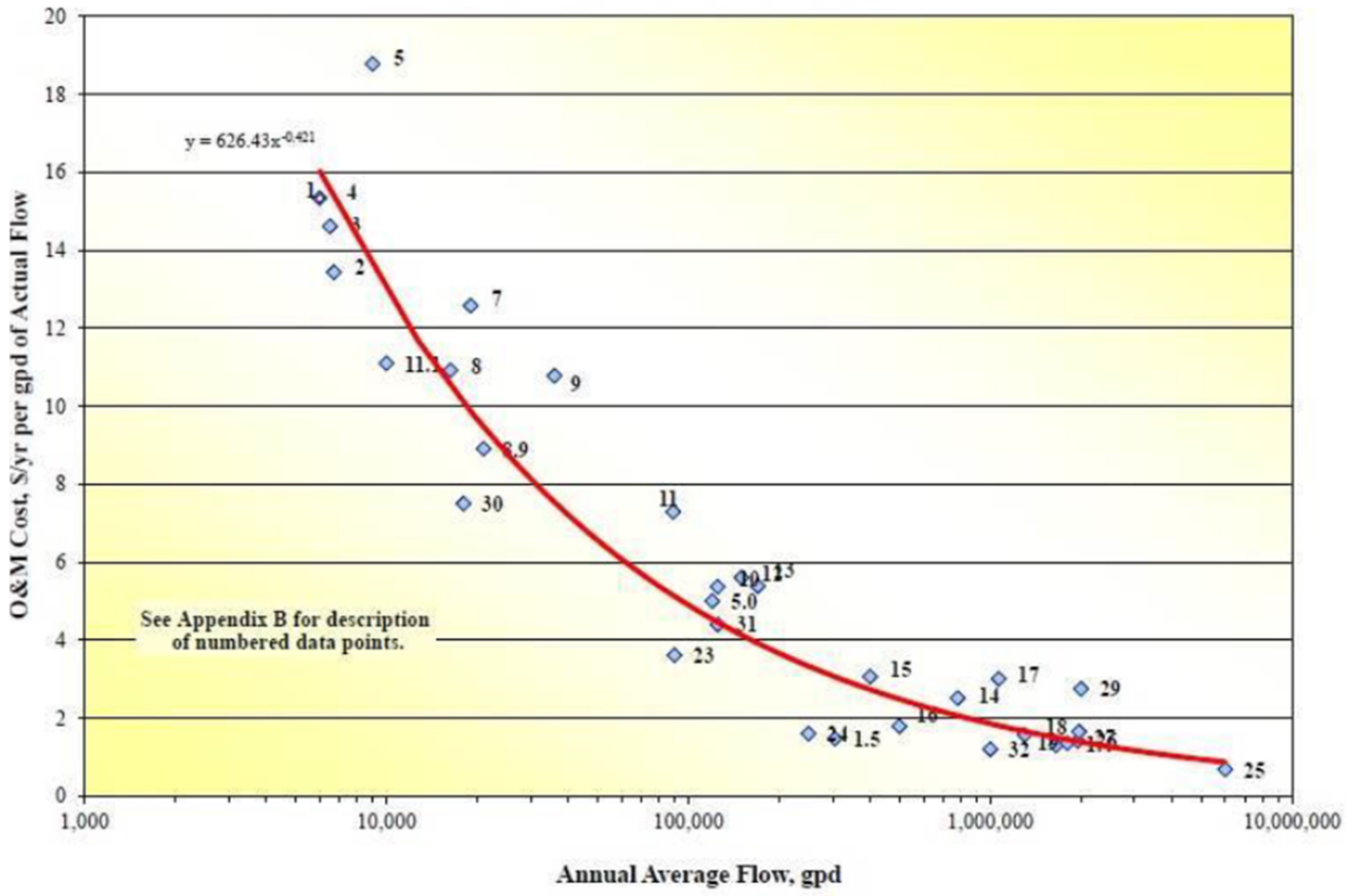


W/MVP O&M Costs / GPD



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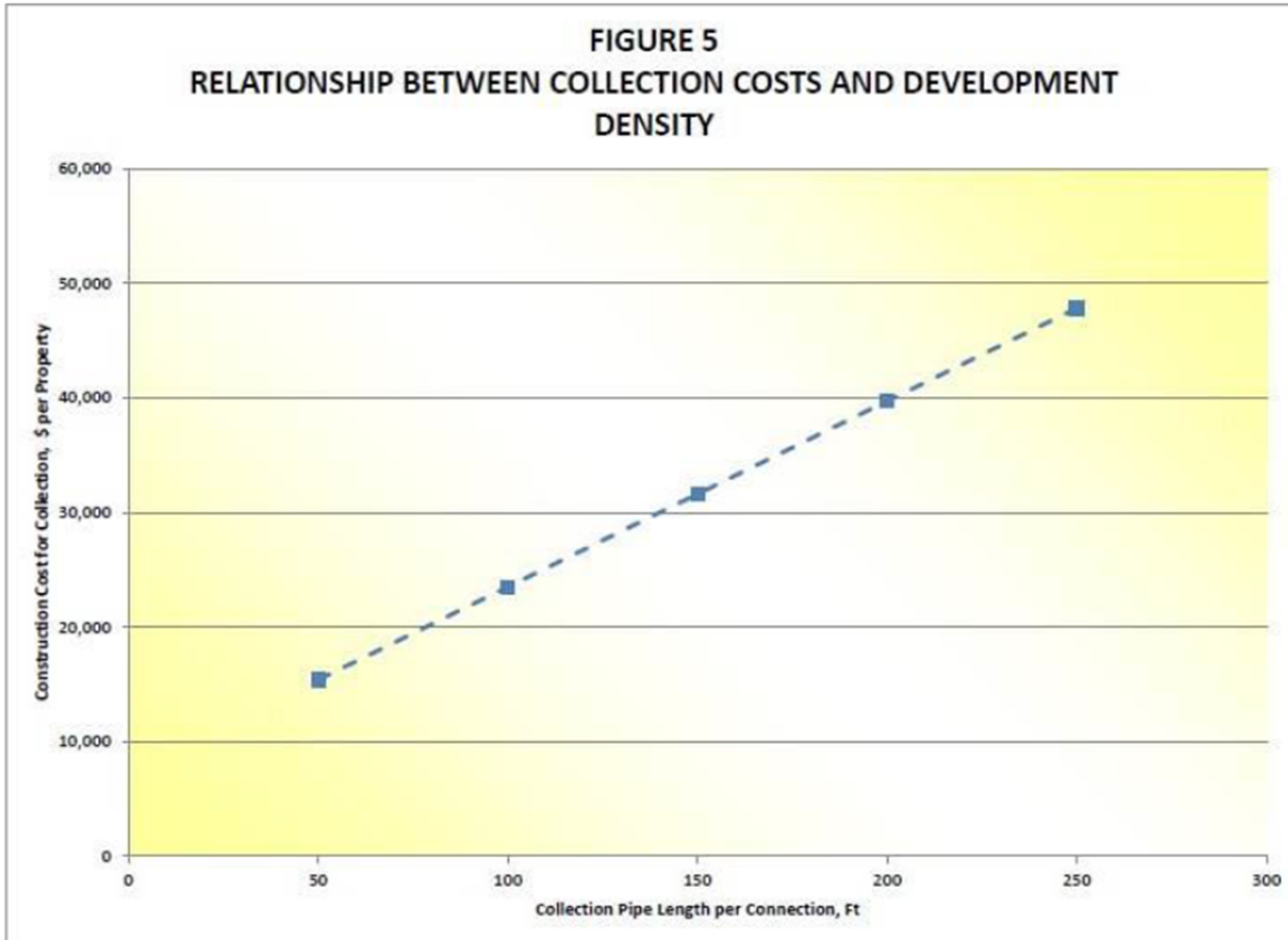
FIGURE 4
RESULTS OF O&M COST SURVEY



W/MVP Collection Costs / Mile



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COMMISSION



Map

Selection

Selection by [select a layer]

Clear

Base Map

Planning Scenarios

Data Summary

Cape Cod Commission

Contact Us




Cape Cod Commission
3225 Main Street (Route 6A)
Barnstable, Massachusetts 02630
(508) 362-3828
www.capecodcommission.org
[Email Us](#)

About

The Cape Cod Commission developed the WatershedMVP application for professionals, municipal officials and community members in order to assist in creating the most cost-effective and efficient solutions to Cape Cod's wastewater problem. The application is an informational resource intended to provide regional estimates for planning purposes. WatershedMVP is an initiative of the Cape Cod Commission's Strategic Information Office (SIO). To learn more about the WatershedMVP application and the Cape Cod Commission and its SIO, please [Contact Us](#).

Sources

Help



WATERSHED MVP

MULTI-VARIANT PLANNER

About

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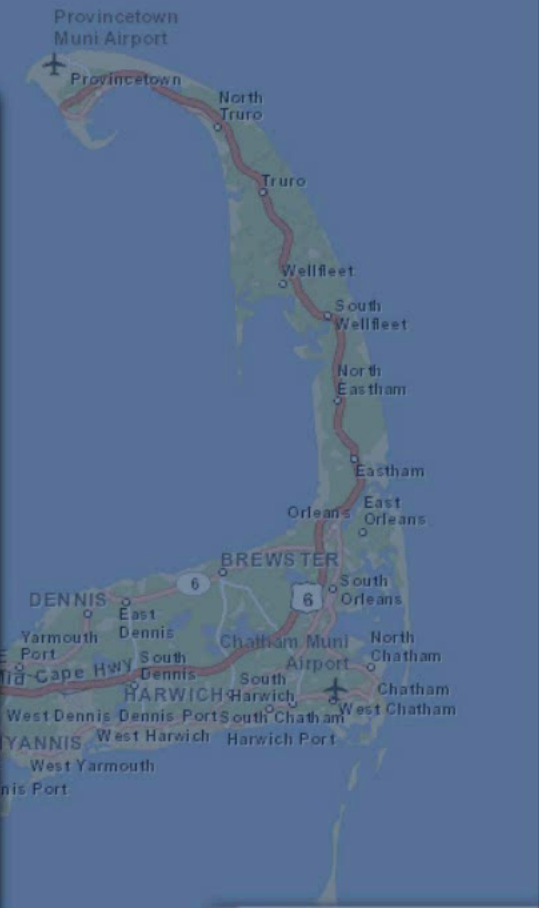
Sources

Parcel Data (Assessing Data and boundaries):

MassGIS Commonwealth of Massachusetts' Office of Geographic Information, a part of the Information Technology Division (ITD) within the Executive Office for Administration and Finance, provided the Cape Cod Commission with the parcel boundaries and assessing data (ranging from 2010-2012) for 14 of the 15 Cape



