Cape Cod 208 Area Water Quality Planning
Nauset and Cape Cod Bay Marsh Group Watershed Working Group

Meeting Two
Tuesday, October 22, 2013
Eastham Town Hall, 2500 State Hwy, Eastham, MA 02642
8:30 am - 12:30 pm

8:30 Welcome, Review 208 goals and Process and the Goals of today's meeting – *Cape Cod Commission*

8:40 Introductions, Agenda Overview, Updates and Action Items– *Facilitator and Working Group*

9:00 Range of Possible Solutions – *Cape Cod Commission and Working Group*
- Technology Matrix
- Technologies Overview
- Survey Questions and Comments
- Additional Questions and Discussion

10:30 Break

10:45 Problem Solving Process and Principles – *Cape Cod Commission and Working Group*
- Overview of 7-steps for Problem-Solving Process
- Examination of Categories of Solutions and their impacts on the Environment, Economy, and Community (triple bottom line)
- Discussion – Identify Considerations and Priorities for Application

12:00 Preparing for Meeting 3 and Beyond – *Cape Cod Commission*
- Review Tools, Alternatives Analysis Approach
- Evaluating Scenarios for Meeting Nitrogen Goals
- Other Process Next Steps

12:15 Public Comments

12:30 Adjourn

Nauset and Cape Cod Bay Marsh Group

Technologies and Approaches

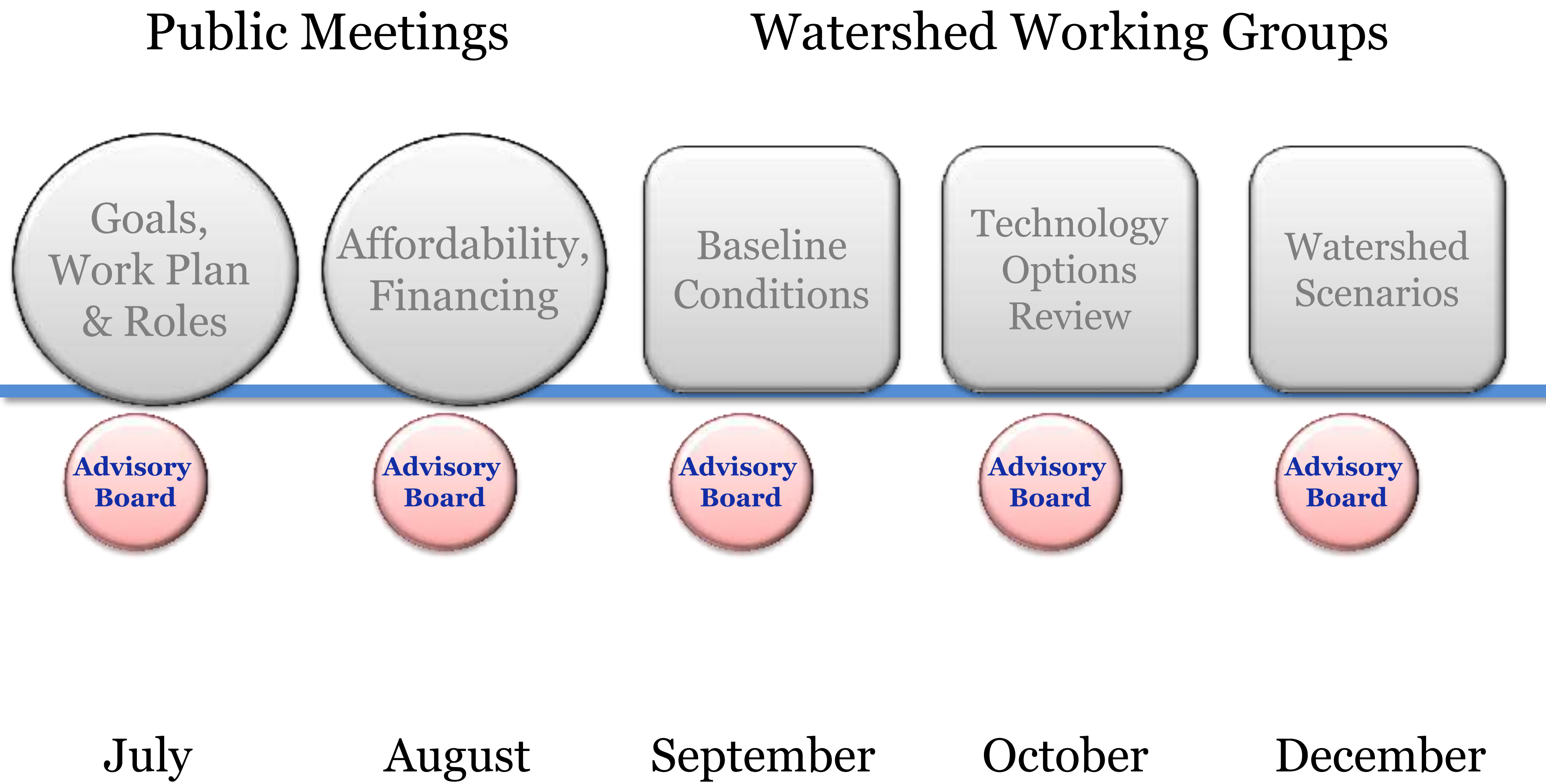
What is the stakeholder process?

Public Meetings

Watershed Working Groups

July	August	September	October	December
Goals, Work Plan & Roles	Affordability, Financing	Baseline Conditions	Technology Options Review	Watershed Scenarios