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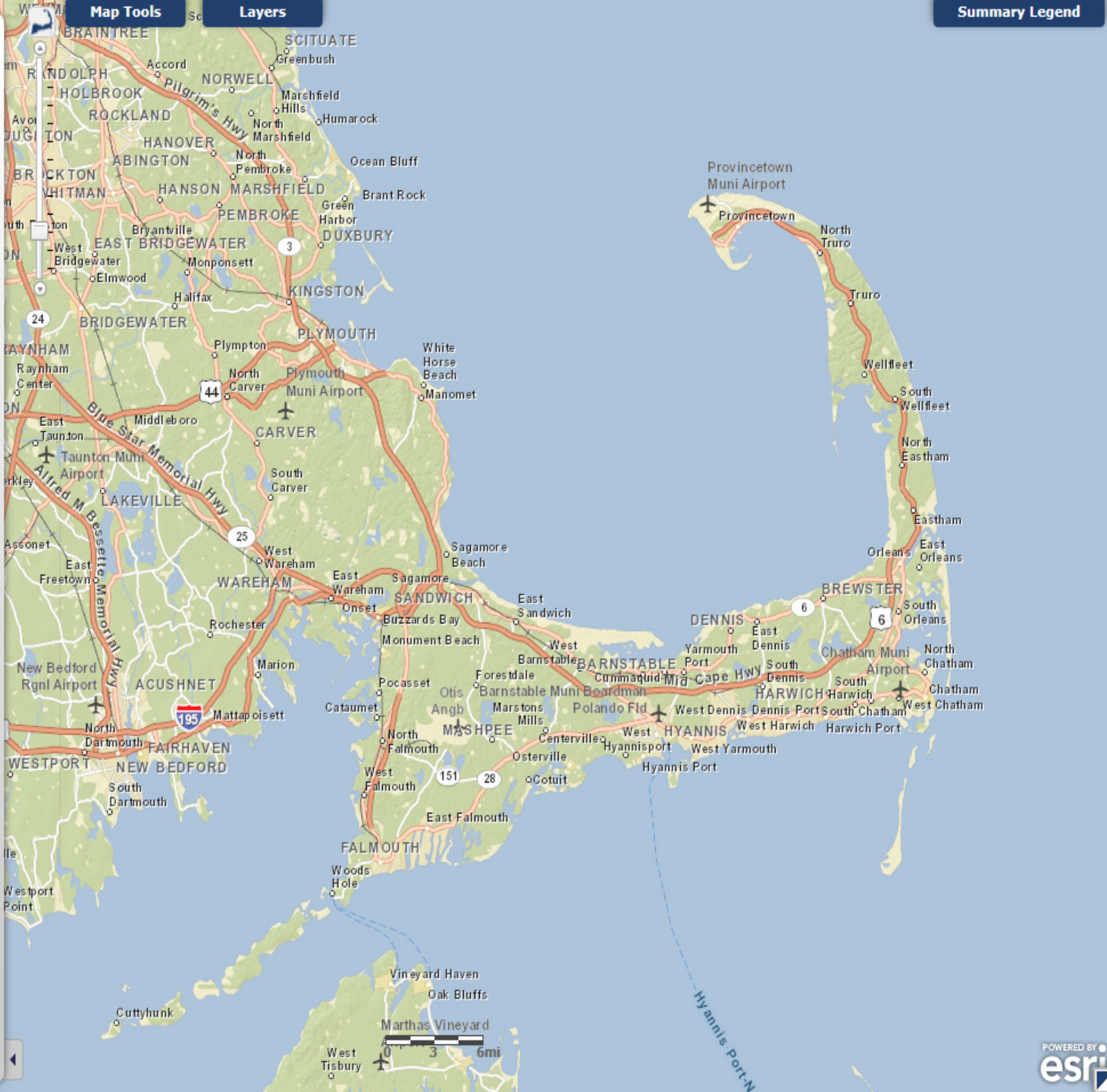


- Map
- Selection
 - Selection by [select a layer]
 - Clear
- Base Map
- Planning Scenarios
- Data Summary
- Cape Cod Commission
- Contact Us



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- CAPE COD COMMISSION
- About
- Sources
- Help



Wizard Scenario Builder

Create a subembayment scenario using the Scenario Builder Wizard

Scenario Builder Wizard

Look up Scenario ID:

Find

Map

Selection

Selection by

Clear

Base Map

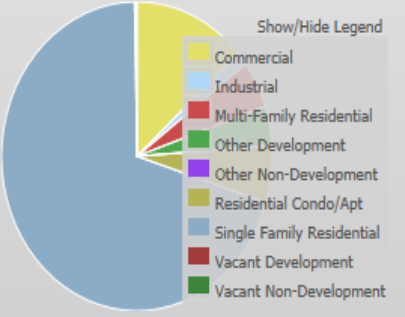
Planning Scenarios

Data Summary

Summarize by

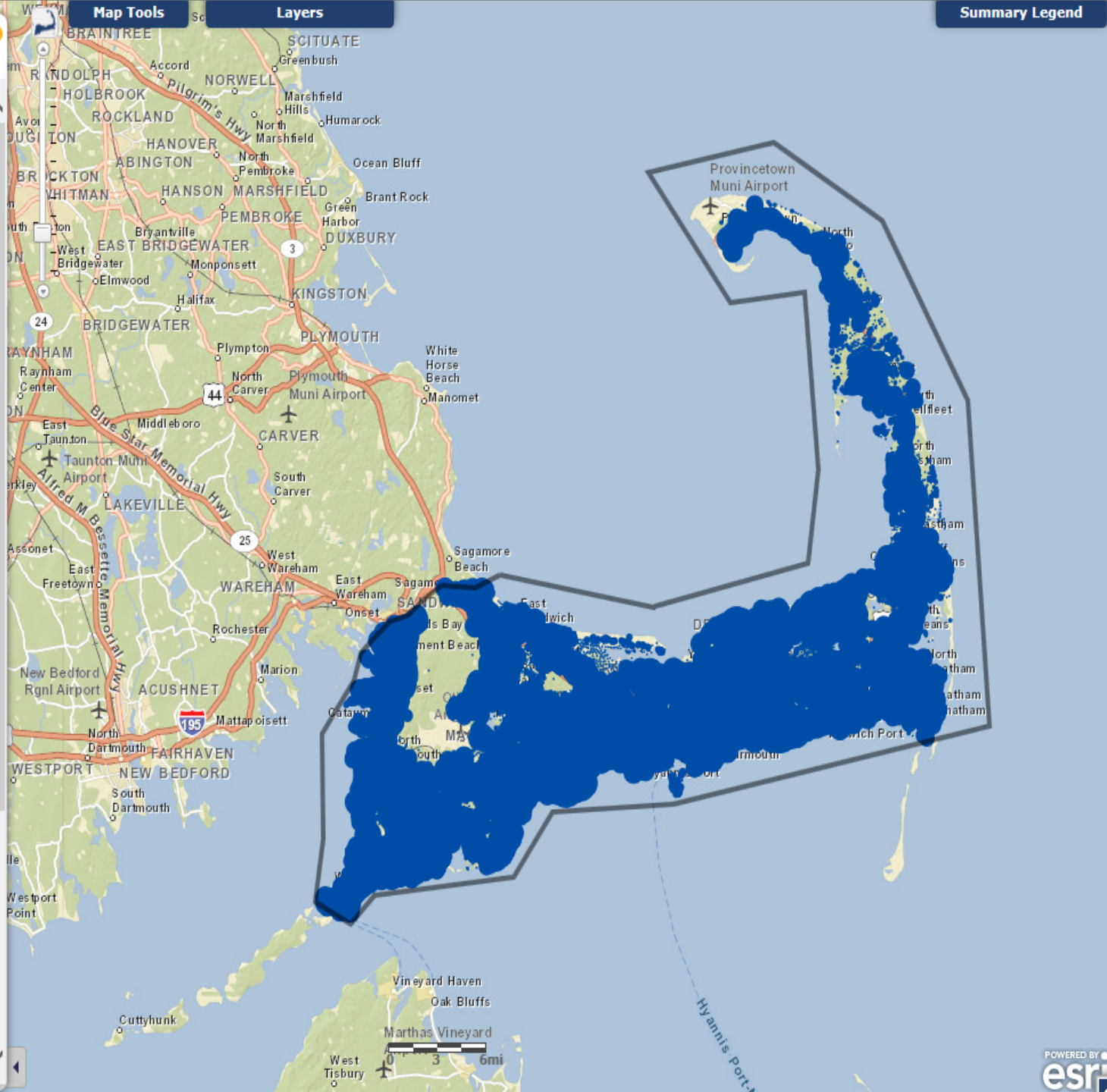
- Existing
- Future
- Scenario

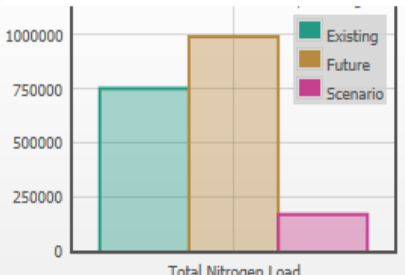
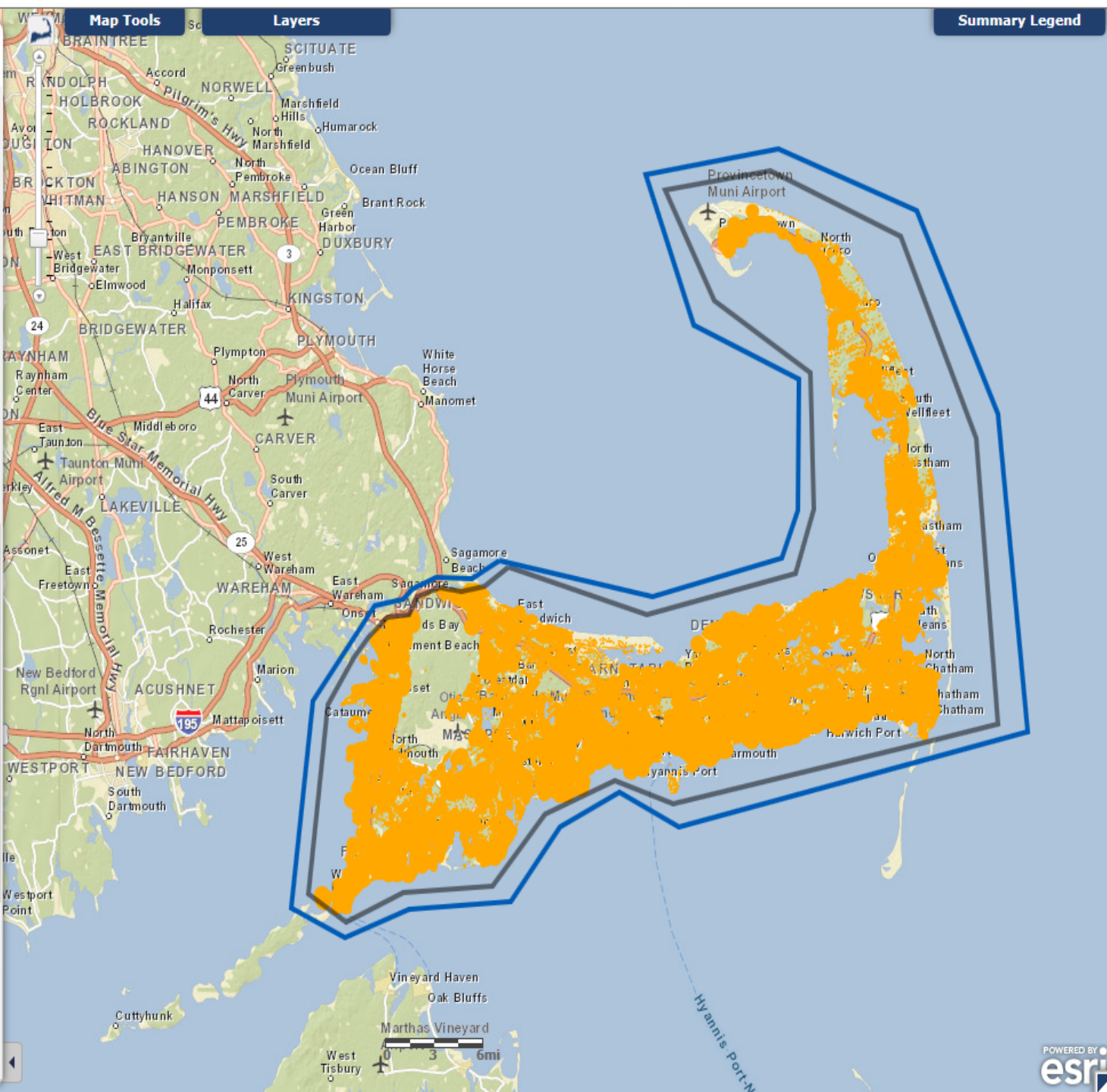
Chart



Results

Total Number of Properties Selected	156,264
Existing Sewered	5,275
Existing GWDP	60
Total Existing Water Use	28,092,382.31 g/day