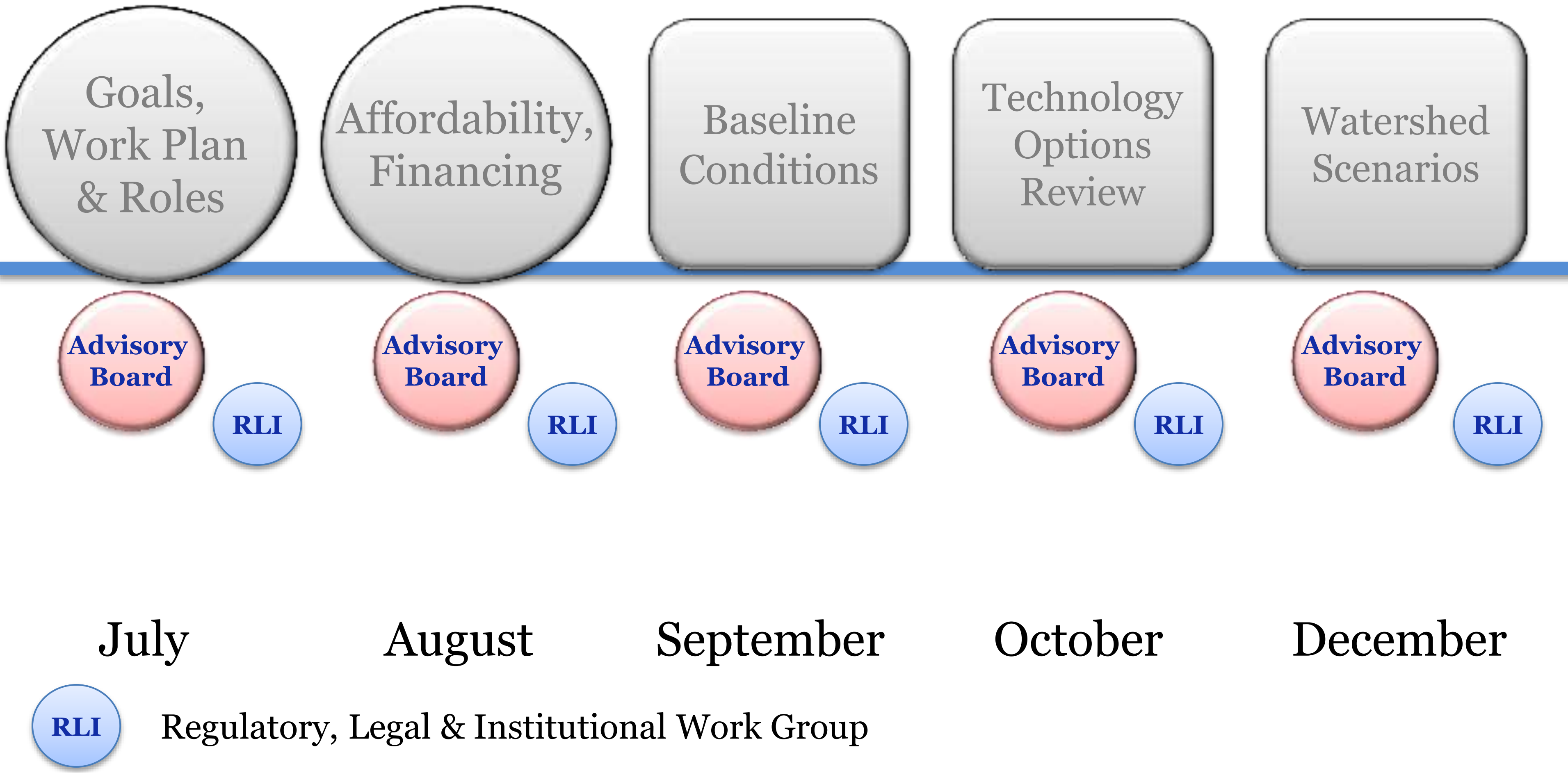
208 Planning Process



208 Planning Process

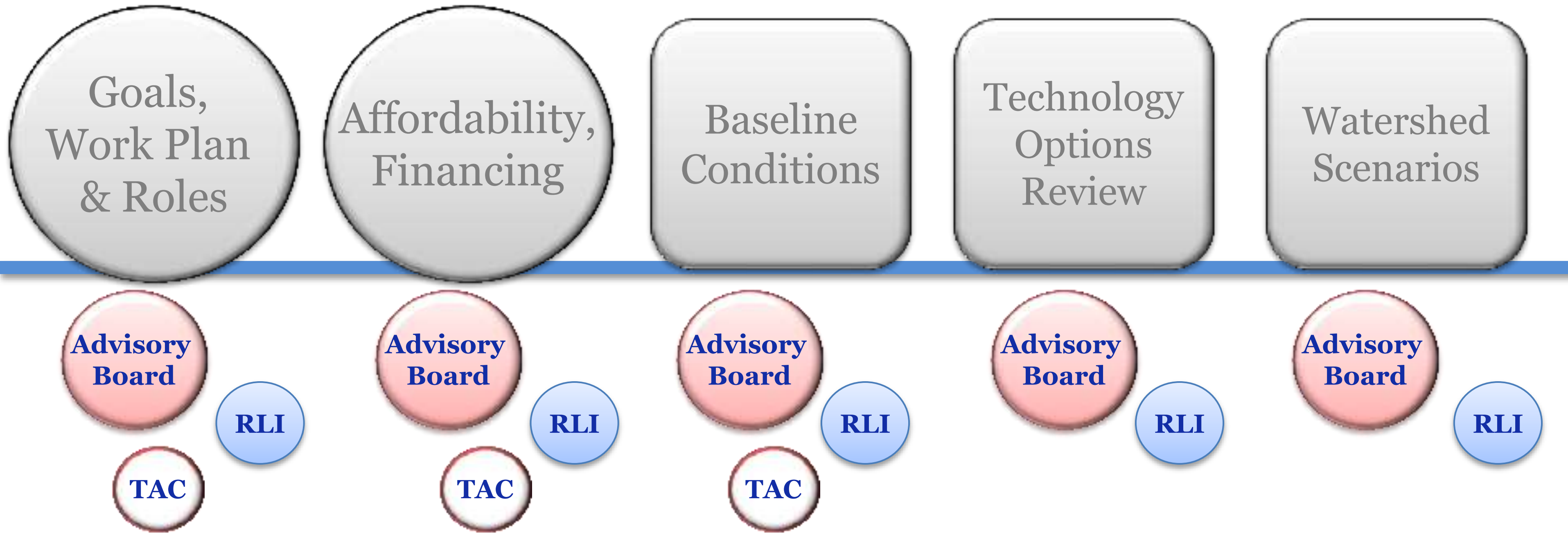
Public Meetings

Watershed Working Groups



208 Planning Process

Public Meetings   Watershed Working Groups

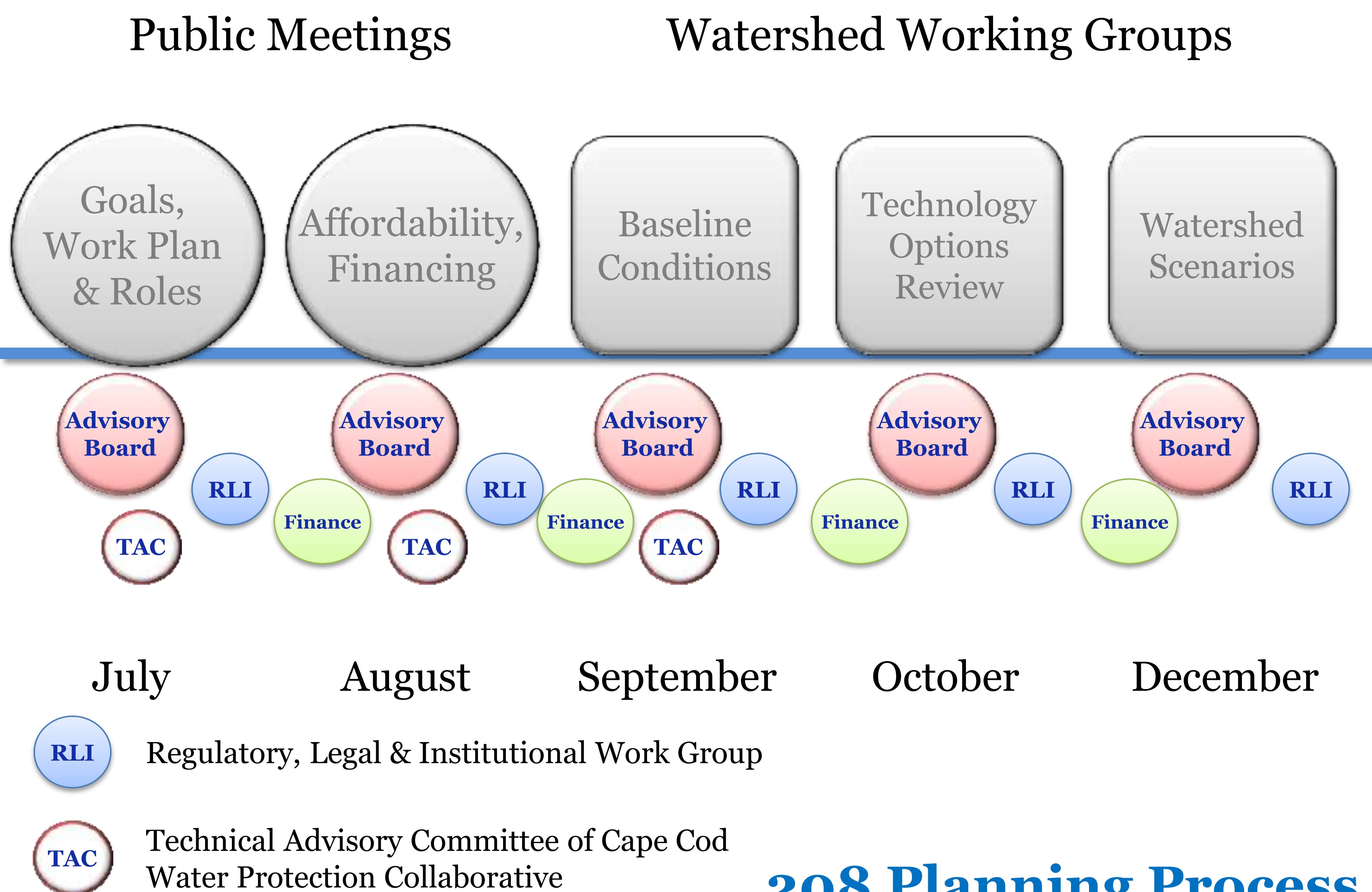


July   August   September   October   December

RLI Regulatory, Legal & Institutional Work Group

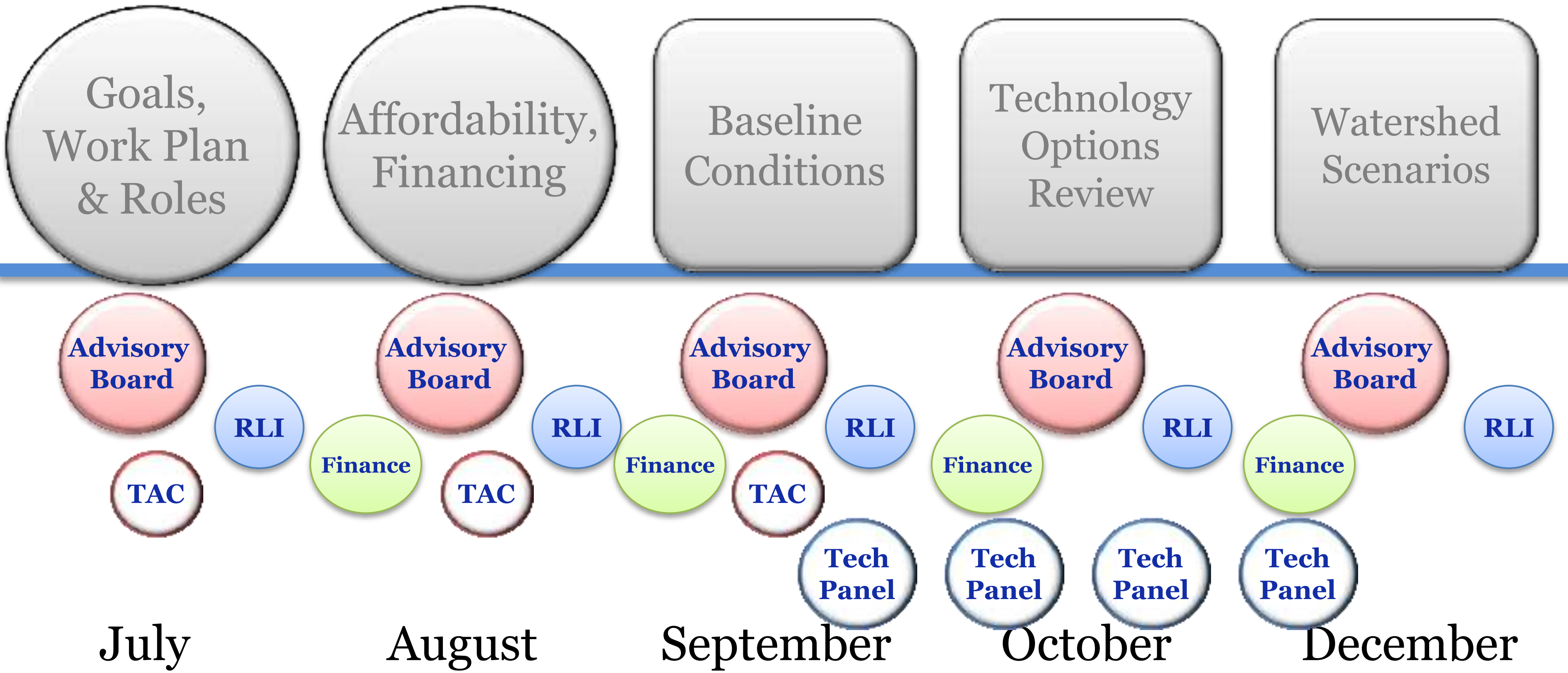
TAC Technical Advisory Committee of Cape Cod Water Protection Collaborative

208 Planning Process



208 Planning Process

Public Meetings — Watershed Working Groups



RLI — Regulatory, Legal & Institutional Work Group

TAC — Technical Advisory Committee of Cape Cod Water Protection Collaborative

208 Planning Process

Baseline Conditions

11 Working Group Meetings: Sept 18-27

Goal of the First Meeting:

To review and develop shared understanding of the characteristics of these watersheds, the work done to date, existing data and information available, and how to apply all of this to planning for water quality improvements for these watersheds moving forward.

Progress since last meeting

- ❑ Meeting materials

Progress since last meeting

- ❑ Meeting materials
- ❑ GIS data layers

Progress since last meeting

- ❑ Meeting materials
- ❑ GIS data layers
- ❑ Chronologies

Baseline Conditions

11 Working Group Meetings: Sept 18-27

Technology Options Review

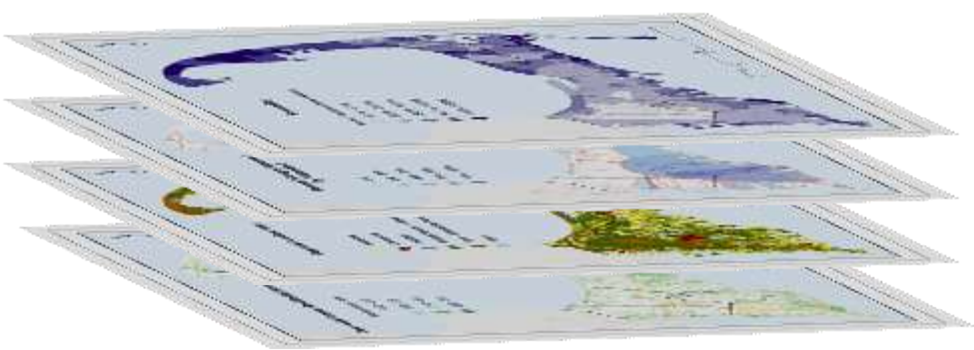
11 Working Group Meetings: Oct 21-Nov 5

208 Planning Process

Baseline Conditions
11 Working Group Meetings: Sept 18-27

Technology Options Review
11 Working Group Meetings: Oct 21-Nov 5

Watershed Scenarios
11 Working Group Meetings: Dec 2-11



208 Planning Process

Baseline Conditions

11 Working Group Meetings: Sept 18-27

Technology Options Review

11 Working Group Meetings: Oct 21-Nov 5

Watershed Scenarios

11 Working Group Meetings: Dec 2-11

Watershed Event

November 13

Center for the Arts Dennis

Wrap up of Cape2O: ur in charge!

Summary of planning process to date

Outline of second 6 months of the 208 planning process

208 Planning Process

Technology Options Review

11 Working Group Meetings: Oct 21-Nov 5

Goal of Today's Meeting:

To develop a shared understanding of the potential technologies and approaches identified to date, and the benefits and limitations of each; to explore the environmental, economic, and community impacts of a range of categories of solutions; and to identify priorities and considerations for applying technologies and approaches to remediate water quality impairments in your watershed.

Technologies and Approaches for Improving Water Quality

Technologies and Approaches for Improving Water Quality

- The Fact Sheets present various information on the technologies being considered.
- Additional information is contained on the Technology Matrix including the following:
  - Site Requirements
  - Construction, Project and Operation and Maintenance Costs
  - Reference Information
  - Regulatory Comments
- Input from the Stakeholders is requested regarding a technology's Public Acceptance

Technologies and Approaches for Improving Water Quality

- Comprehensive analysis of nutrient control technologies and approaches.

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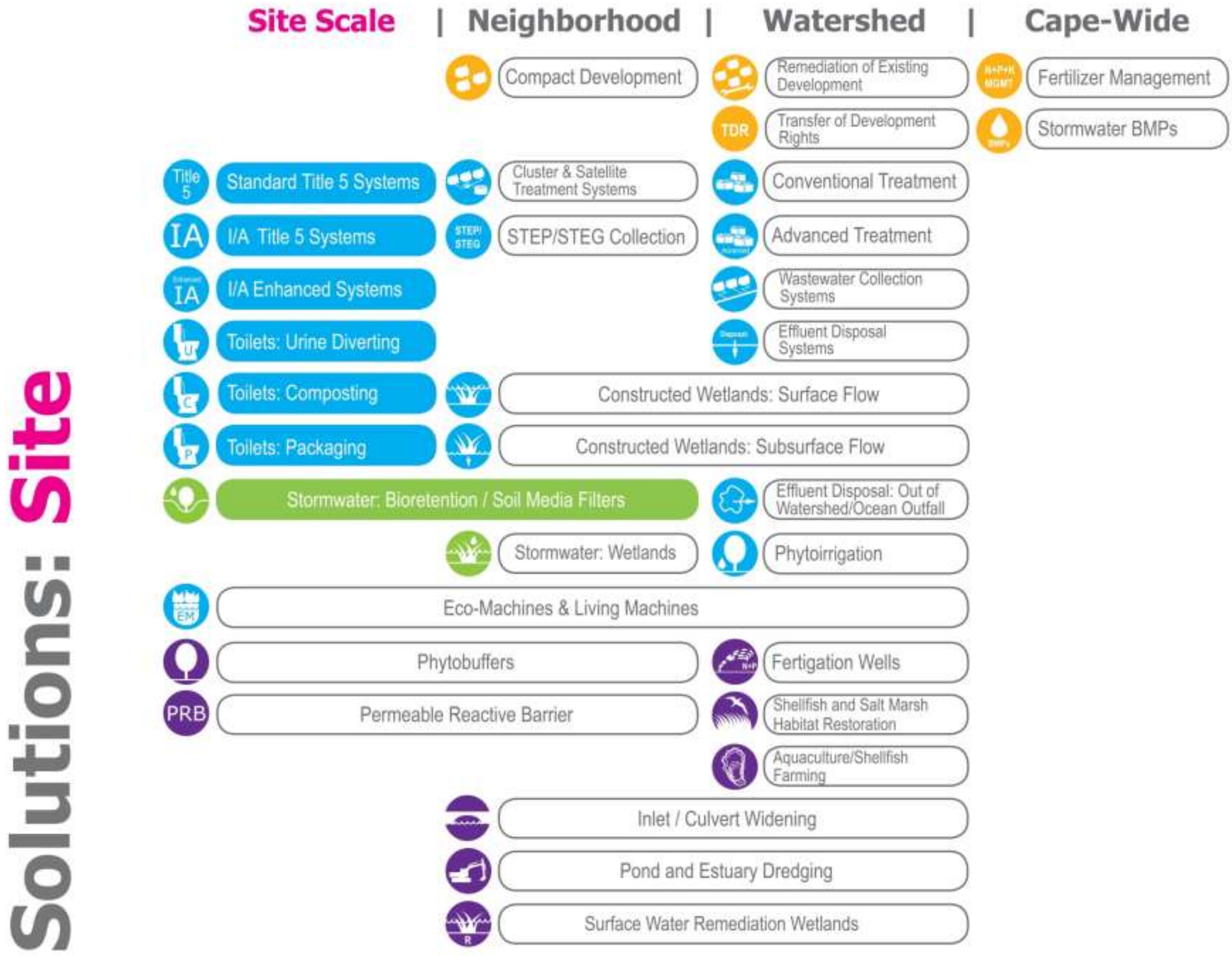
- Regulatory programs can address nutrient controls for both existing development and future development.


Site Scale | Neighborhood | Watershed | Cape-Wide
Solutions
Compact Development
Remediation of Existing Development
Fertilizer Management
N+P+K MGMT
TDR
Transfer of Development Rights
Stormwater BMPs
BMPs
Title 5
Standard Title 5 Systems
Cluster & Satellite Treatment Systems
Conventional Treatment
IA
I/A Title 5 Systems
STEP/ STEG
STEP/STEG Collection
Advanced Treatment
IA
I/A Enhanced Systems
Wastewater Collection Systems
Toilets: Urine Diverting
Effluent Disposal Systems
Toilets: Composting
Constructed Wetlands: Surface Flow
Toilets: Packaging
Constructed Wetlands: Subsurface Flow
Stormwater: Bioretention / Soil Media Filters
Effluent Disposal: Out of Watershed/Ocean Outfall
Stormwater: Wetlands
Phytoirrigation
EM
Eco-Machines & Living Machines
Phytobuffers
Fertigation Wells
PRB
Permeable Reactive Barrier
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
Surface Water Remediation Wetlands


Solutions: Site
Site Scale
Neighborhood
Watershed
Cape-Wide
Compact Development
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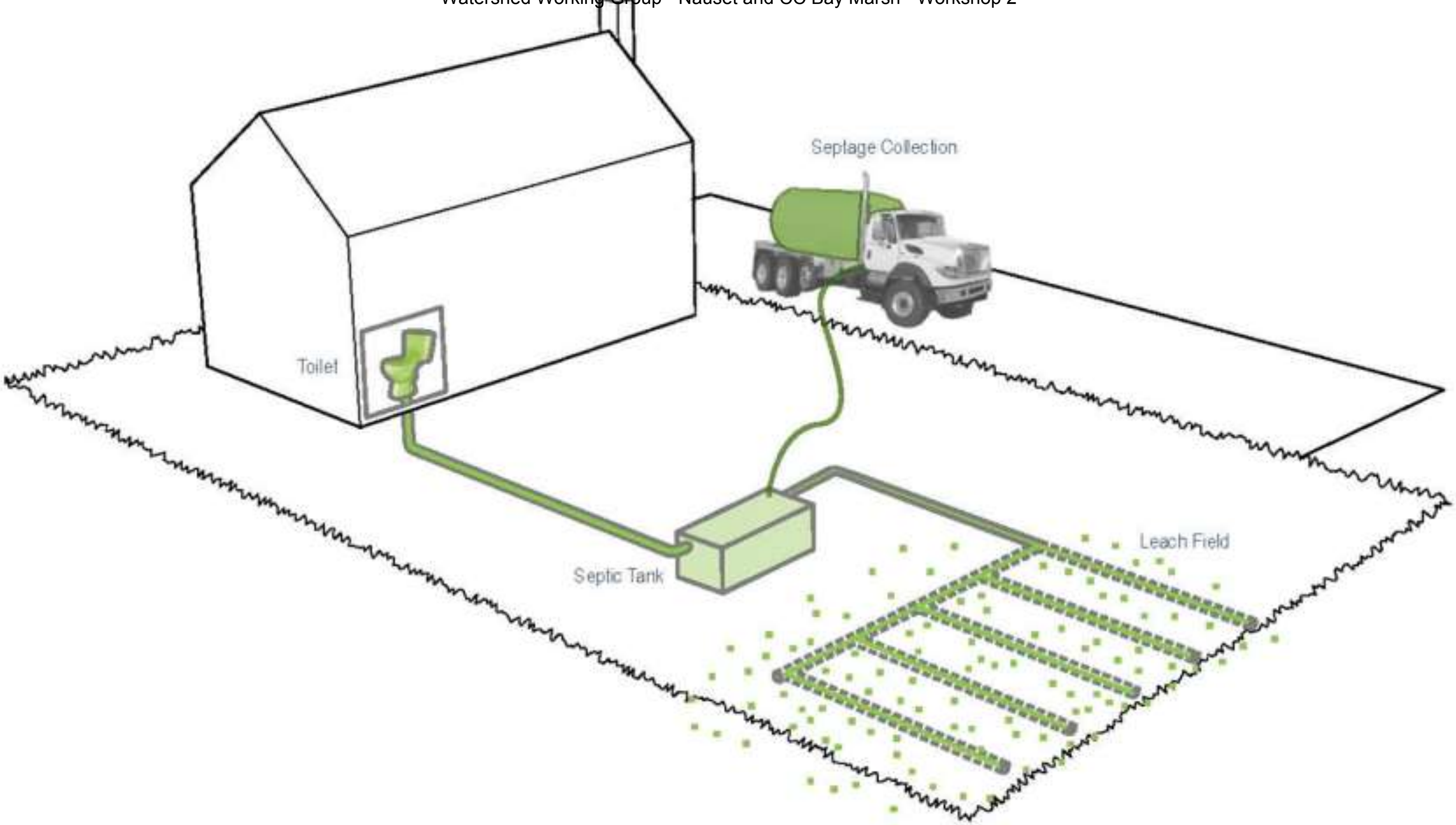
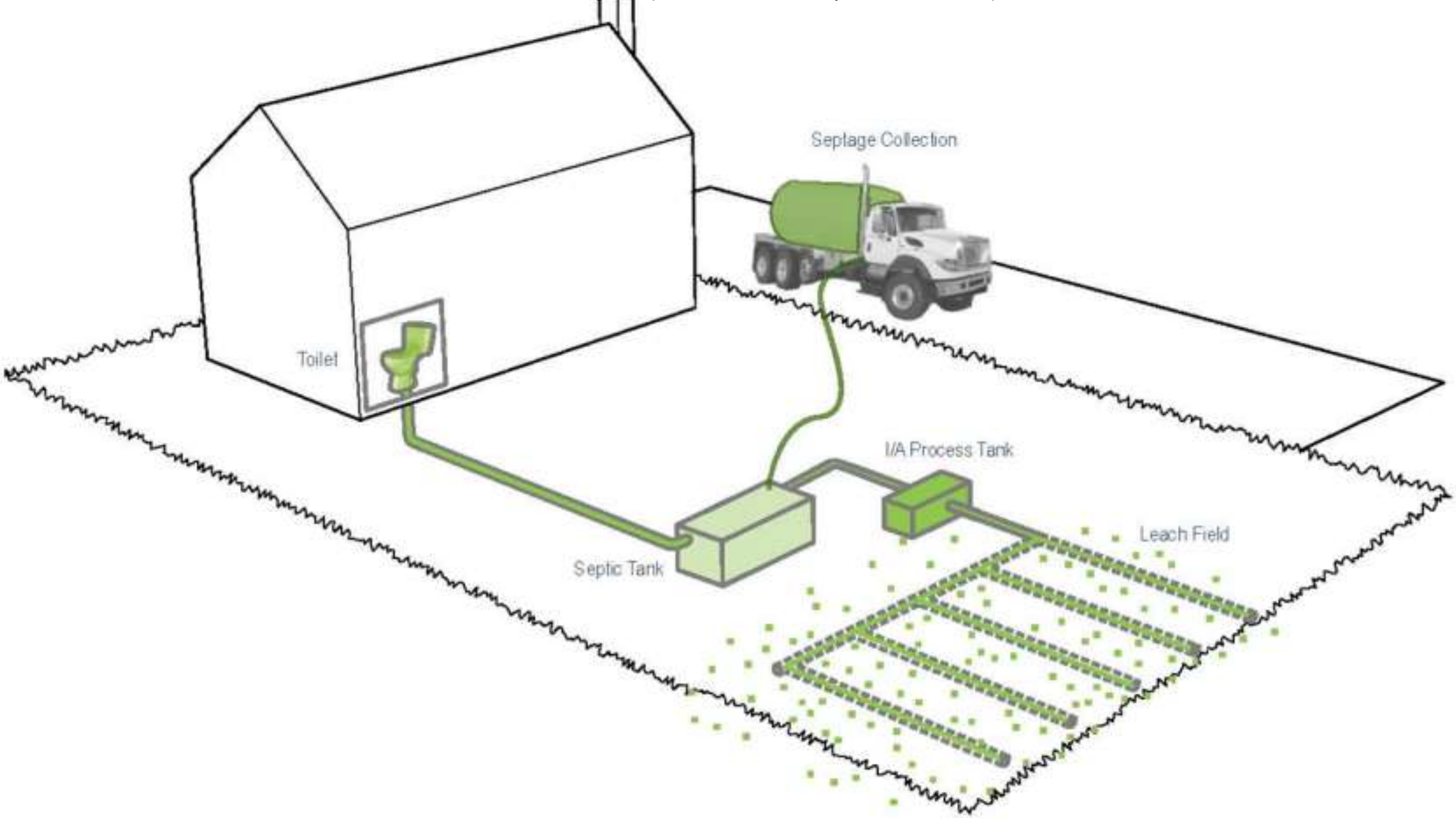


Scale: SITE
Target: WASTEWATER

Standard Title 5 Systems

Title 5

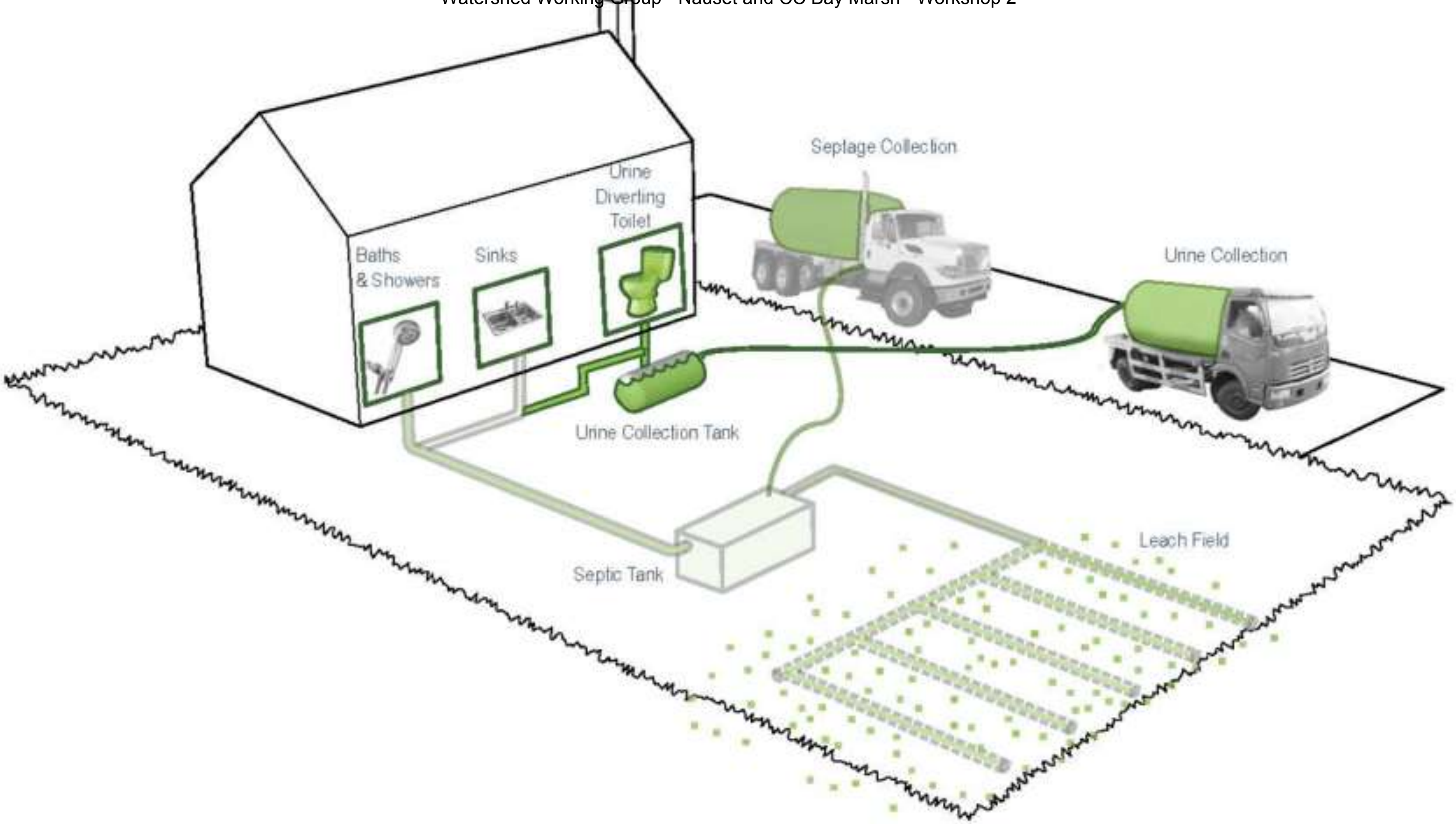


Scale: SITE
Target: WASTEWATER

I/A Title 5 Systems

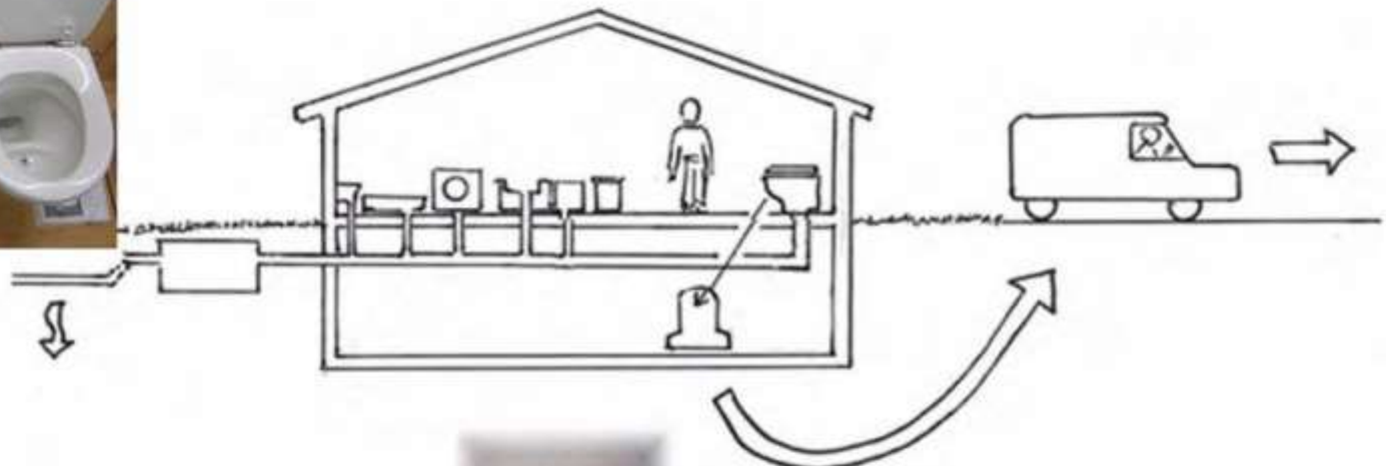
Enhanced IA

IA



Scale: SITE
Target: WASTEWATER

Toilets: Urine Diverting



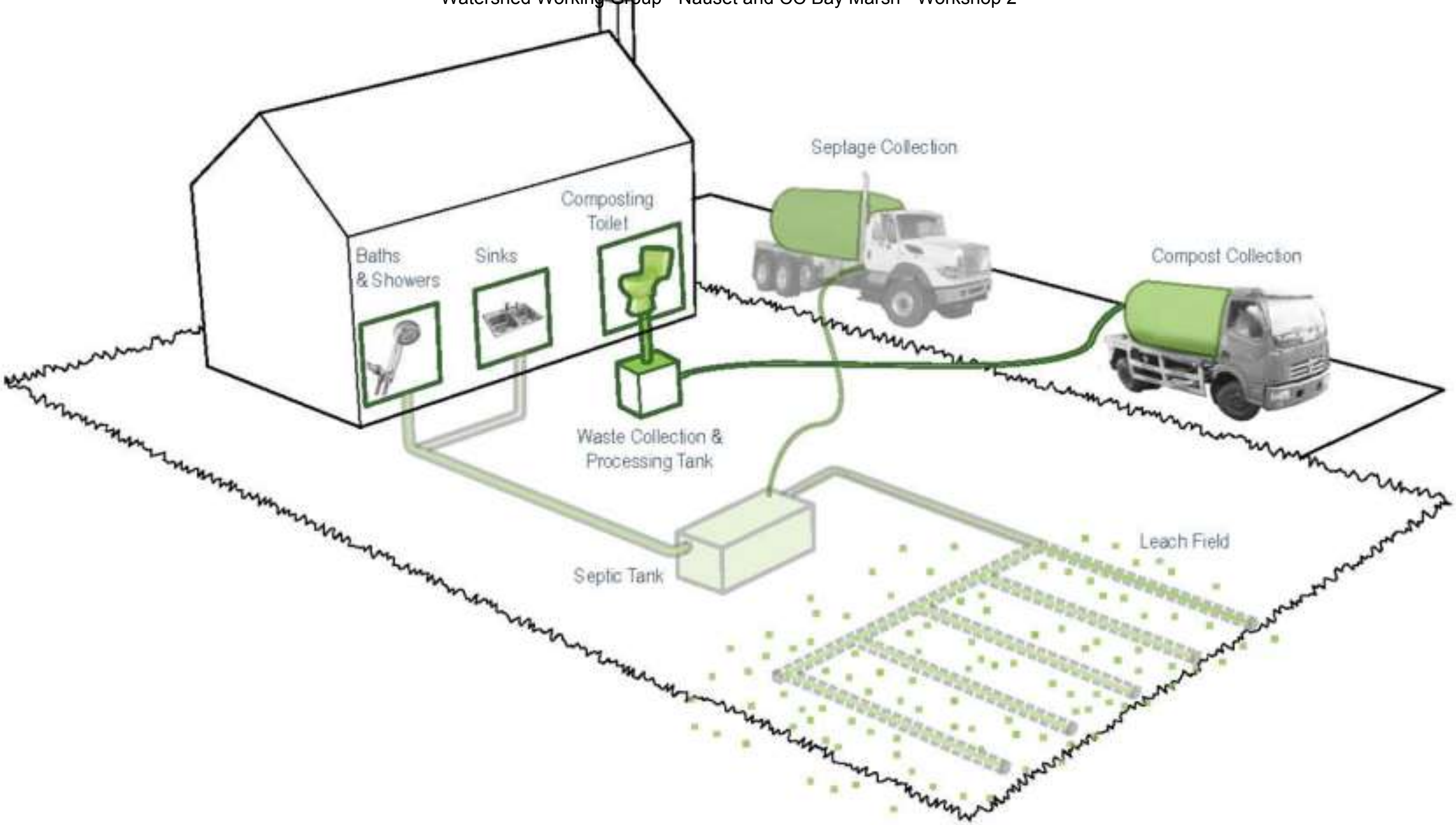
Waterless
Urinal

IBC container
(220 gallons)