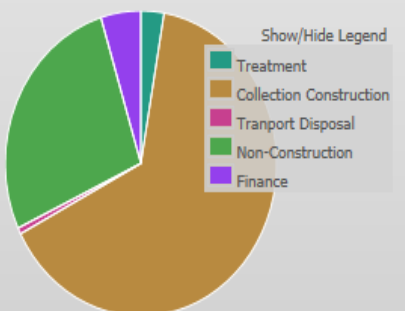


Results

Total Number of Properties Selected	156,328
Existing Sewered	5,368
Existing GWDP	60
Total Scenario Cost	\$6,974,147,176
Cost/lb of Nitrogen Removed	\$435

Costs

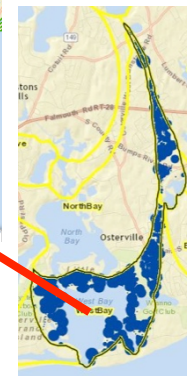
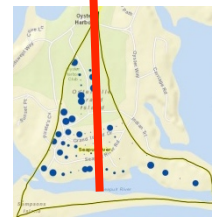
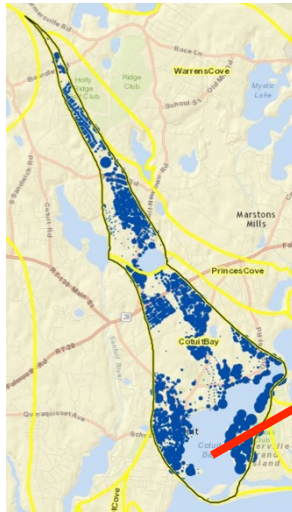
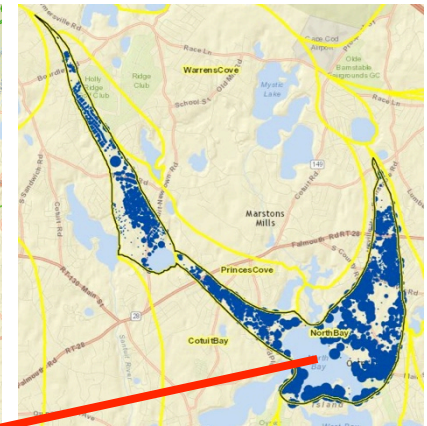
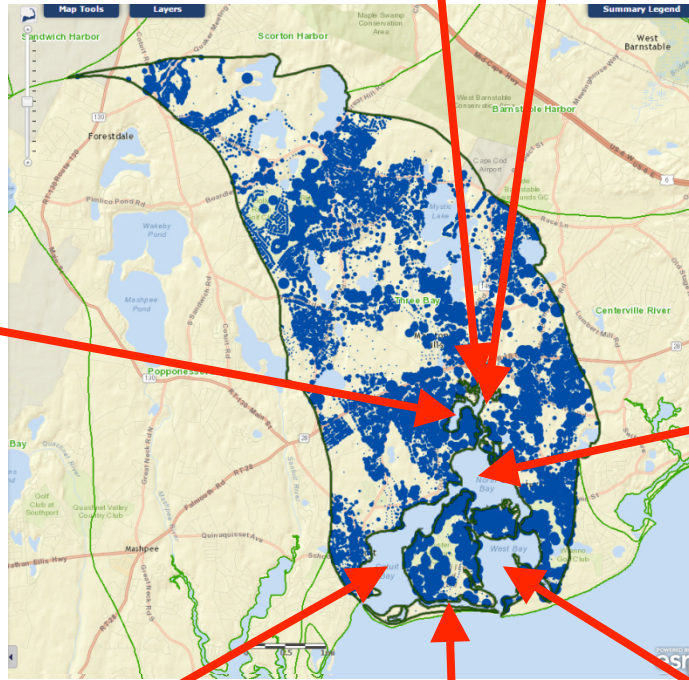
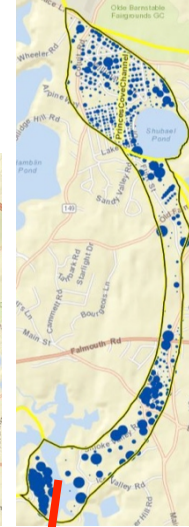
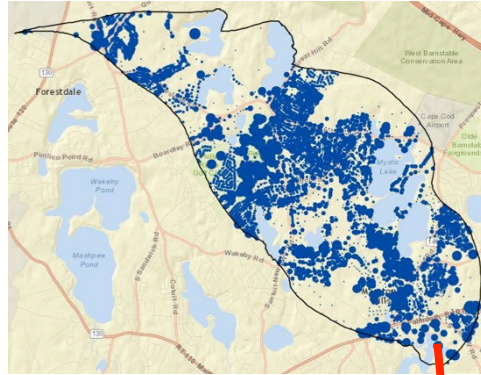
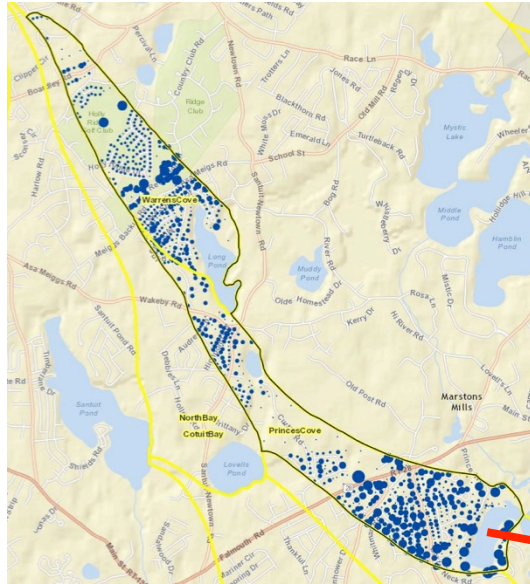
Show Capital Cost



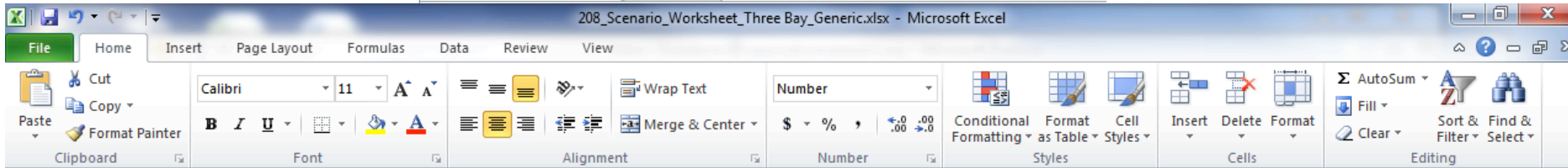
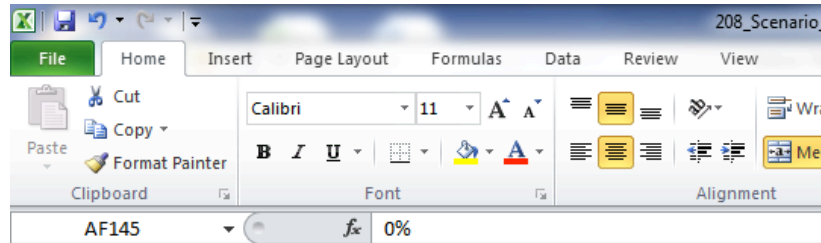
Total Capital Cost	\$7,095,622,000
Total Annual Cost	\$597,946,000
Treatment Cost	\$204,460,000
Collection Construction Cost	\$4,814,399,000
Tranport Disposal Cost	\$49,442,000
Non-Construction Cost	\$2,027,321,000
Finance Cost	\$354,781,000
Payment Period	12.46 years
Finance Rate	0.05

Balancing the Nitrogen Between Watersheds

Accounting

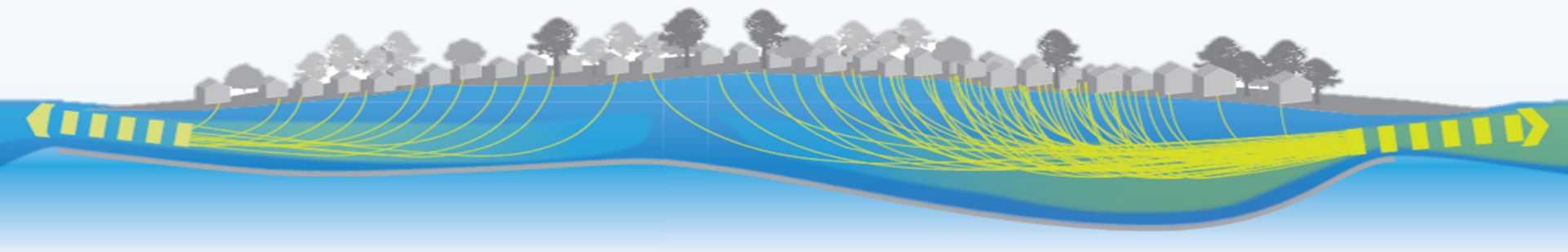


Watershed MVP Tracker



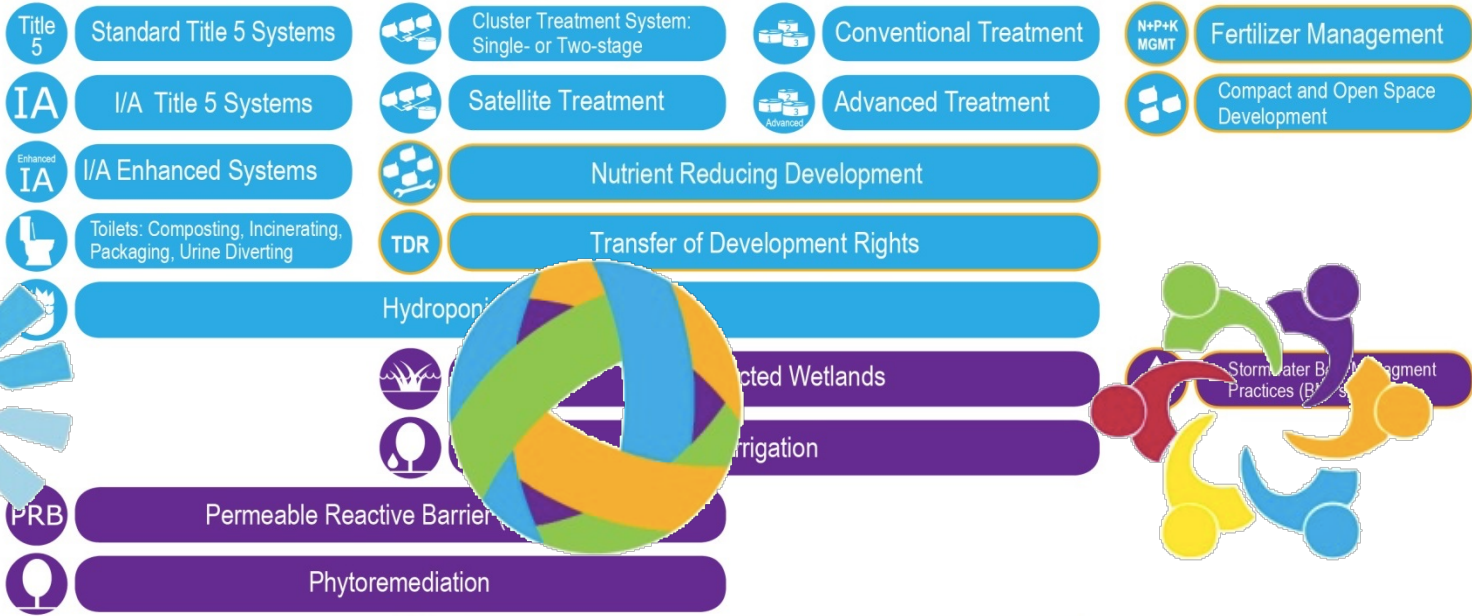
Data Sheet for Scenario #		for Three Bay		Manually Entered		Aggregate		Adjusted Aggregate		Develop		Septic Load		Grag Infrastructure		Import		Export	
Watershed Total	Kg/Yr	Over	NA	Flow Through Coefficient	Existing Wastewater Load	Septic Wastewater Load	Septic Wastewater Load Treated for In-shed Disposal	Treatment Removal Percentage	Treated Septic Wastewater Return Load	Imported Septic Wastewater Load	Treatment Removal Percentage (0% if pre-treated)	Imported Septic Wastewater Load (Treated)	Collected Septic Wastewater Load for Export						
MEP Target	30,019																		
Septic W/W Load	18,540																		
Excess Septic	11,479																		
Goal Net after GI	30,019																		
Scenario W/W after GI	18,540	162%																	
Remaining Excess																			
Disposal Site Totals																			
W/W Capacity (g/d)																			
Current Load (g/d)																			
Remaining Load (g/d)	0																		
Cotuit Bay	20%																		
MEP Target	5,904																		
Septic W/W Load	1,181																		
Excess Septic	4,723																		
Goal Net after GI	5,904																		
Scenario W/W after GI	1,181	25%																	
Remaining Excess																			