40" x 40" x48"

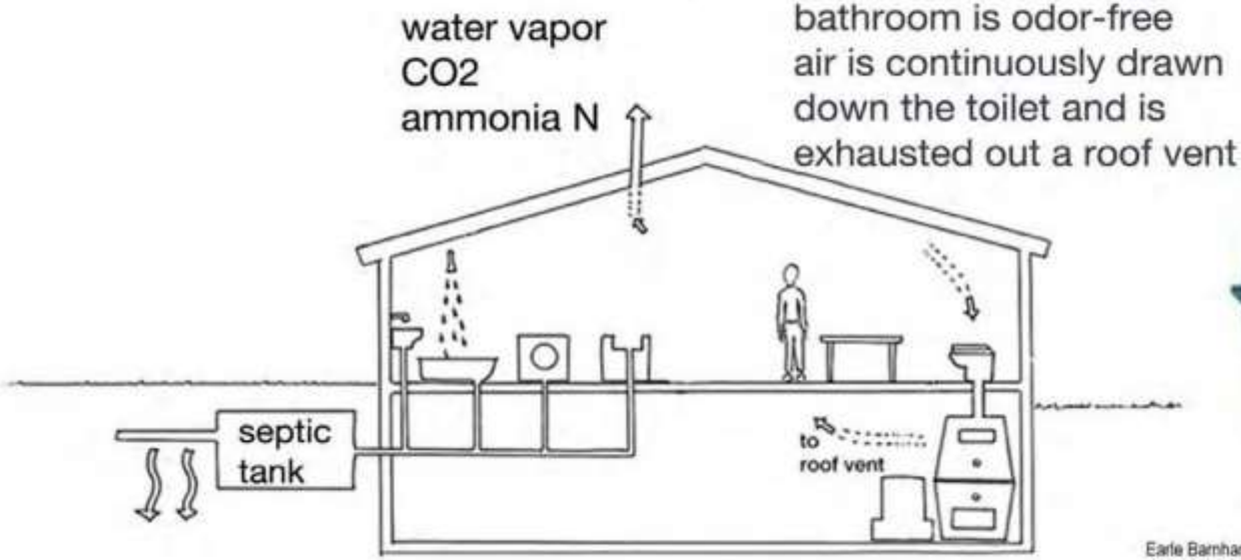
Source: Earle Barnhart, The Green Center Inc. and Horsley-Witten Group Inc.

Toilets: Urine Diverting



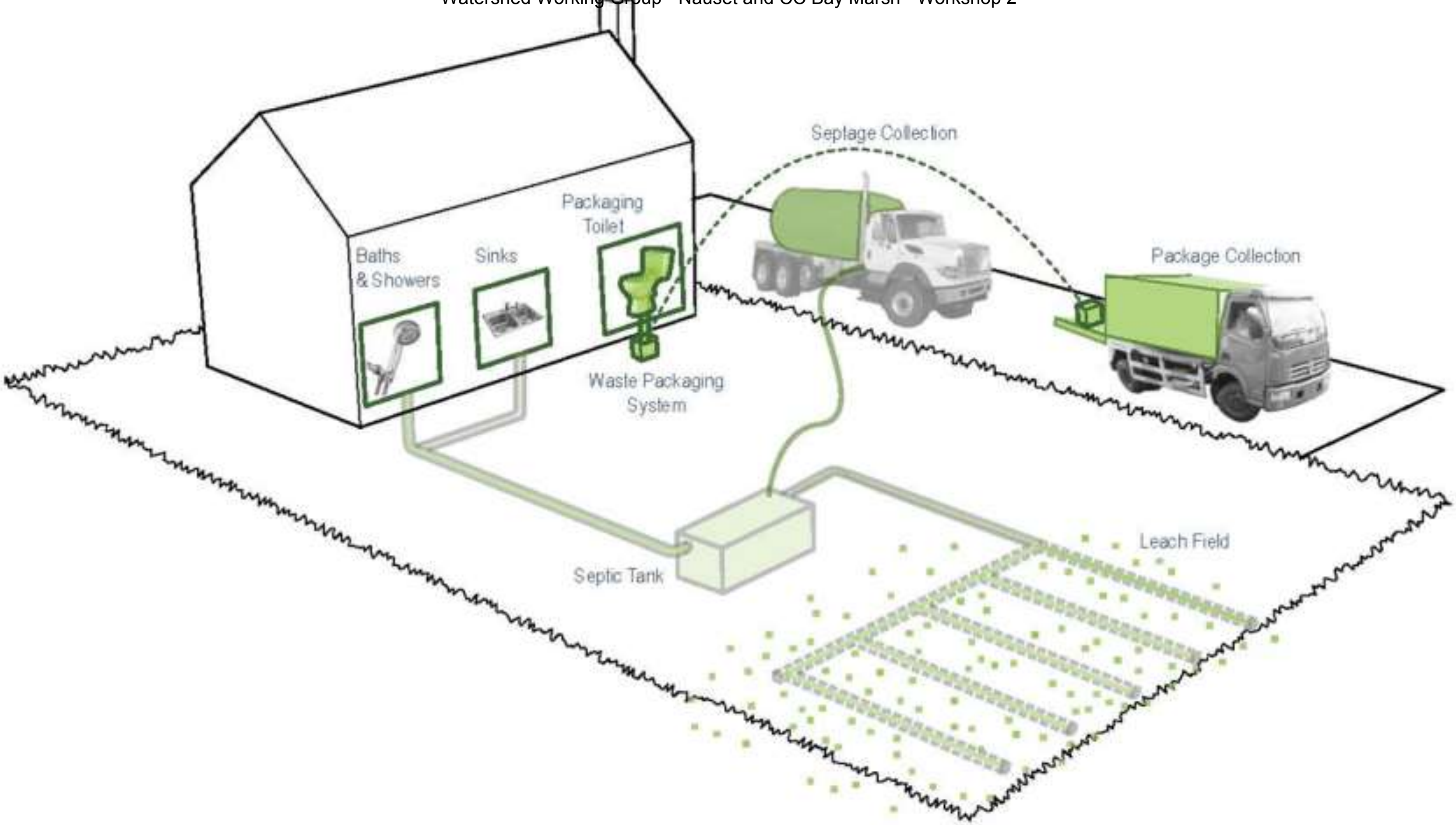
Scale: SITE
Target: WASTEWATER

Toilets: Composting



Source: Earle Barnhart, The Green Center Inc.

Toilets: Composting



Scale: SITE
Target: WASTEWATER

Toilets: Packaging

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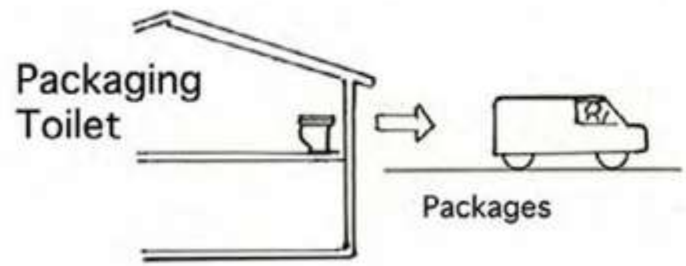
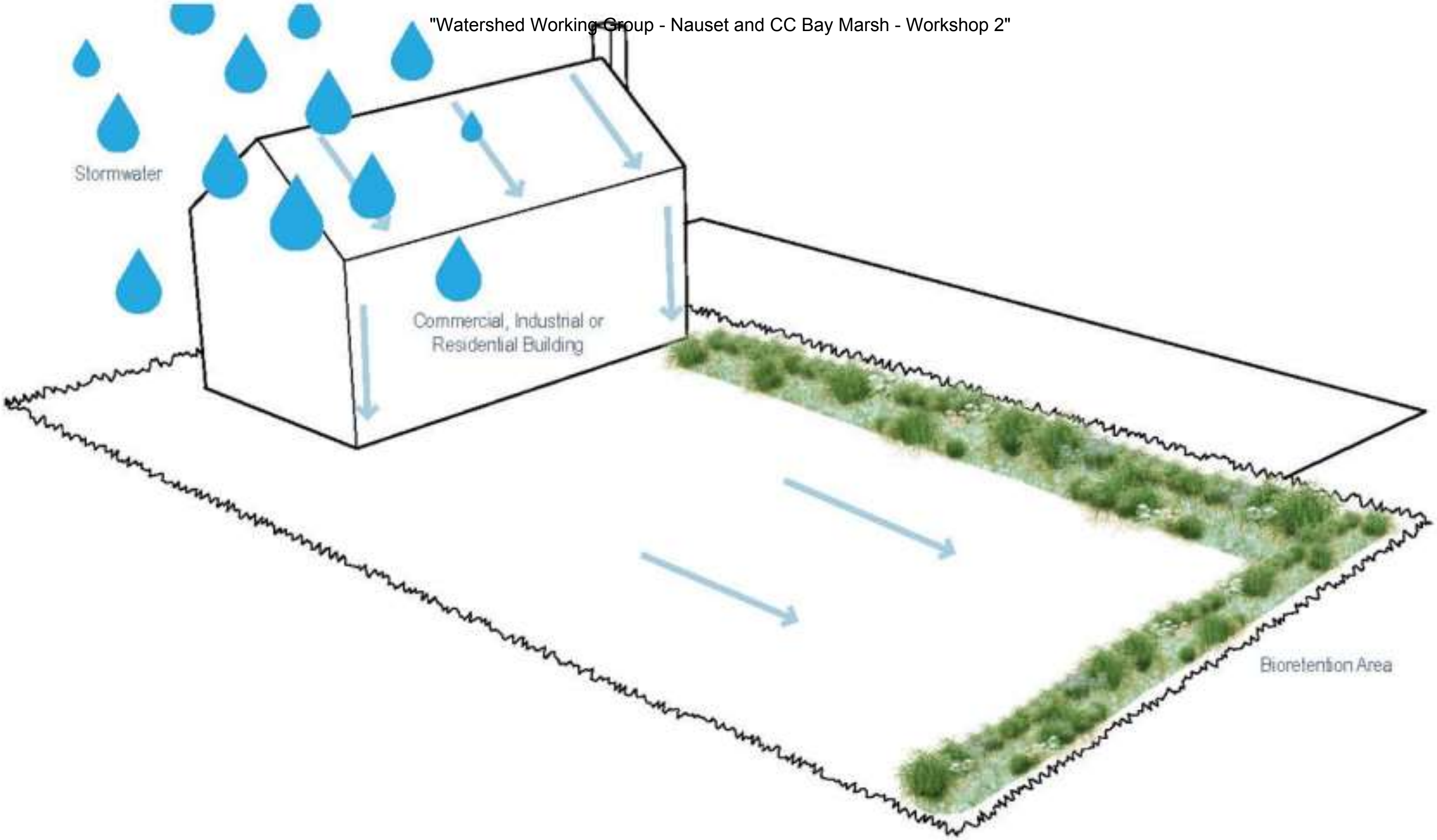


Source: Earle Barnhart, The Green Center Inc.

Toilets: Packaging



Scale: SITE
Target: STORMWATER

Stormwater: Bioretention / Soil Media Filters

Precedent: 12th Ave. Stormwater Project, Portland, OR
Source: City of Portland

Stormwater: Bioretention / Soil Media Filters

Rain Gardens


Solutions: Neighborhood
Site Scale | Neighborhood | Watershed | Cape-Wide
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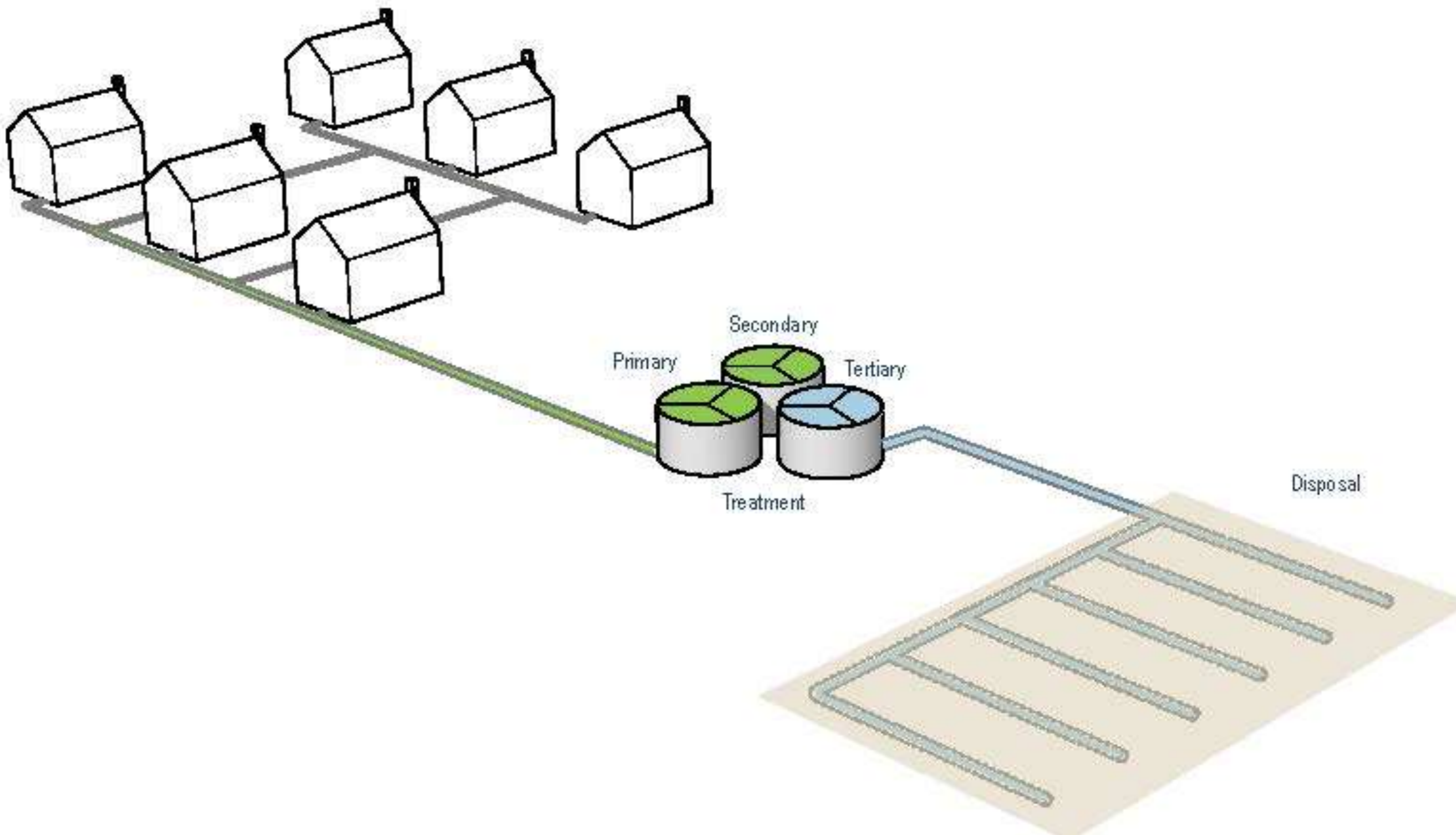
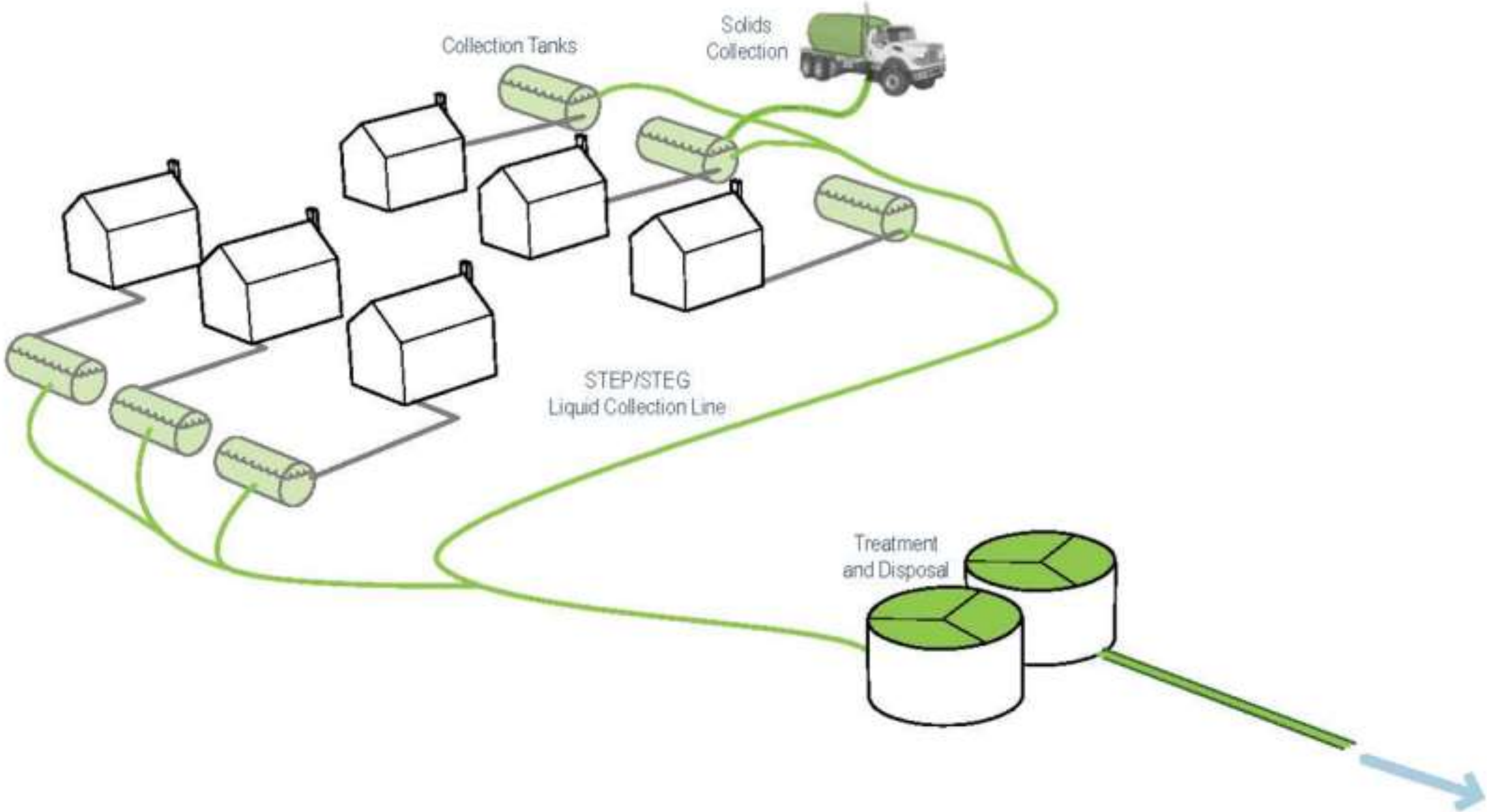


Scale: NEIGHBORHOOD
Target: WASTEWATER

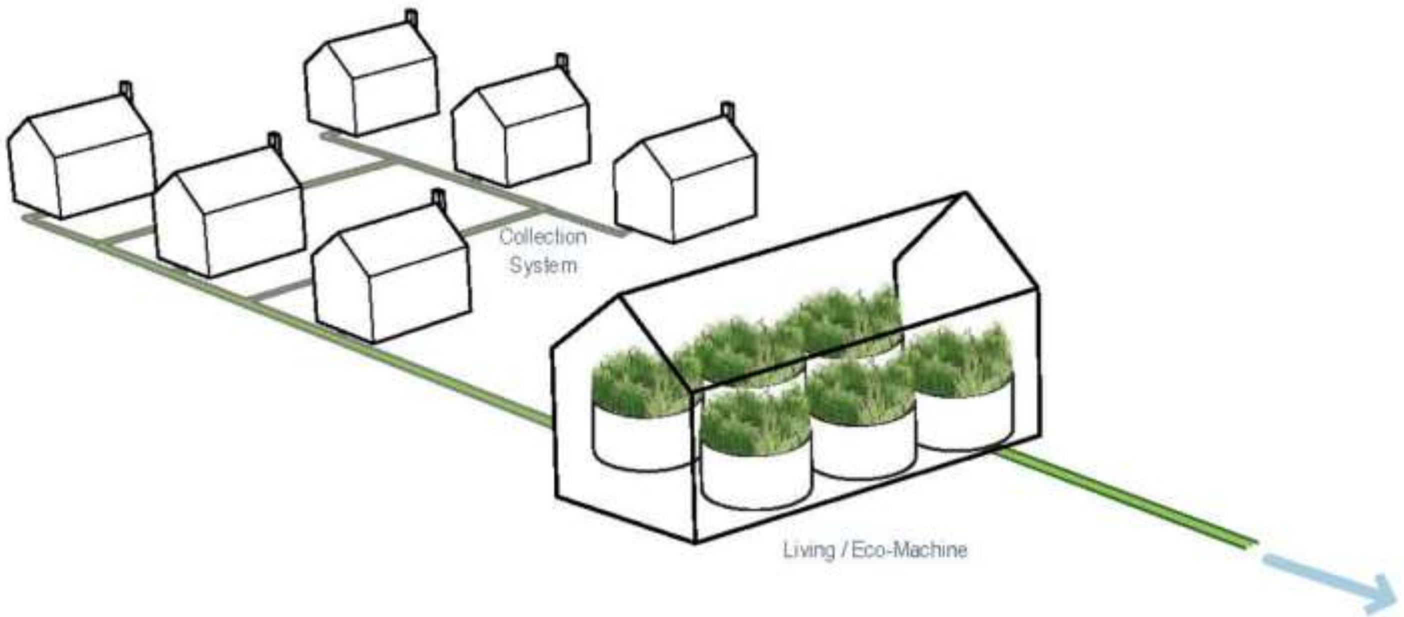
Cluster & Satellite Treatment Systems



Scale: NEIGHBORHOOD
Target: WASTEWATER

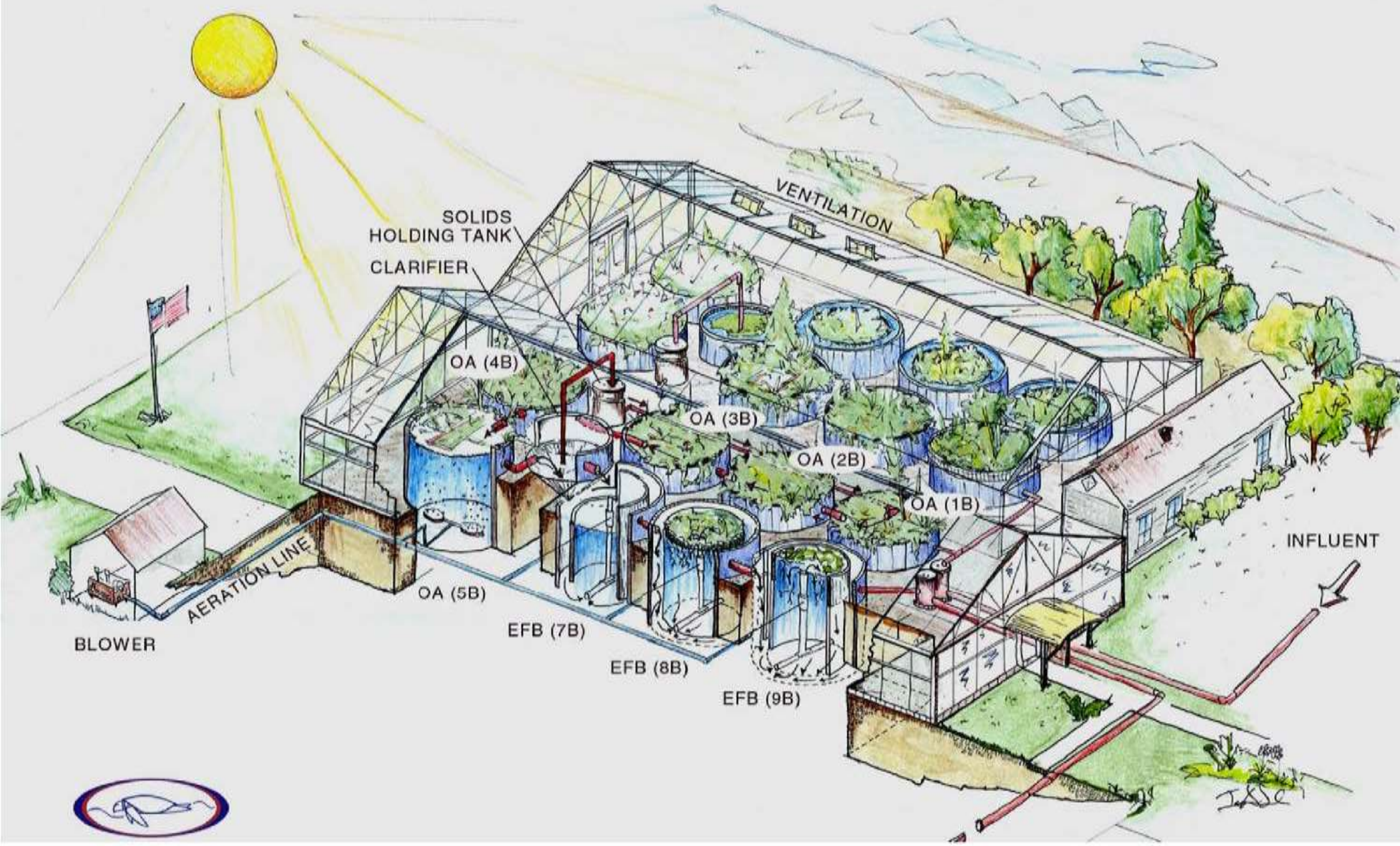
STEP / STEG Collection

STEP/ STEG



Scale: NEIGHBORHOOD
Target: WASTEWATER

Eco-Machines and
Living Machines



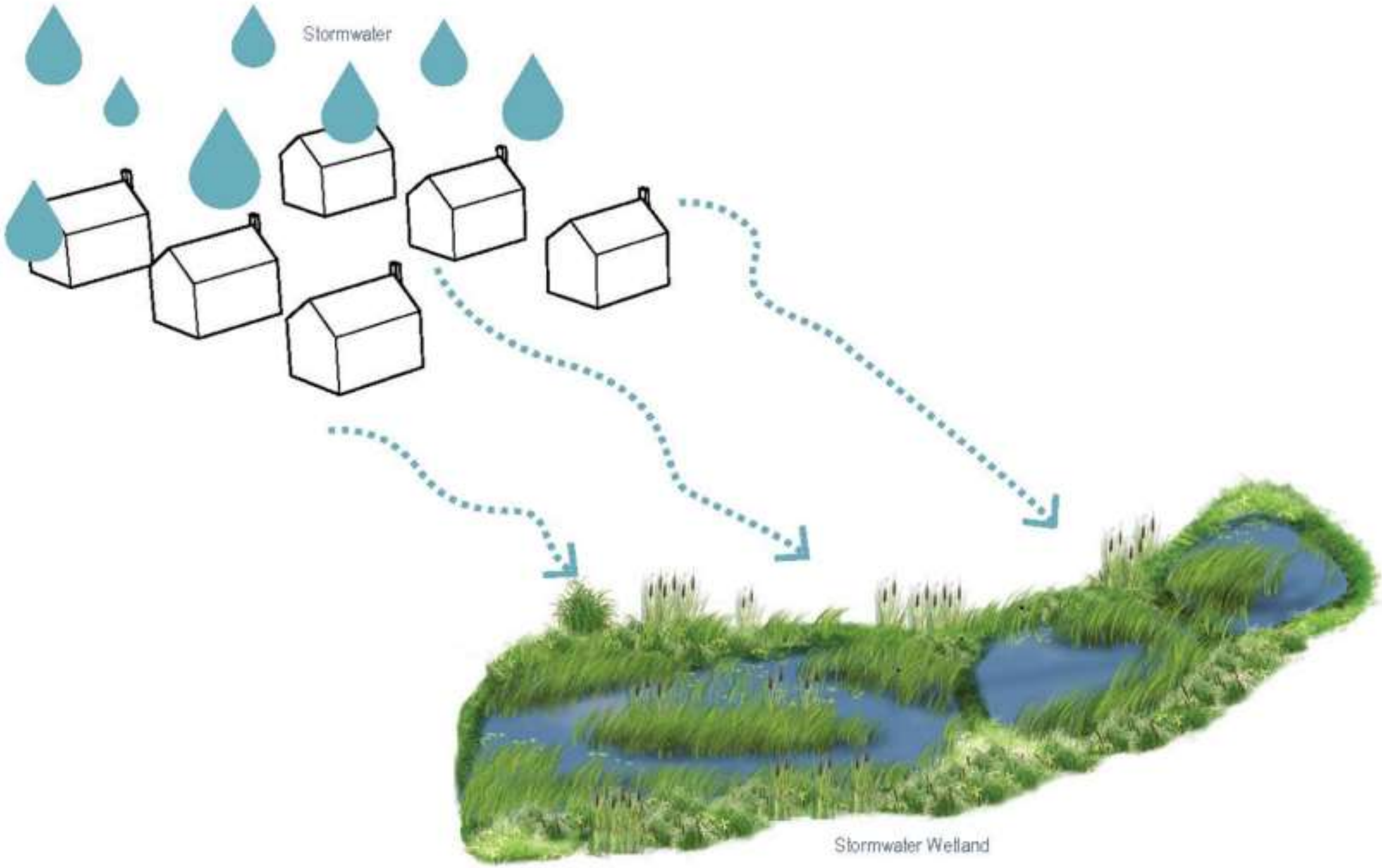
Precedent: Living Machine, South Burlington, VT
Source: Todd Ecological