MONTH | DAY | YEAR



USING
DIVERSE TECHNOLOGIES
TO DEVELOP
WATERSHED-BASED PLANS

| **Site Scale** | **Neighborhood** | **Watershed** | **Cape-Wide**



Reduction

Treatment before disposal to ground

Remediation

Treatment in groundwater

Restoration

Treatment in water body

- Stormwater: Bioretention / Soil Media Filters
- Stormwater: Constructed Wetlands
- Aquaculture/Shellfish Farming
- Coastal Habitat Restoration
- Inlet / Culvert Widening
- Constructed Wetlands: Floating
- Pond and Estuary Circulators
- Surface Water Remediation Wetlands
- Pond and Estuary Dredging

Calculator for NT

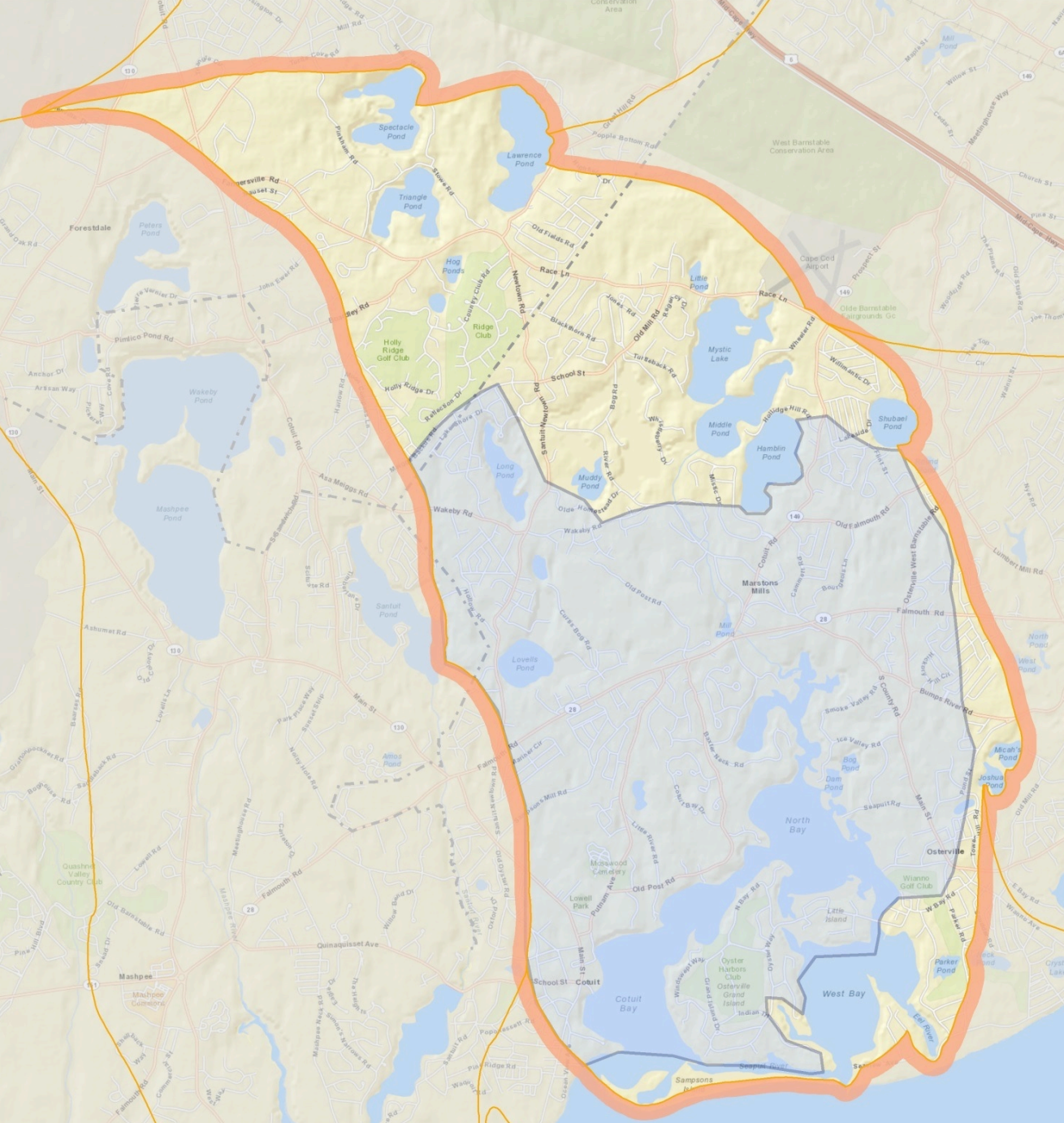
3	MEP Targets and Goals		kg/year	kg/day	kg/day	Nitrogen (kg/yr)
4	Present Total Nitrogen Load				119.5	43,622
5			Controllable Nitrogen Load			
6		Wastewater	34,440	94.4		
7		Fertilizer	6,121	16.8		
8		Stormwater	3,061	8.4		
9	Target Nitrogen Load				65.2	23,798
10	Nitrogen Removal Required				54.3	19,824
11						
12	Total Number of Properties		9,153			
13						
14	Low Barrier to Implementation		Percent of Total Removed		Reduction by Technology (Kg/yr)	Remaining to Meet Target (Kg/yr)
15	A) Fertilizer Management		50		3,061	16,764
16	B) Stormwater Mitigation		50		1,531	15,233
17						
18	Watershed/Embayment Options		Quantity		Reduction by Technology (Kg/yr)	Remaining to Meet Target (Kg/yr)
19	A) Permeable Reactive Barrier (PRB)		5,500 linear feet		766	14,467
20	B) Constructed Wetlands (No Collection System)		0 acres		0	14,467
21	C) Constructed Wetlands (with Collection System)		0 acres		0	14,467
22	D) Phytoirrigation		0 acres		0	14,467
23	E) Phytobuffers		0 acres		0	14,467
24	F) Fertigation - Turf		300 acres		1,200	13,267
25	G) Fertigation - Cranberry Bogs		181 acres		2,172	11,095
26	H) Surface Water Remediation Wetland		0 acres		0	11,095
27	I) Dredging/Inlet Widening		66,000 cu. yard		4,012	7,083
28	J) Phytoremediation		0 acres		0	7,083
29	K) Aquaculture/Oyster Beds		20 acres		5,000	2,083
30	L) Coastal Habitat Restoration		0 acres		0	2,083
31	M) Floating Constructed Wetlands		0 cu feet		0	2,083
32						
33	Alternative On-Site Options		Quantity		Reduction by Technology (Kg/yr)	Remaining to Meet Target (Kg/yr)
34	A) Ecotoilets (UD & Compost)		458 homes		2,746	-663
35	B) UD School or Public Facility		700 people		1,008	-1,671
36	C) I & A Systems		0 homes		0	-1,671
37	D) Enhanced I & A Systems		0 homes		0	-1,671
38						
39			Quantity		Reduction by Technology (Kg/yr)	Remaining to Meet Target (Kg/yr)
40	Unattenuated Load Remainder***		0 homes		0	-1,671

THREE BAYS

WATERSHEDS

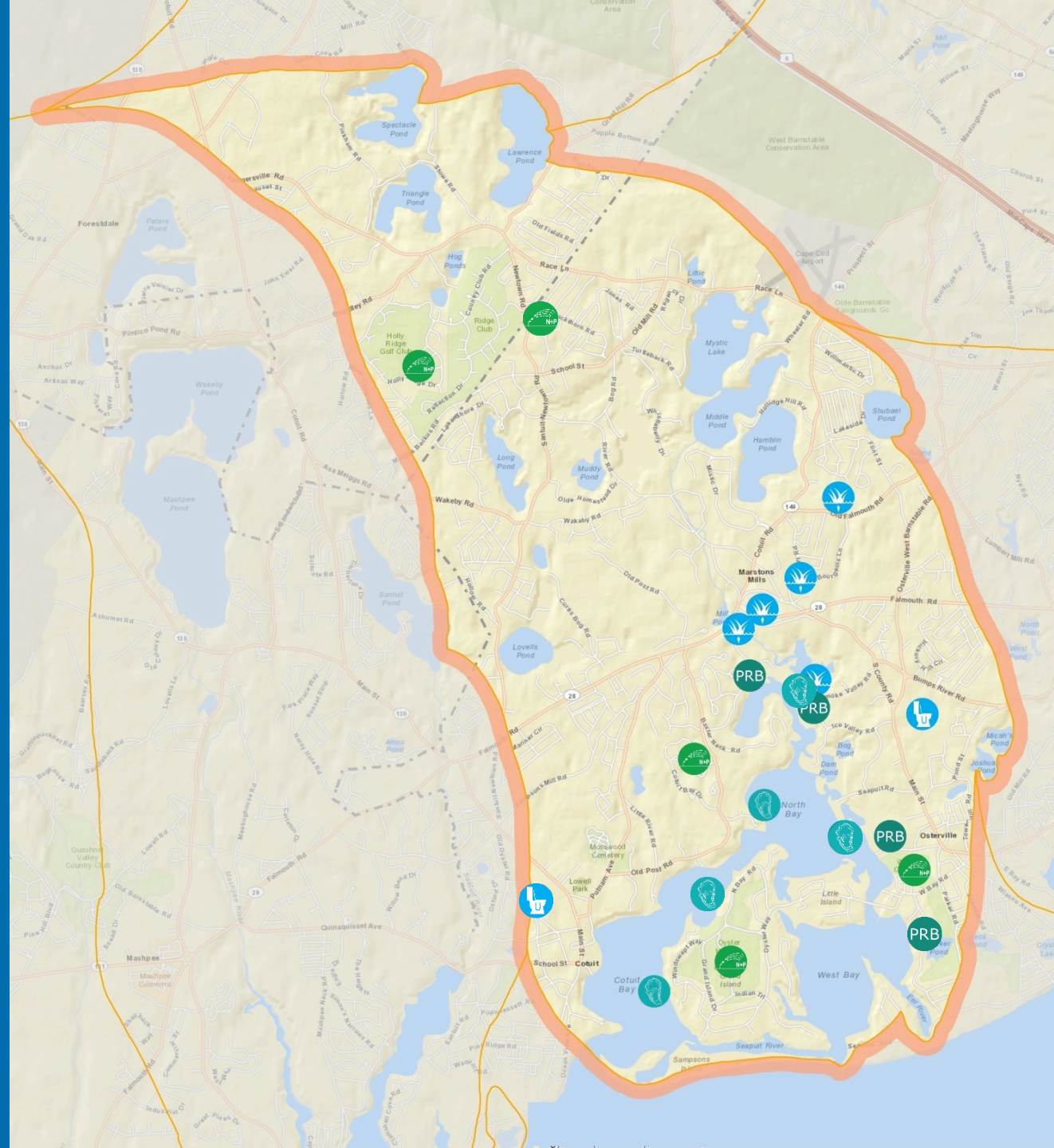


Traditional Scenario



Sources: Esri, De Kong, Esri (Thailand)

Non-Traditional Scenario





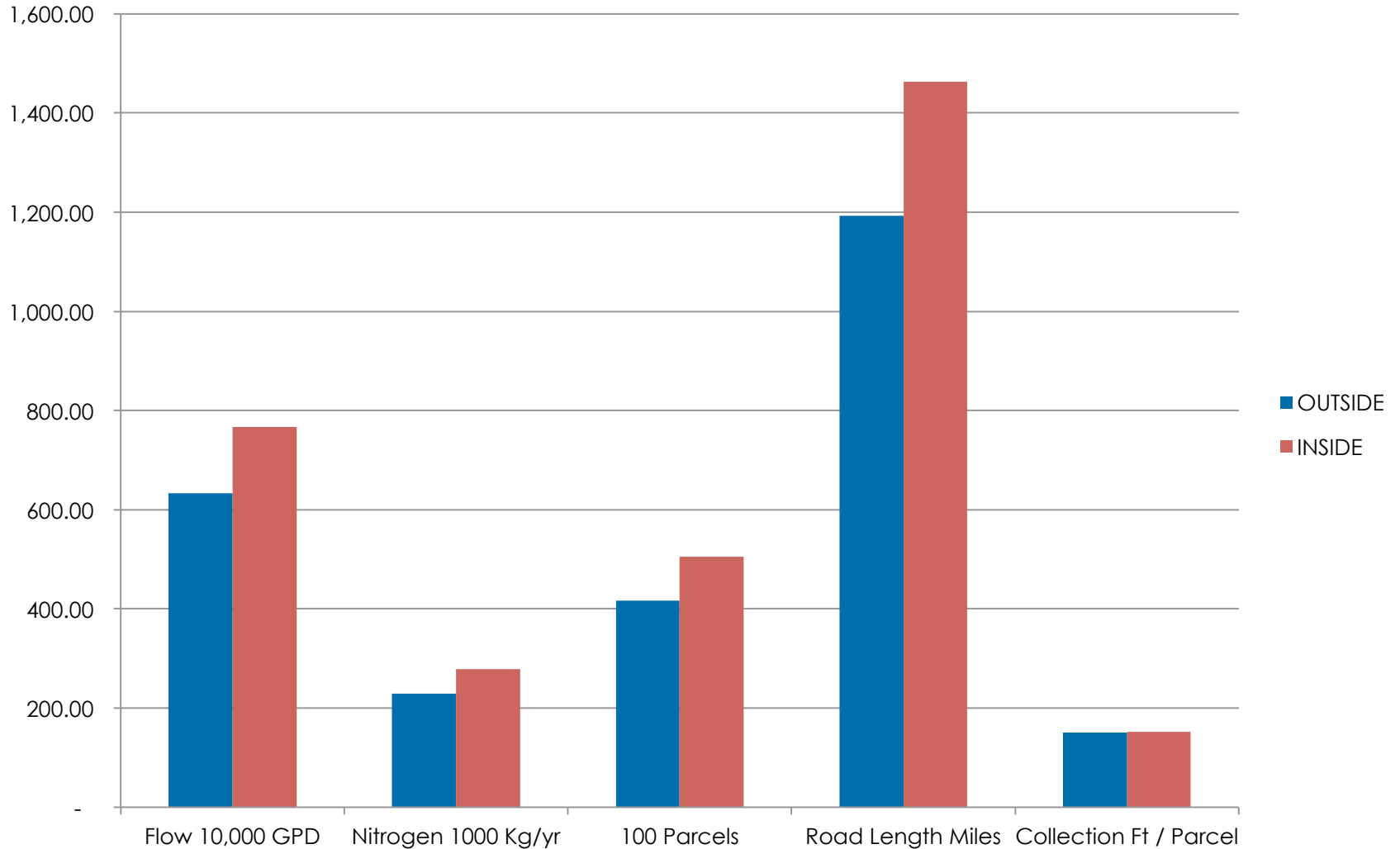
More...