Eco-Machines and Living Machines

Precedent: Living Machine - South Burlington, VT + Photobioreactors - Falmouth, MA
Source: Todd Ecological and Tom Cambareri

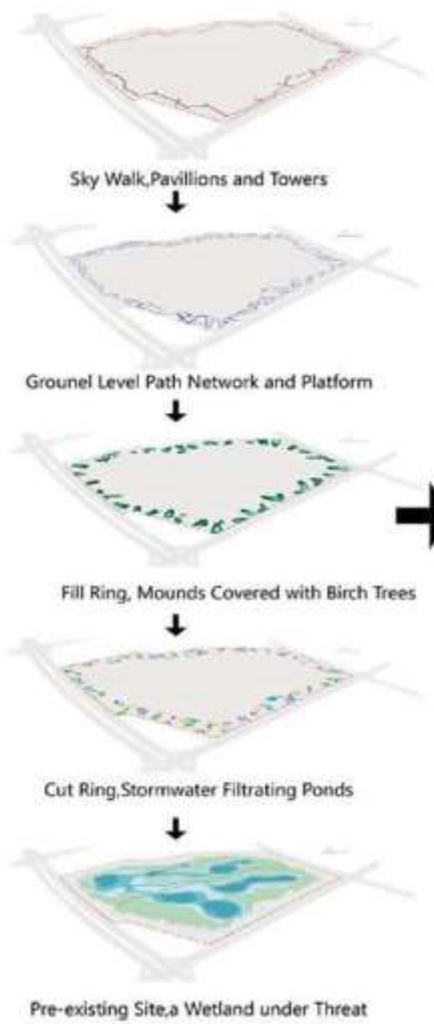
Eco-Machines and
Living Machines

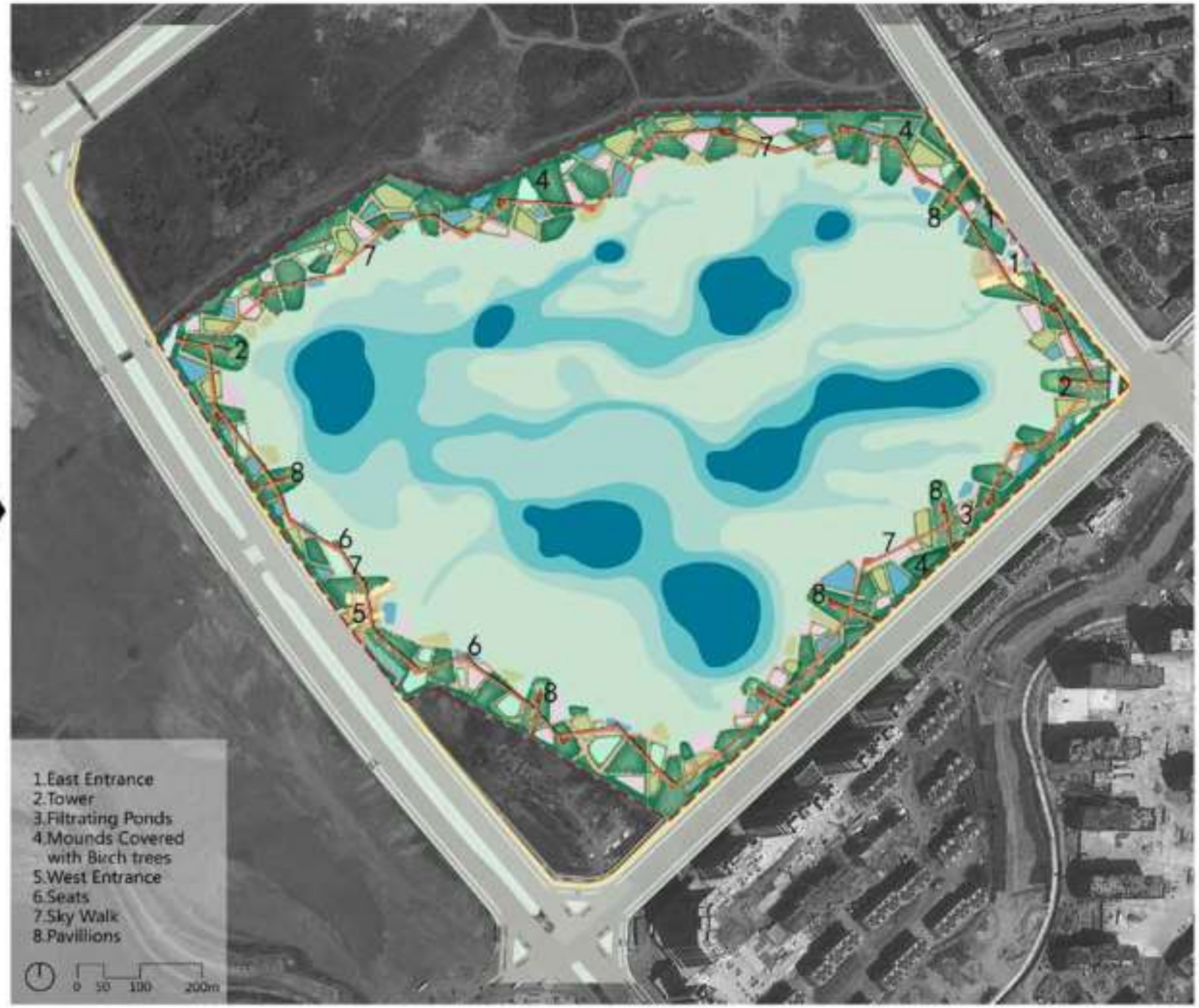
EM



Scale: NEIGHBORHOOD
Target: STORMWATER

Stormwater Wetlands





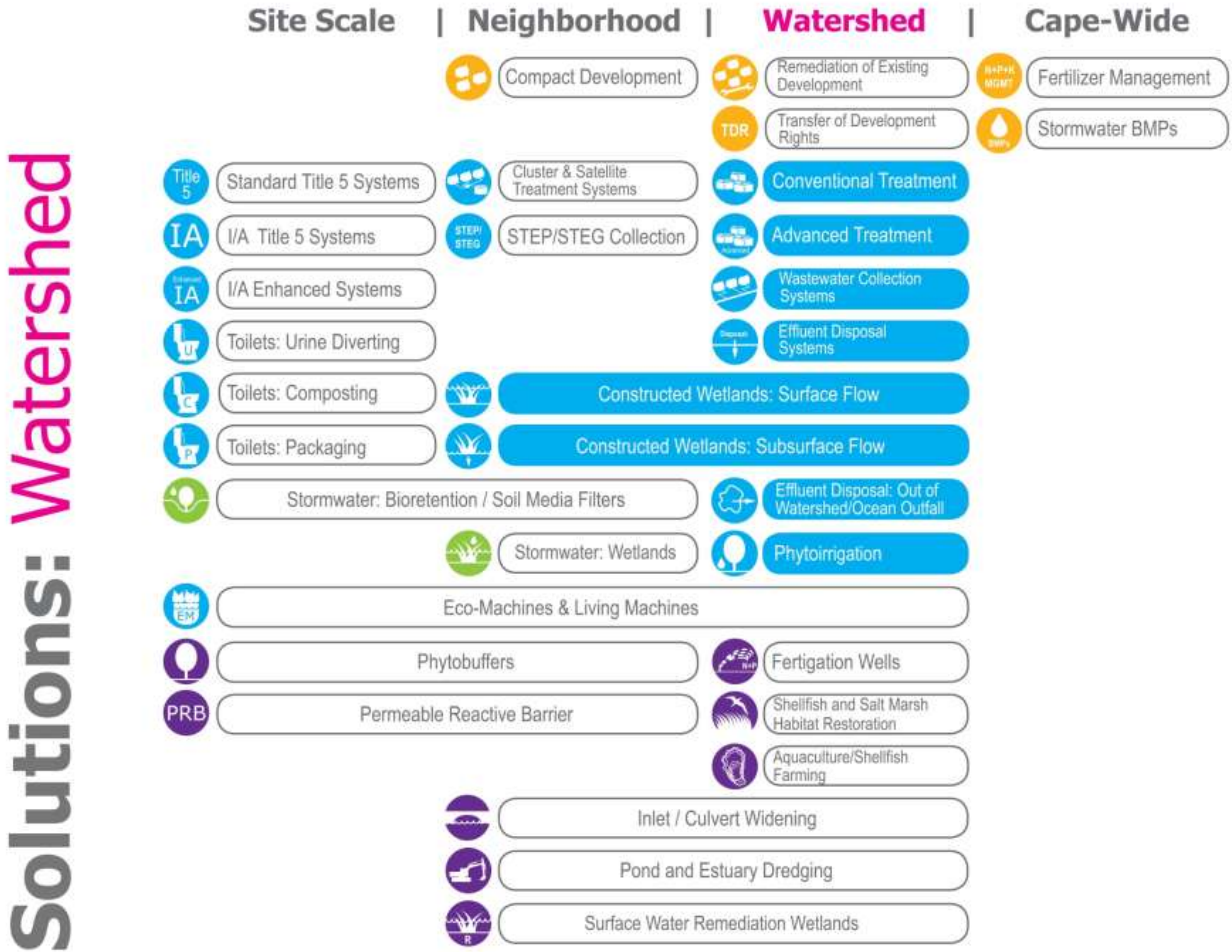
Precedent: Quinli Stormwater Park, China

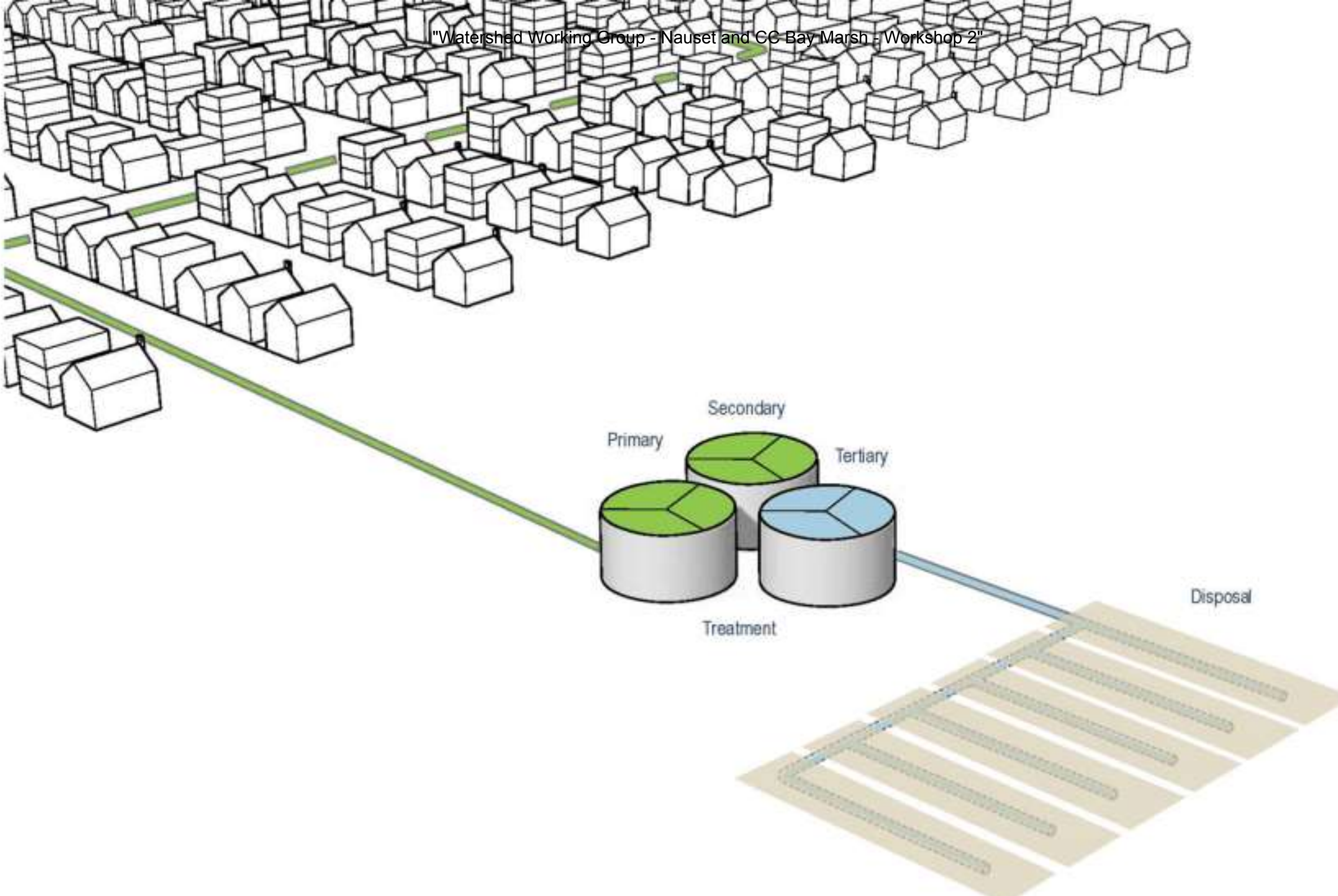
Source: Turenscape

Stormwater Wetlands

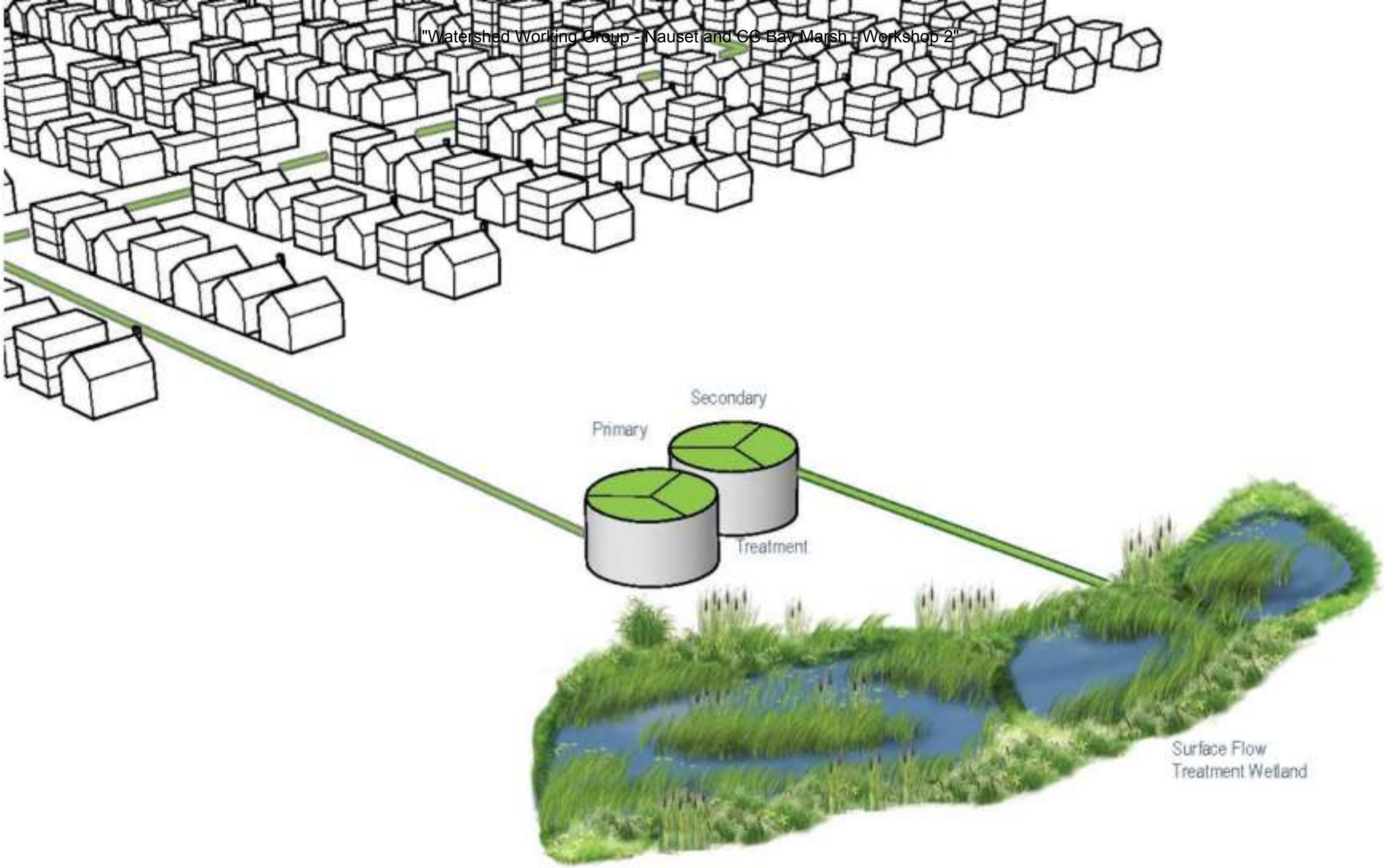
Stormwater Wetlands

"Watershed Working Group - Nauset and CC Bay Marsh - Workshop 2"





Scale: WATERSHED
Target: WASTEWATER

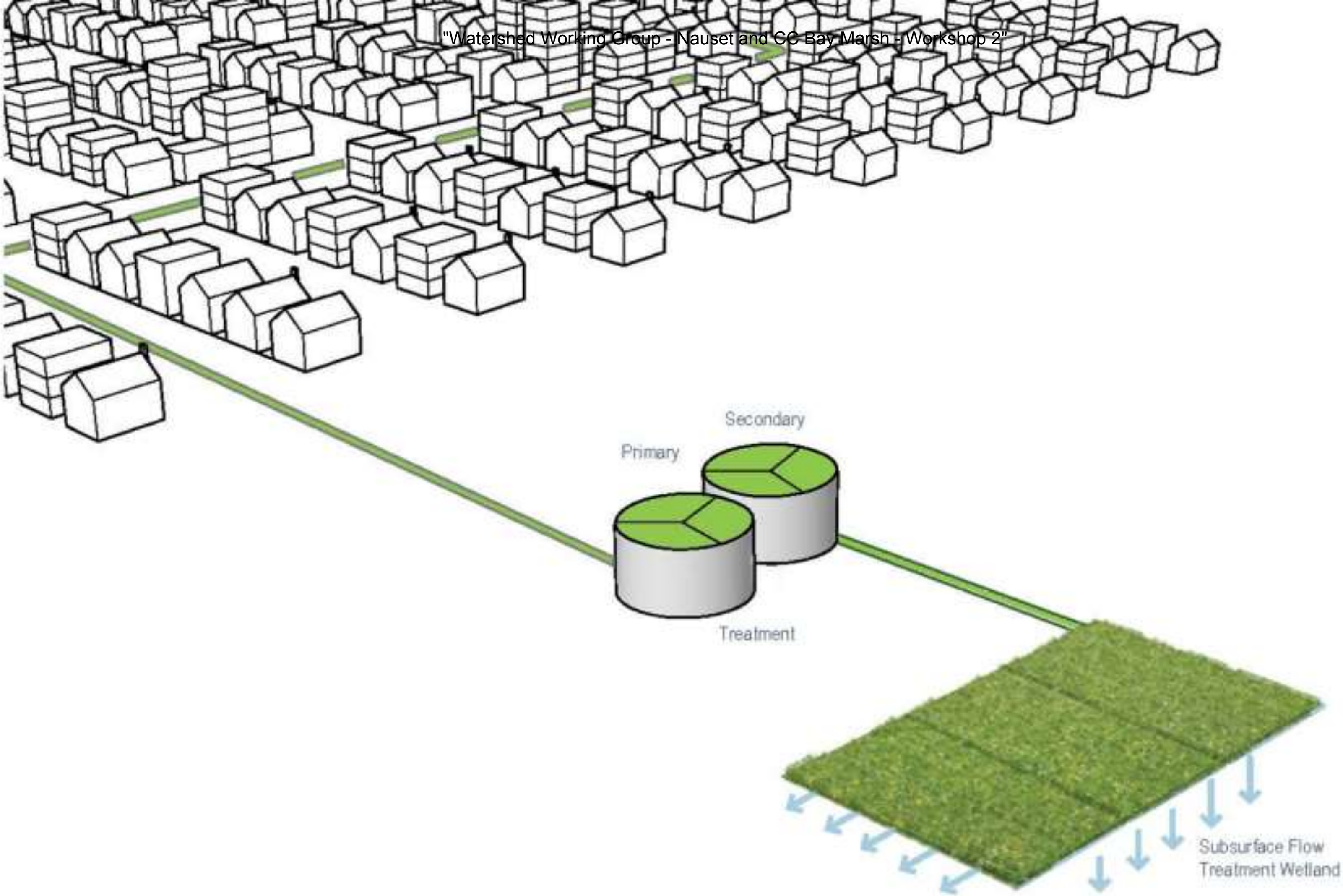


Scale: WATERSHED
Target: WASTEWATER

Constructed Wetlands:
Surface Flow

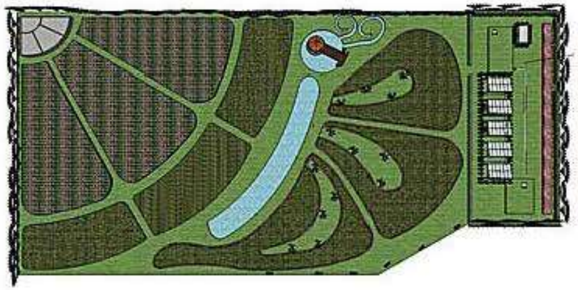
Precedent: Talking Waters Garden - Albany, OR
Source: Kate Kennen