Basemap

Targeted Centralized-In Solutions



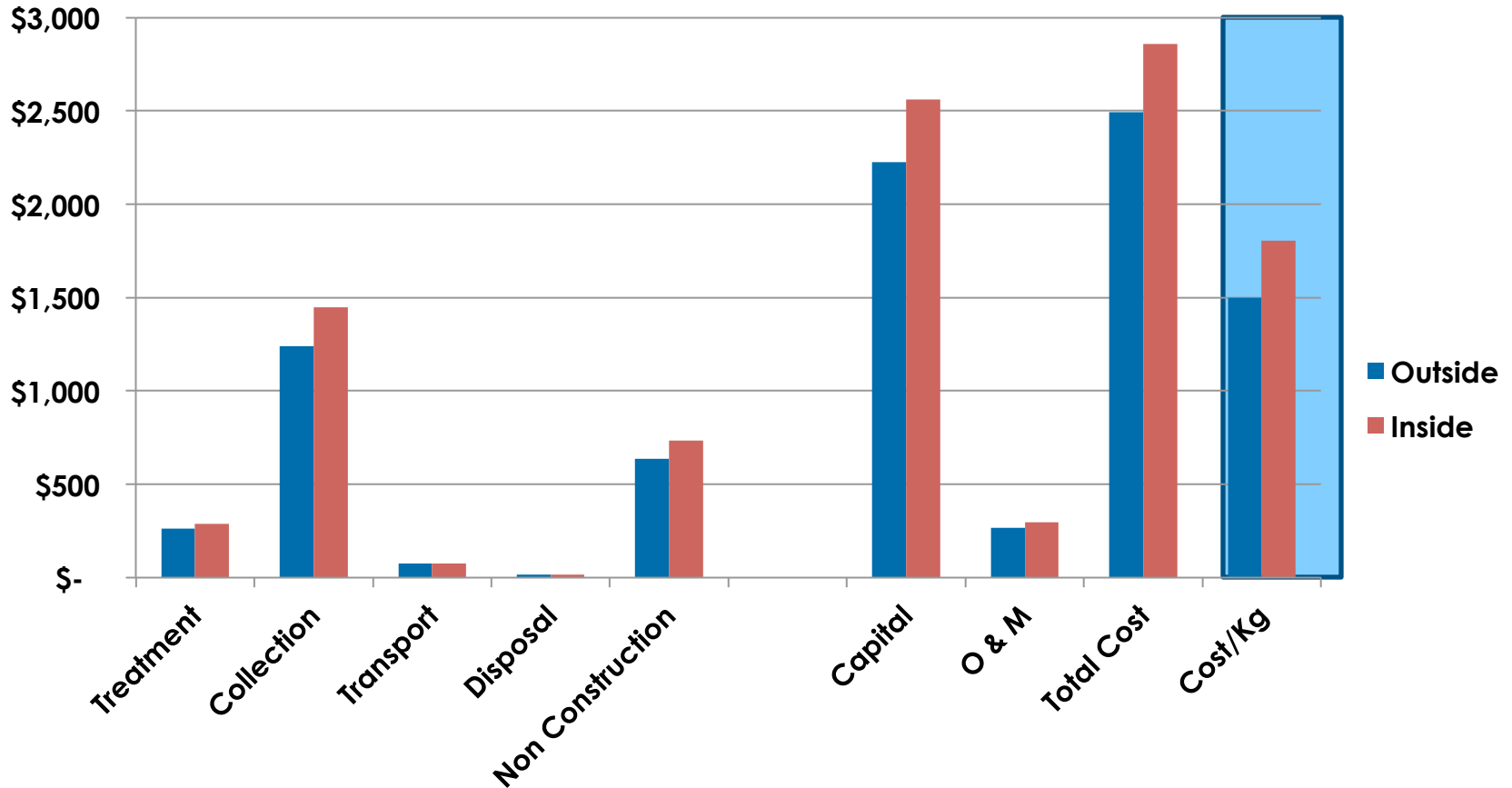
Comparative Centralized Results*



*For 28 Targeted Solutions not including Chatham or Swan Pond

Comparative Centralized Results*

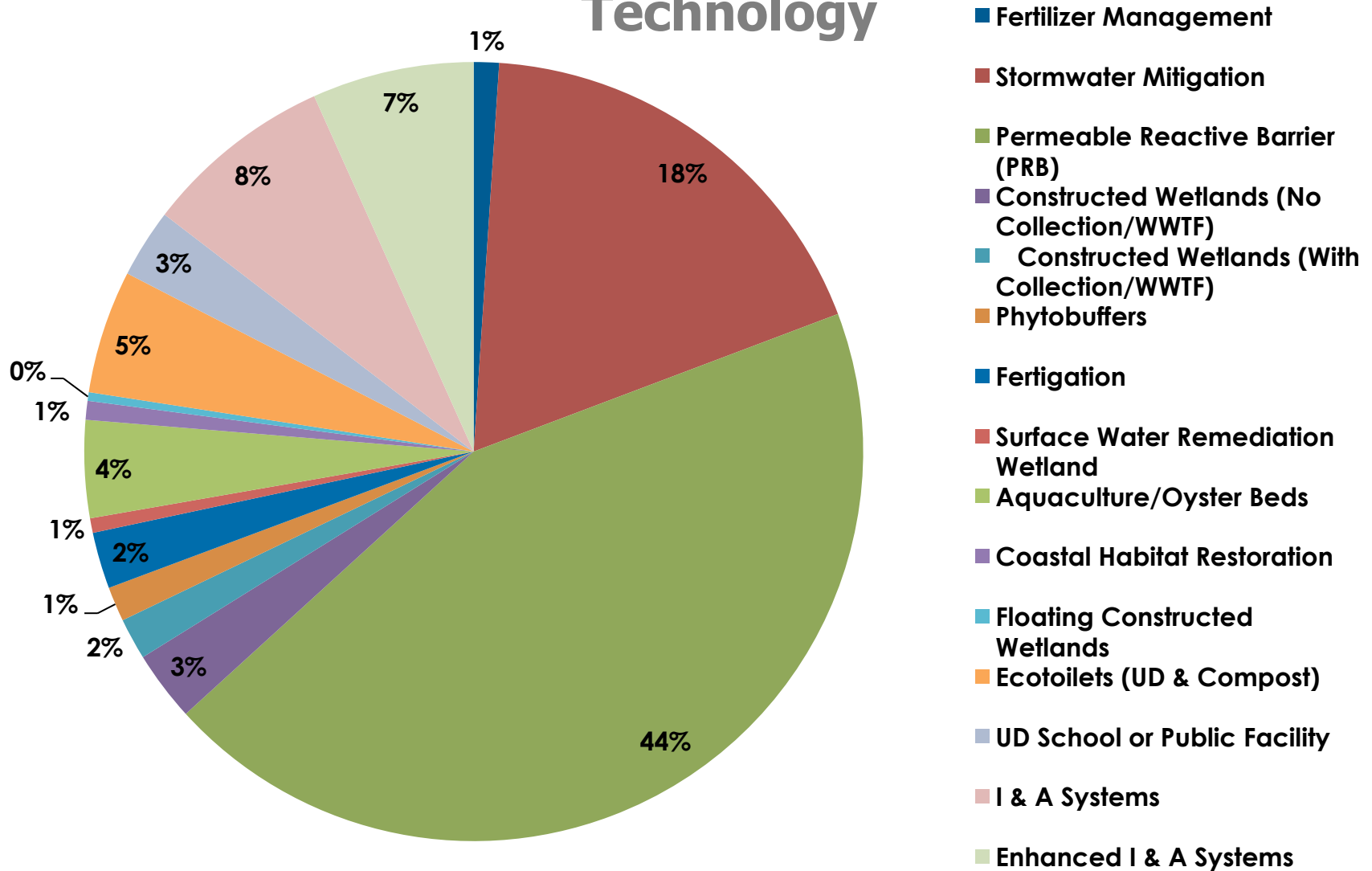
Millions



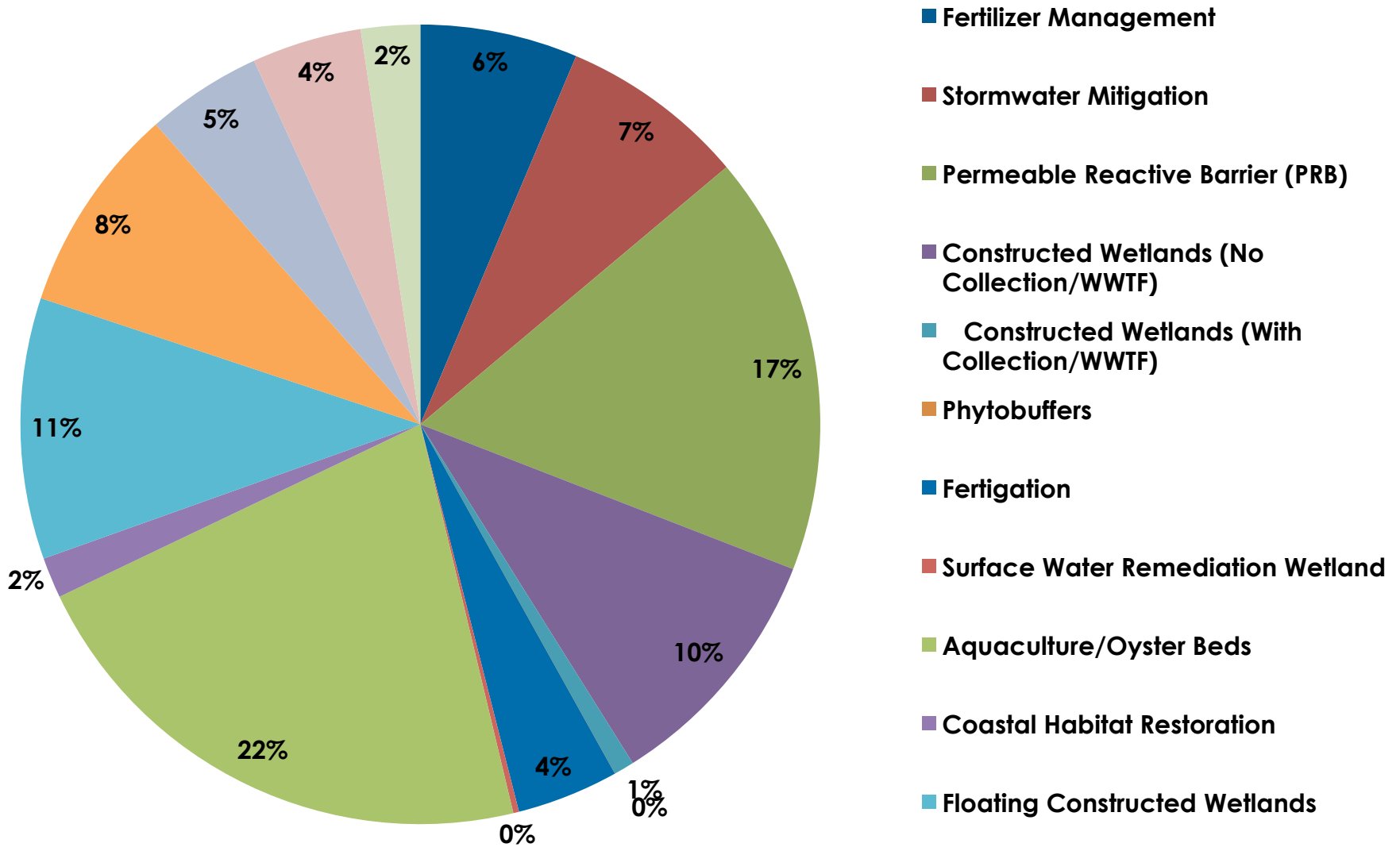
Straight Dollars

*For 28 Targeted Solutions not including Chatham or Swan Pond

Percent of Regional Non-Traditional Technology



Kg Removed by Non-Traditional Technology



208 Implementation for 2016

- Targeted Watershed Plan Falmouth
- Orleans Hybrid
- Watershed Permits
- Refined Watershed Tools
- Watershed Solutions by June 2016
- Monitoring Protocols
- Aquaculture
- Permeable Reactive Barriers
- Data Management

Acknowledgements

MASS - DEP

EPA

Cape Cod Towns

MEP - SMAST

App Geo, Inc.

AECOM, Inc.

Commission Staffers

Scott Horsley

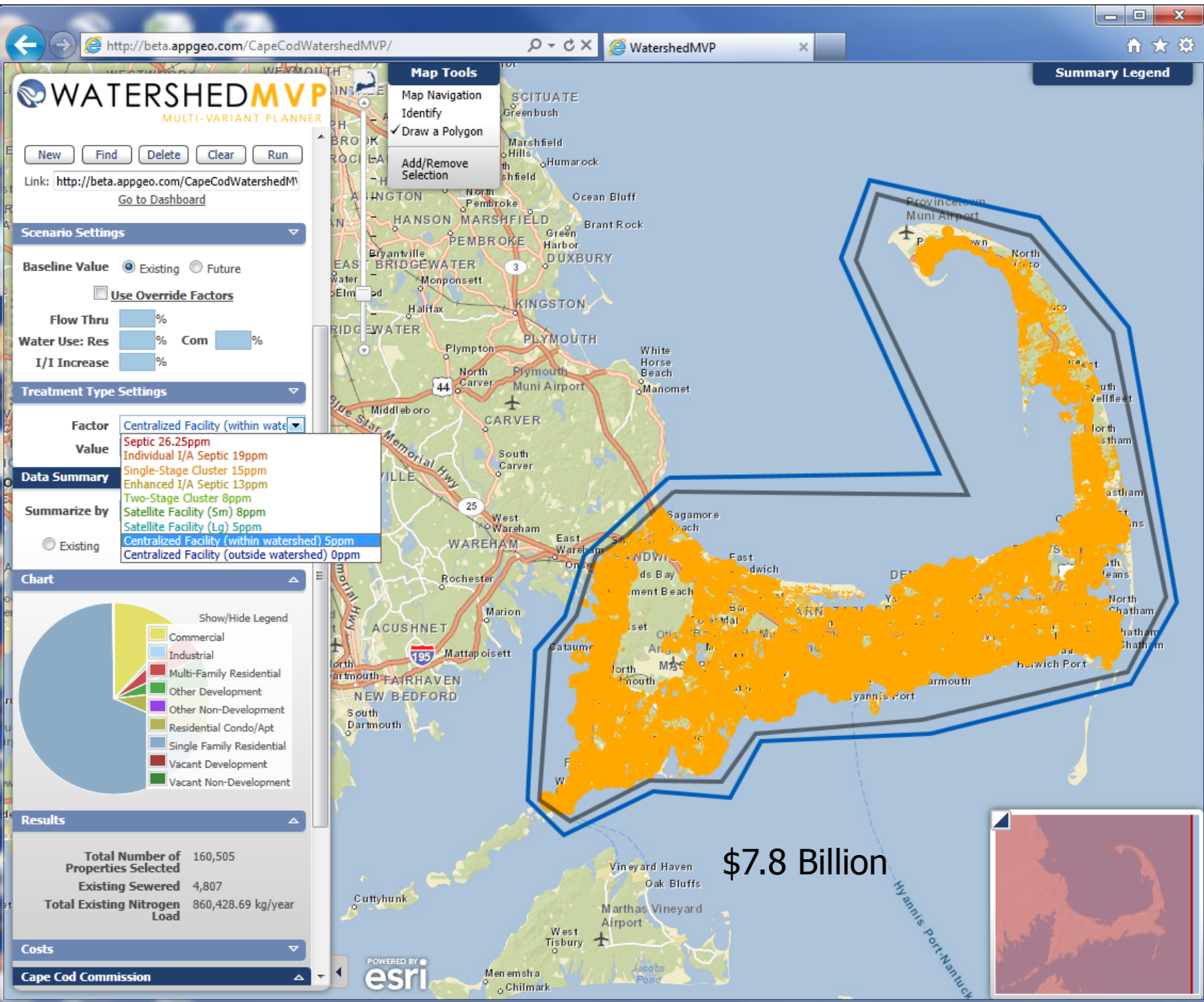


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Back Pocket

Massachusetts Estuary Project (MEP)

- Rigorous Water Quality Monitoring Component
- Watershed Delineation
- Land Use Nitrogen Loading
- Hydrodynamic Modeling of Flushing
- Linked Water Quality Model
- Development of Ecological Ranks
- Establishment of Nitrogen Thresholds/
TMDLs



TEAM
1



cost and effectiveness
septic nitrogen load
economies of scale
potential limitations
permissible

Traditional Approaches



TEAM
2



total controllable nitrogen load
watershed/embayment options
innovation
nitrogen reduction credits
no collection

Non-traditional Approaches





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Section 208 of the Clean Water Act – 1972

Calls for Area Wide water quality management planning to achieve the national goal of restoring and maintaining the chemical physical and biological integrity of the Nation's waters.

“identify water quality ... problems of a region and develop cost effective and environmentally sound approaches to deal with those problems on an area-wide basis”

How do you implement adaptive management?

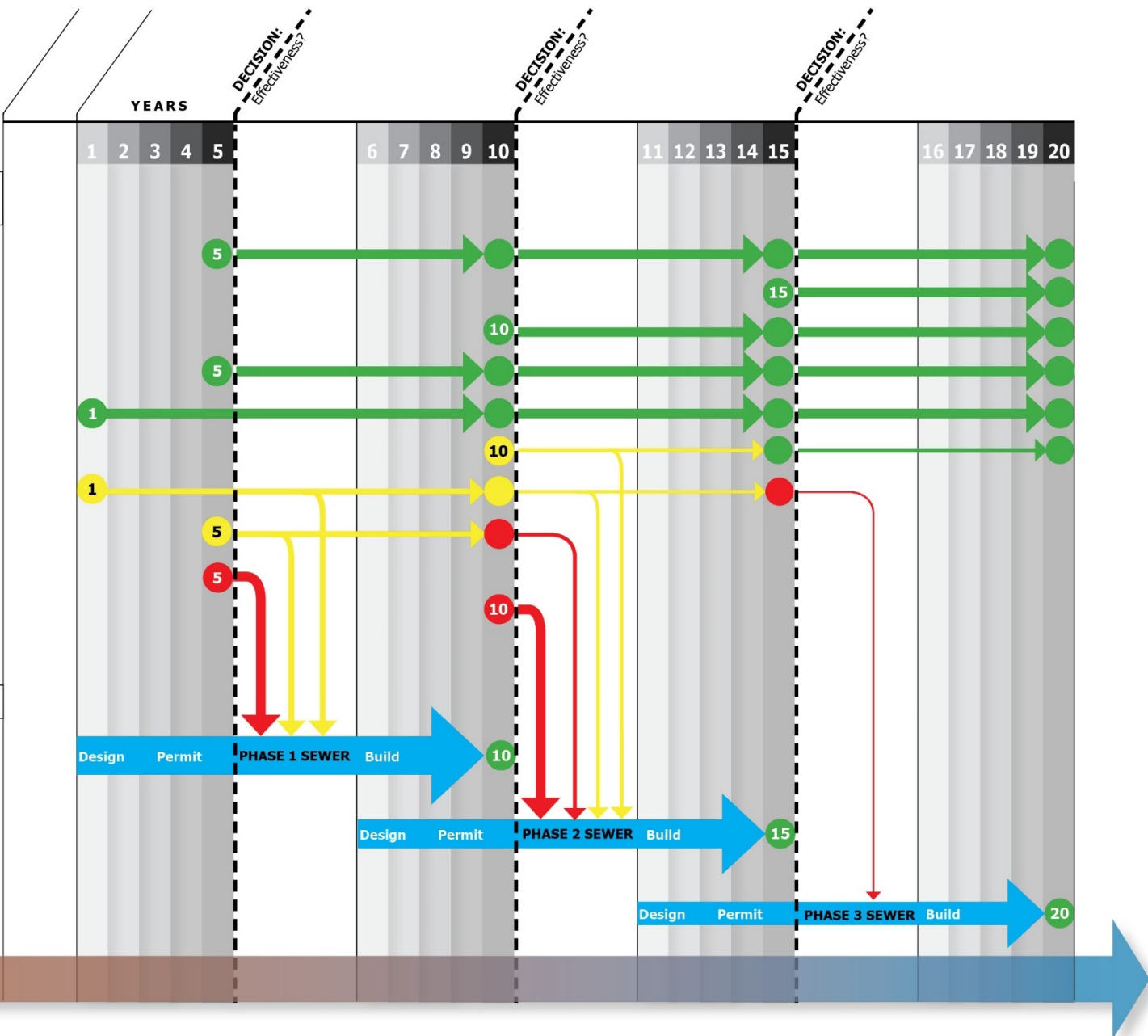
SELECTED SCENARIO:
Alternative Technologies

- Fertilizer Management
- Constructed Wetlands
- Shellfish Aquaculture
- Inlet Widening
- I/A Title 5 Systems
- Const. Wetlands: Floating
- Stormwater BMPs
- Perm. React. Barrier
- Fertigation Wells
- Phytoremediation

Traditional Technologies

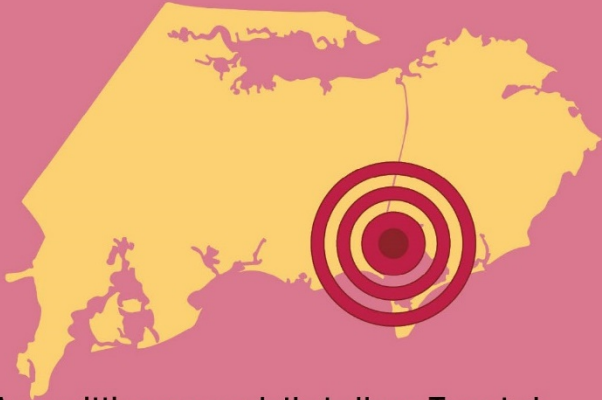
- 1** Priority Collection/ Sewer Areas
- 2** Supplemental Collection/ Sewer
- 3** Supplemental Collection/ Sewer

EMBAYMENT WATER QUALITY



Regulatory Streamlining

TARGETED



A permitting approach that allows Targeted Wastewater Management Plans reduces upfront planning time, lowers cost and focuses attention where it's needed.

WATERSHED PERMIT



Under the watershed permit approach, nitrogen loads are allocated on a watershed-by-watershed basis, as developed through the Waste Treatment Management Agency, or WMA, designations. The watershed permit will list all technology options identified for implementation by stakeholders for the particular watershed, as well as each permittee's specified annual discharge limit.

N+P+K
MGMT

Towns should get credit for what they are already doing. Policies to reduce fertilizer use and stormwater runoff, supported by performance monitoring, should lower watershed nitrogen reduction targets.

BMPs

REDUCTION CREDITS



About US



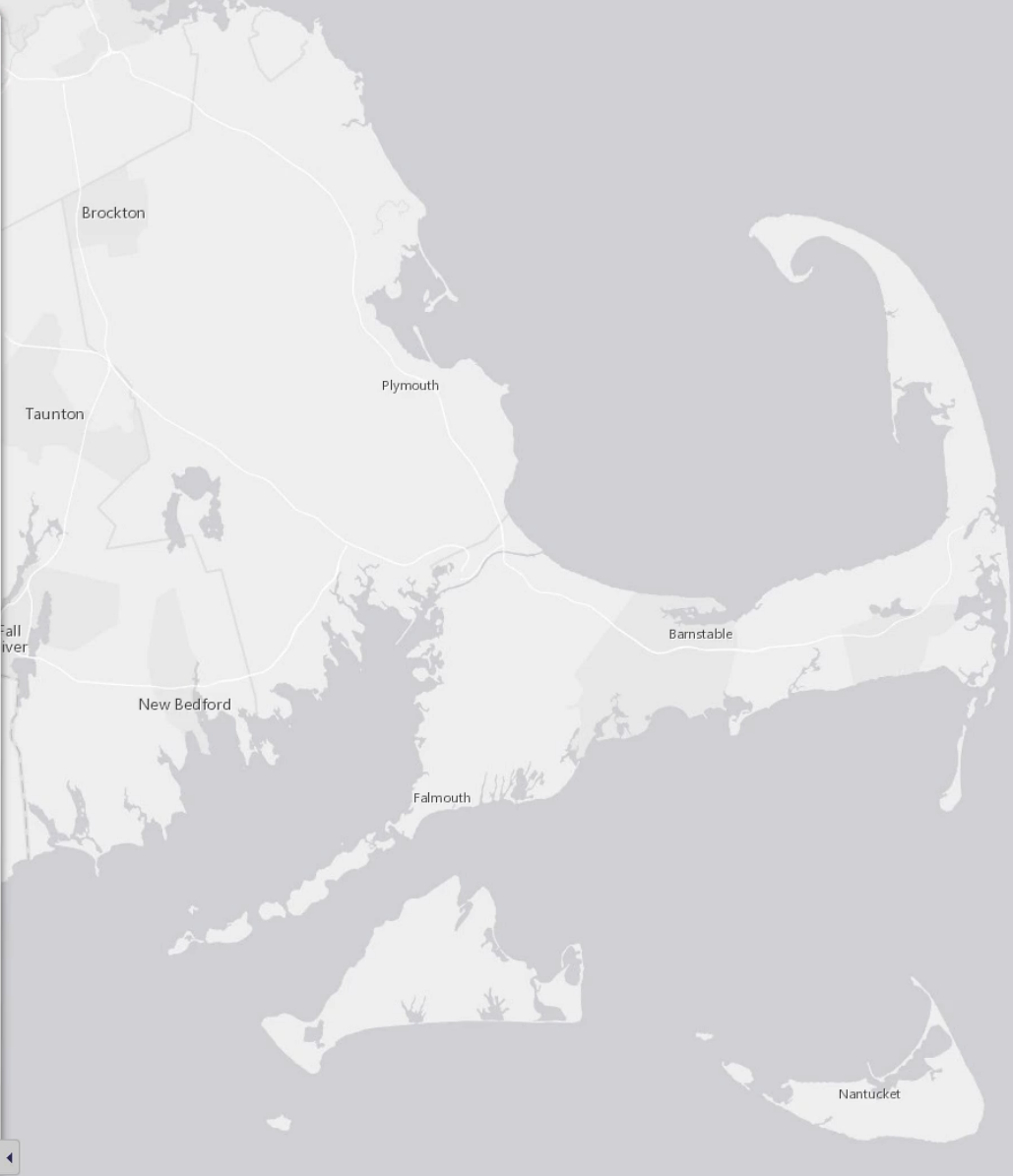
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Overview Map

Search by Address

Cape-wide Datalayers

Import Watershed MVP Scenario



direct capital,
operation
maintenance,
and monitoring
cost by individual
technology

COST

FINANCING

financing
options
appropriate
for each
technology
solution

calculating
the financial
impact on the
average
household

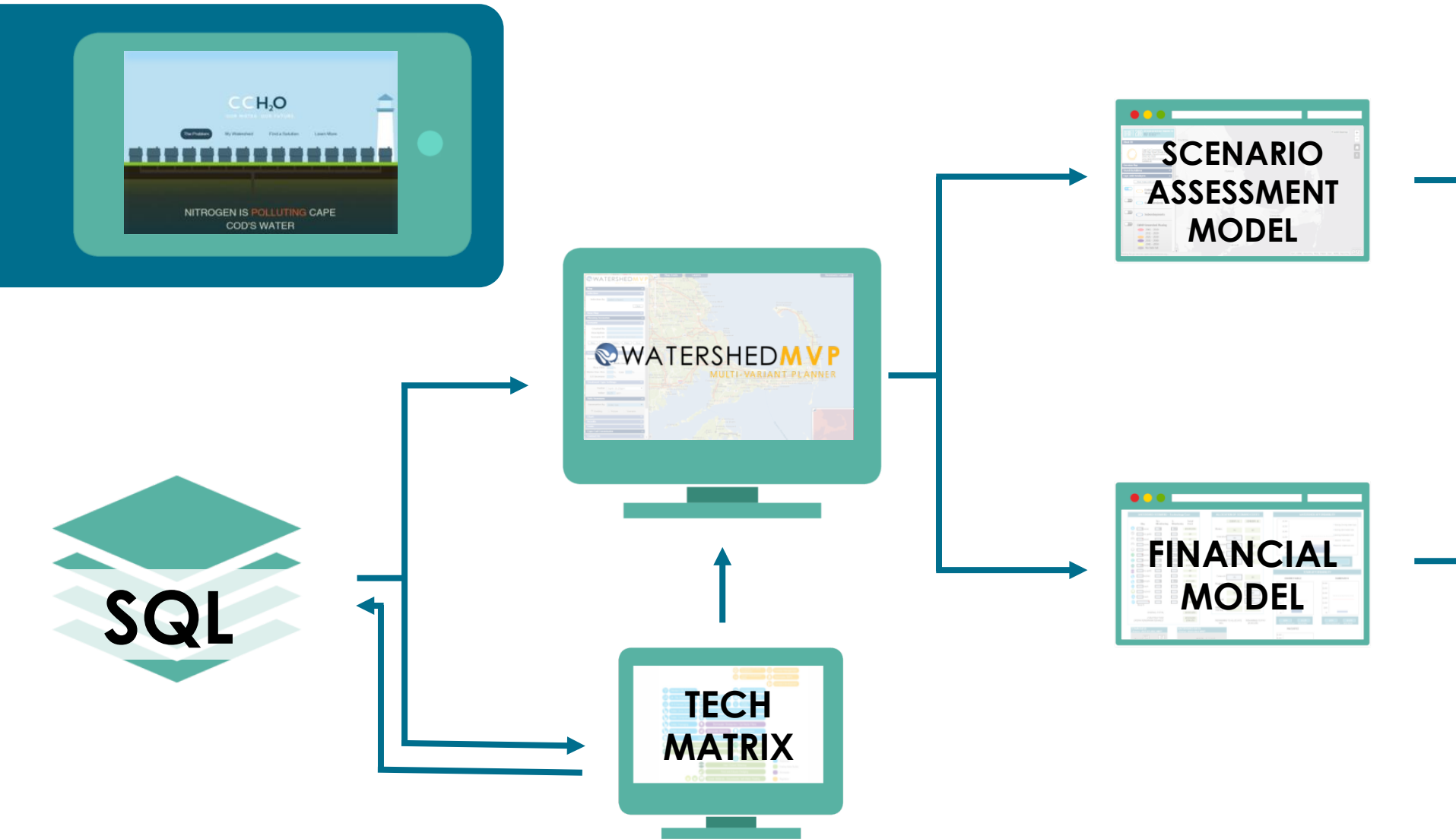
IMPACT

REVENUE

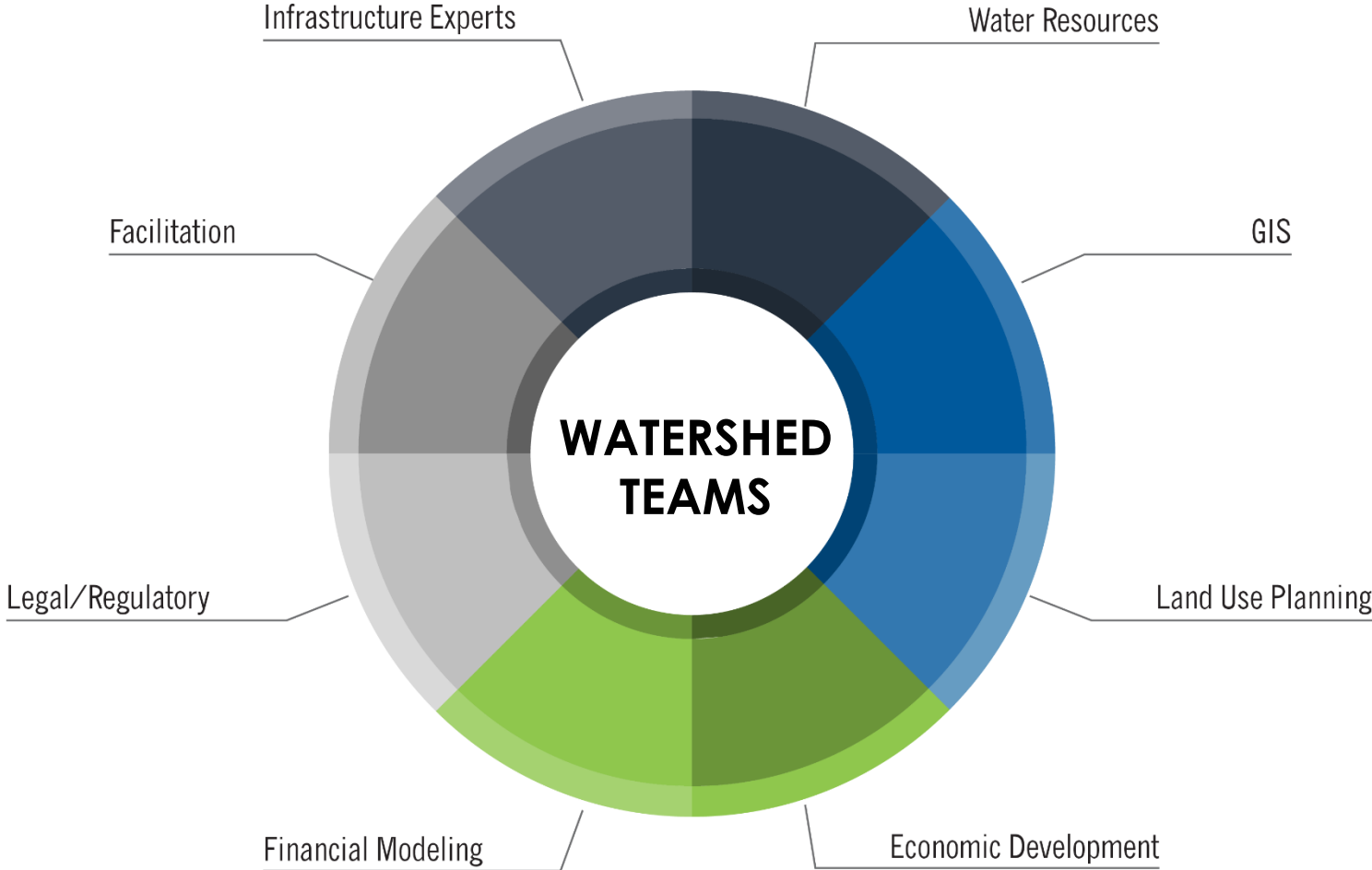
different
methods
to pay for
wastewater
solutions

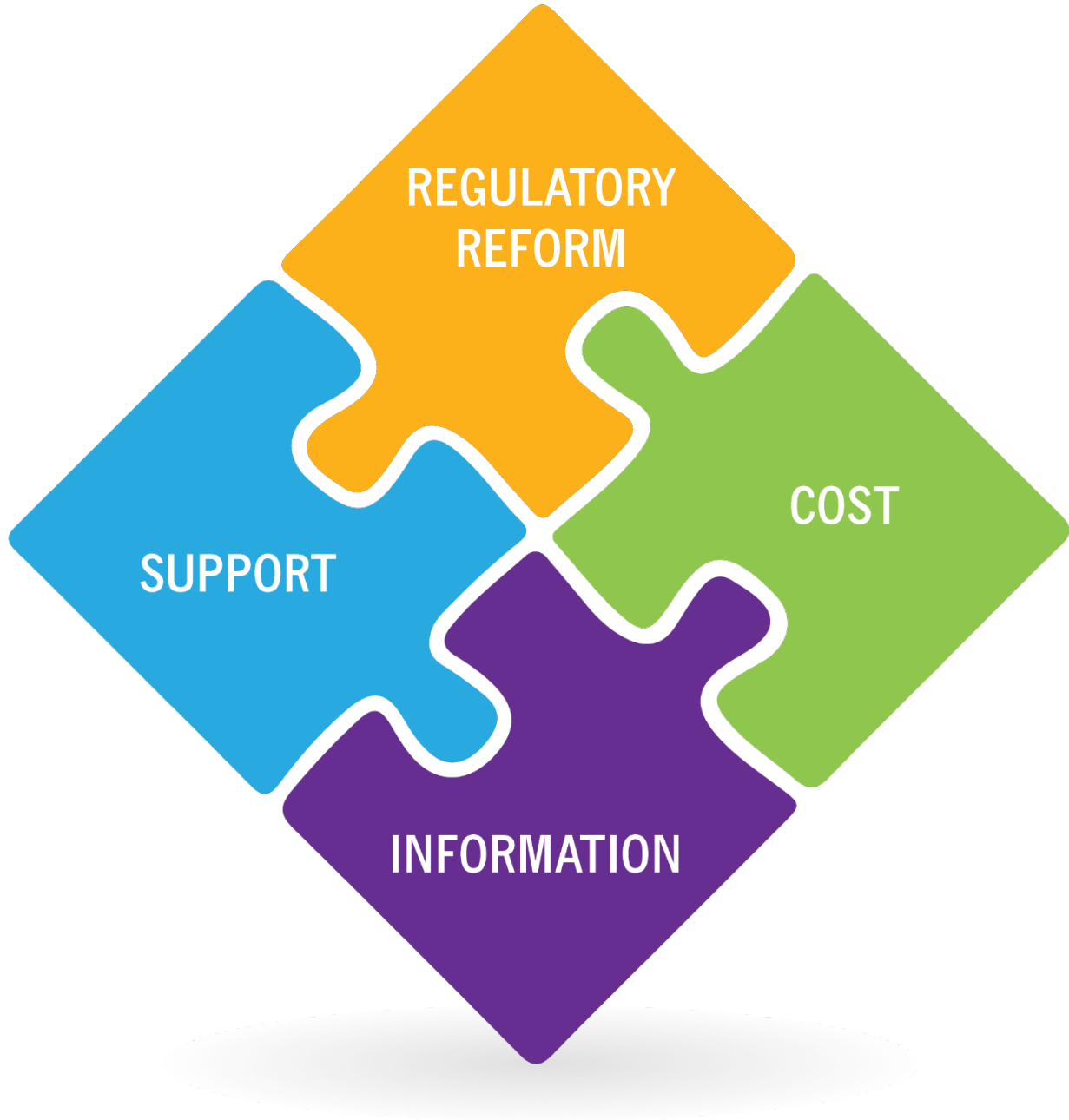


PROVIDING INFORMATION



CONNECTING WITH SUPPORT





REGULATORY
REFORM

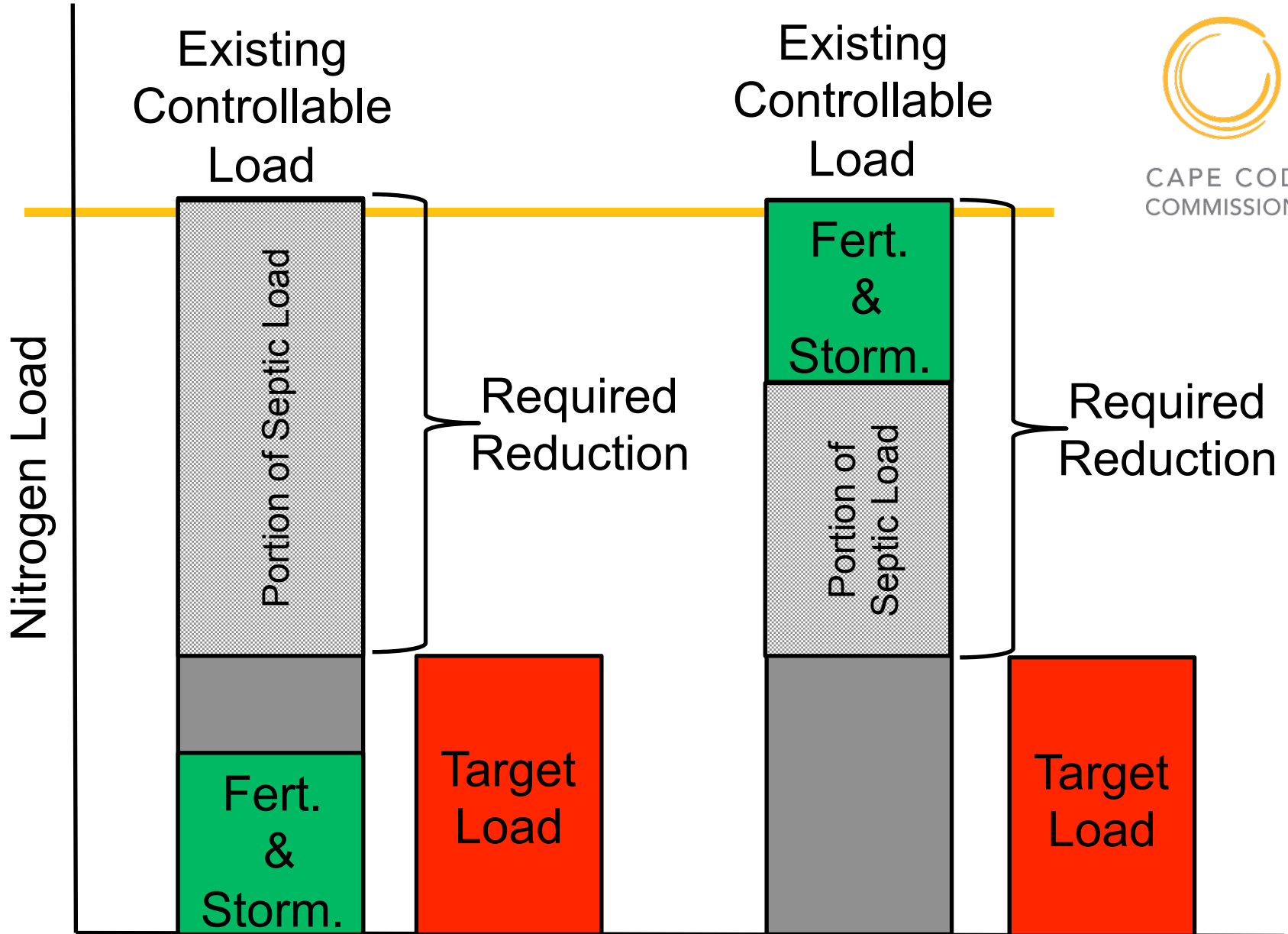
SUPPORT

COST

INFORMATION



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Community PlanIt Game for Cape Cod

 >

The future of Cape Cod's waters is in your hands.

With help from you and the Crats, we can plan that future.

What's a Crat? It's a character in Community PlanIt, an online game that helps communities focus on issues and develop solutions. It's a way to reach, educate and hear from a broader part of the Cape community often missed during conventional meet-and-greet planning processes.

As part of an intensive outreach effort for the regional water quality plan update, the Cape Cod Commission partnered with Emerson College's Engagement Game Lab to create two online games.

By completing challenges, players earn awards and collect coins which they then pledge to sponsor real-world causes. In the end, the top causes are awarded real project funding. In the process, citizens get the chance to tell their stories, interact with people they normally wouldn't, reflect on their views, and generate data useful to planners.



The first game is scheduled to begin in late July,