Constructed Wetlands: Surface Flow



Scale: WATERSHED
Target: WASTEWATER

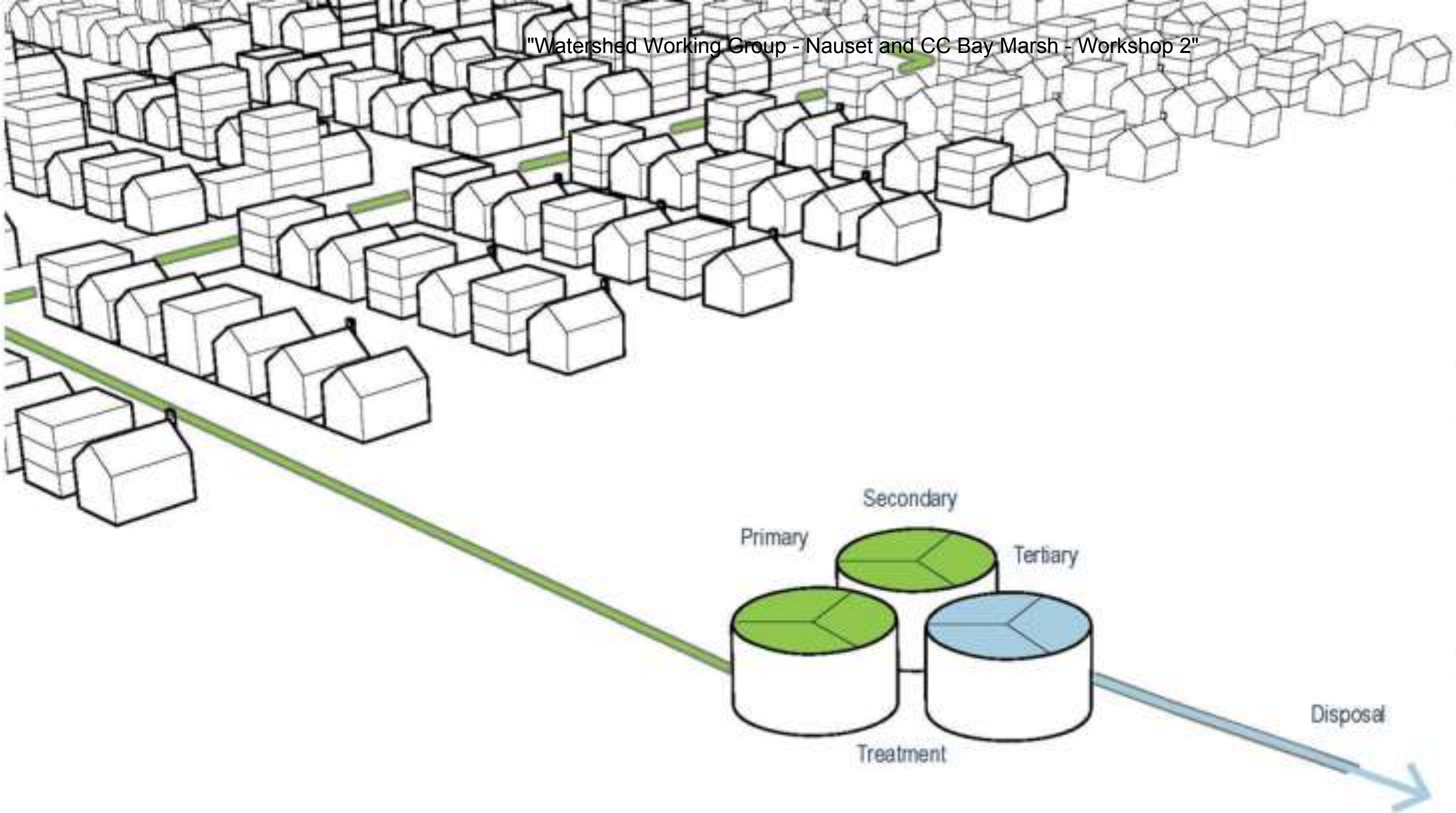
Constructed Wetlands:
Subsurface Flow

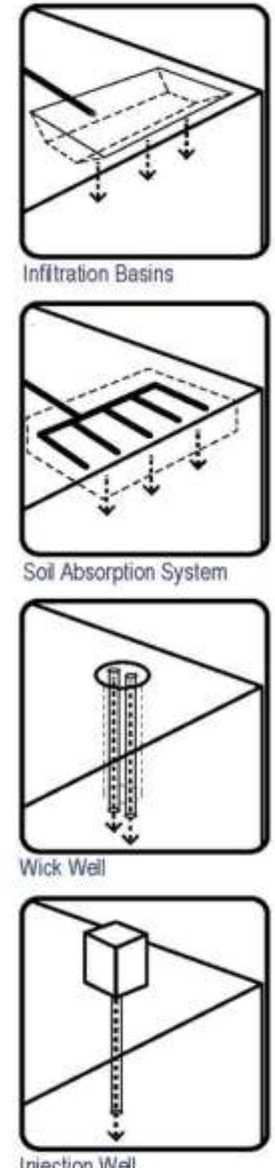


Precedent: Koh Phi Phi Treatment Wetland, Thailand

Source: Hans Brix

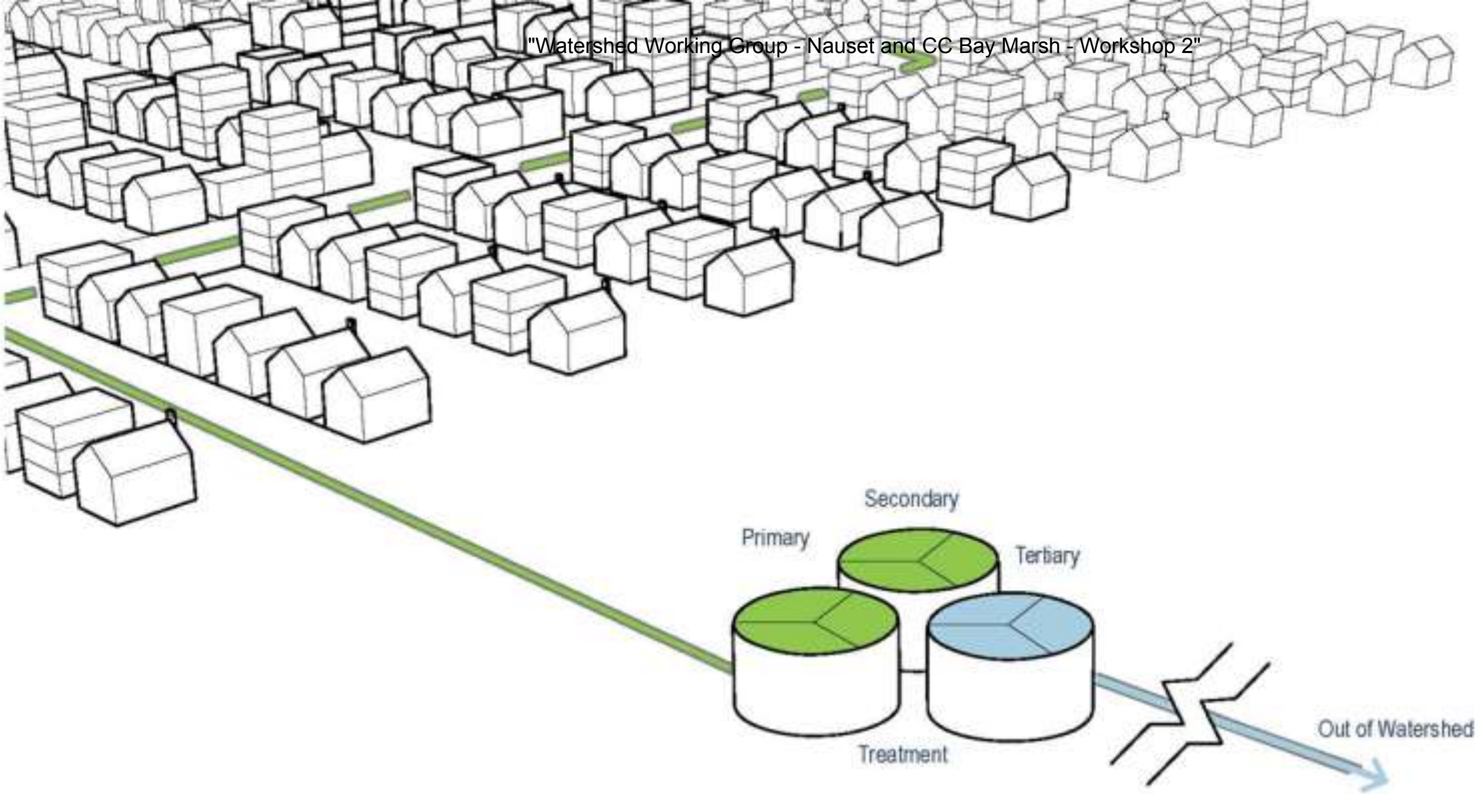
Constructed Wetlands: Subsurface Flow





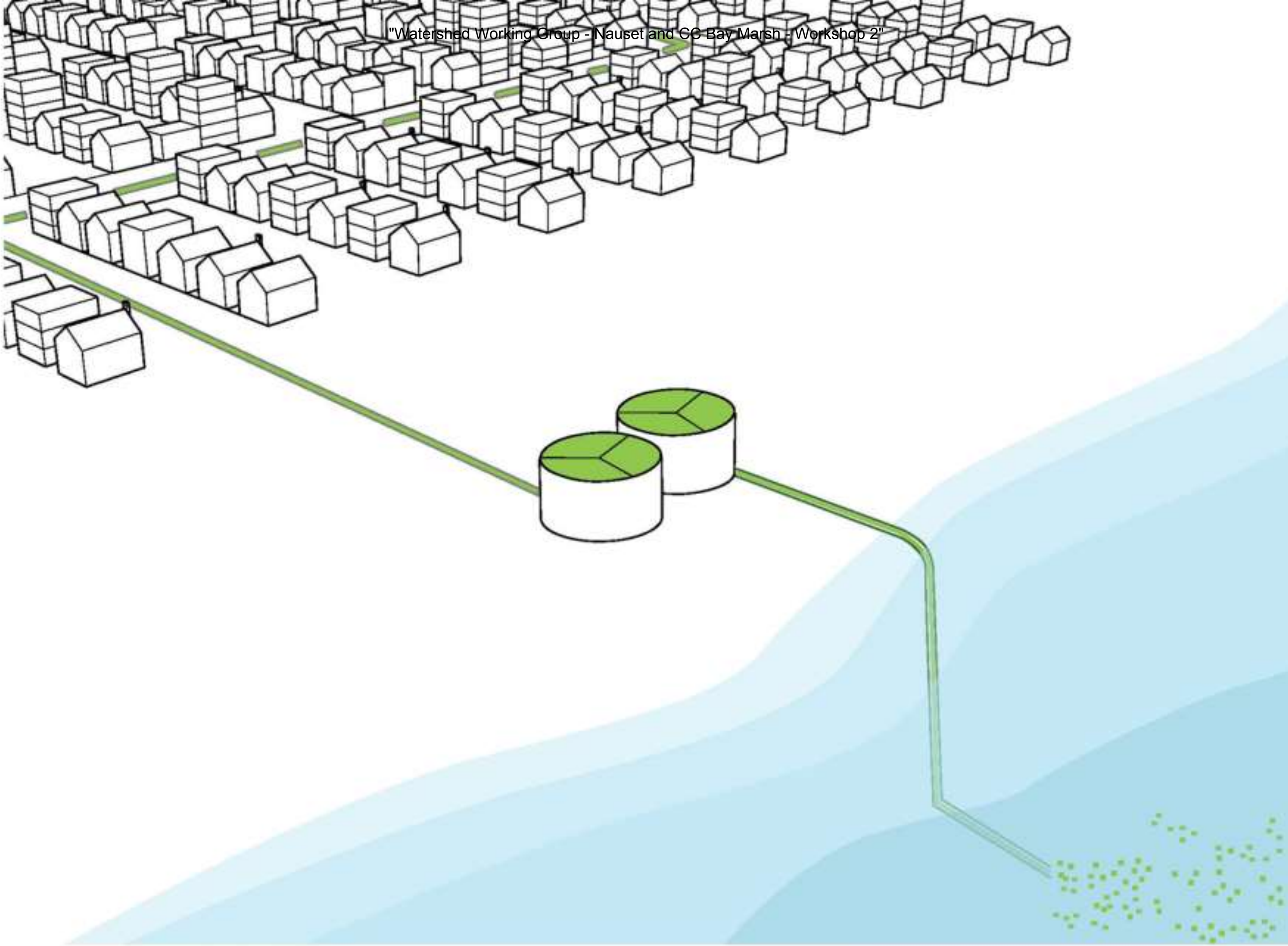
Scale: WATERSHED
Target: WASTEWATER

Effluent Disposal Systems



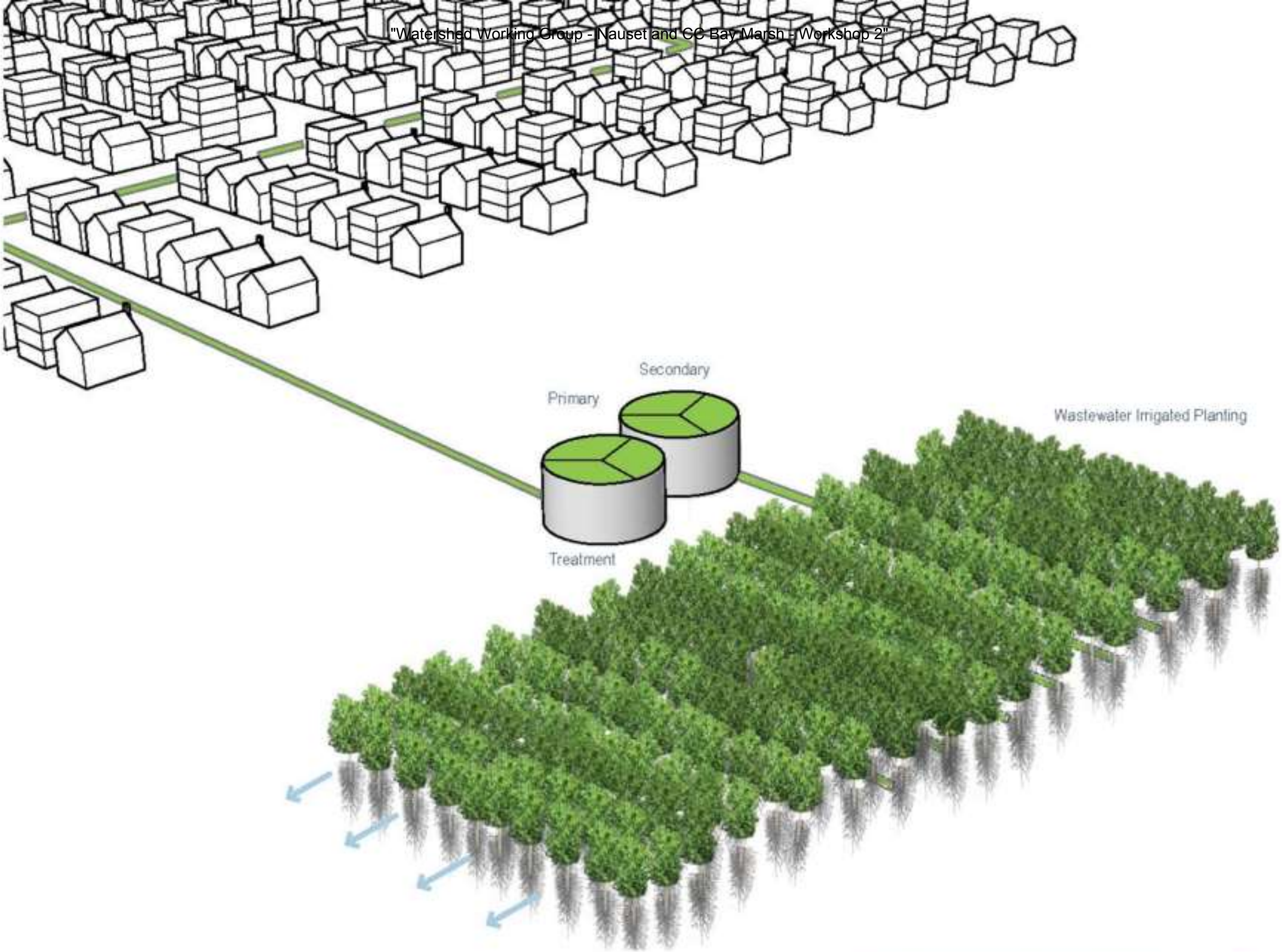
Scale: WATERSHED
Target: WASTEWATER

Effluent Disposal: Out of Watershed



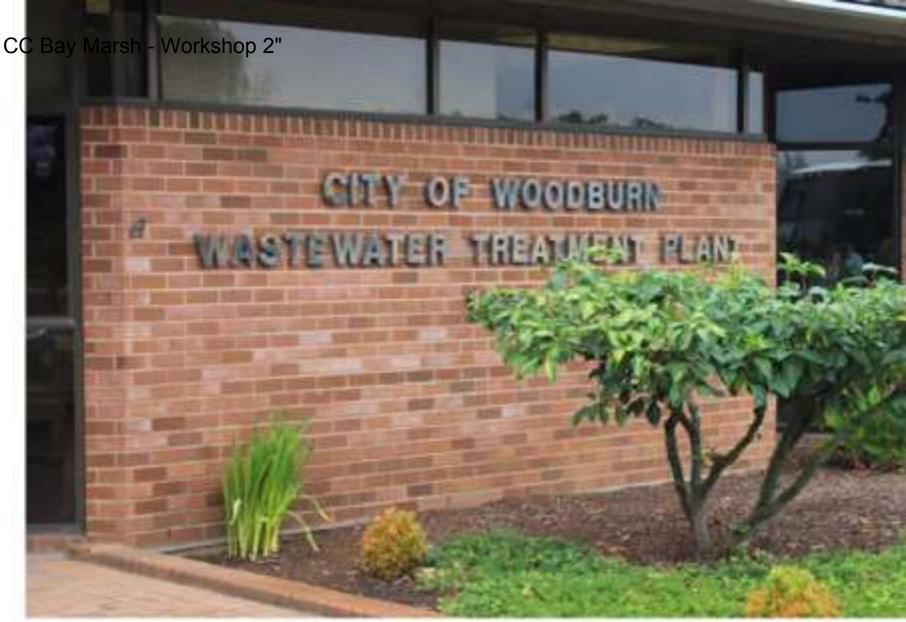
Scale: WATERSHED
Target: WASTEWATER

Effluent Disposal: Ocean Outfall



Scale: WATERSHED
Target: WASTEWATER

Phytoirrigation



Precedent: Woodburn OR, Wastewater Treatment Facility
Source: CH2MHill

Phytoirrigation

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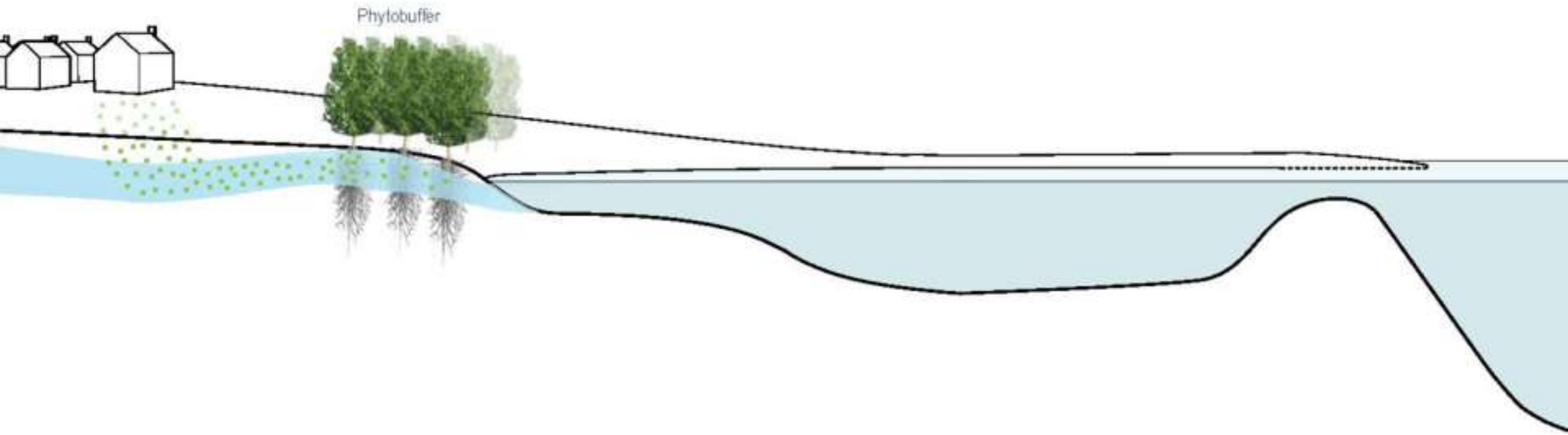
Phytoirrigation

Solutions: Ex. Water

Site Scale | Neighborhood | Watershed | Cape-Wide

Site Scale	Neighborhood	Watershed	Cape-Wide
	Compact Development	Remediation of Existing Development	Fertilizer Management
		Transfer of Development Rights	Stormwater BMPs
Standard Title 5 Systems	Cluster & Satellite Treatment Systems	Conventional Treatment	
I/A Title 5 Systems	STEP/STEG Collection	Advanced Treatment	
I/A Enhanced Systems		Wastewater Collection Systems	
Toilets: Urine Diverting		Effluent Disposal Systems	
Toilets: Composting	Constructed Wetlands: Surface Flow		
Toilets: Packaging	Constructed Wetlands: Subsurface Flow		
Stormwater: Bioretention / Soil Media Filters		Effluent Disposal: Out of Watershed/Ocean Outfall	
	Stormwater: Wetlands	Phytoirrigation	
Eco-Machines & Living Machines			
Phytobuffers		Fertigation Wells	
Permeable Reactive Barrier		Shellfish and Salt Marsh Habitat Restoration	
		Aquaculture/Shellfish Farming	
	Inlet / Culvert Widening		
	Pond and Estuary Dredging		
	Surface Water Remediation Wetlands		

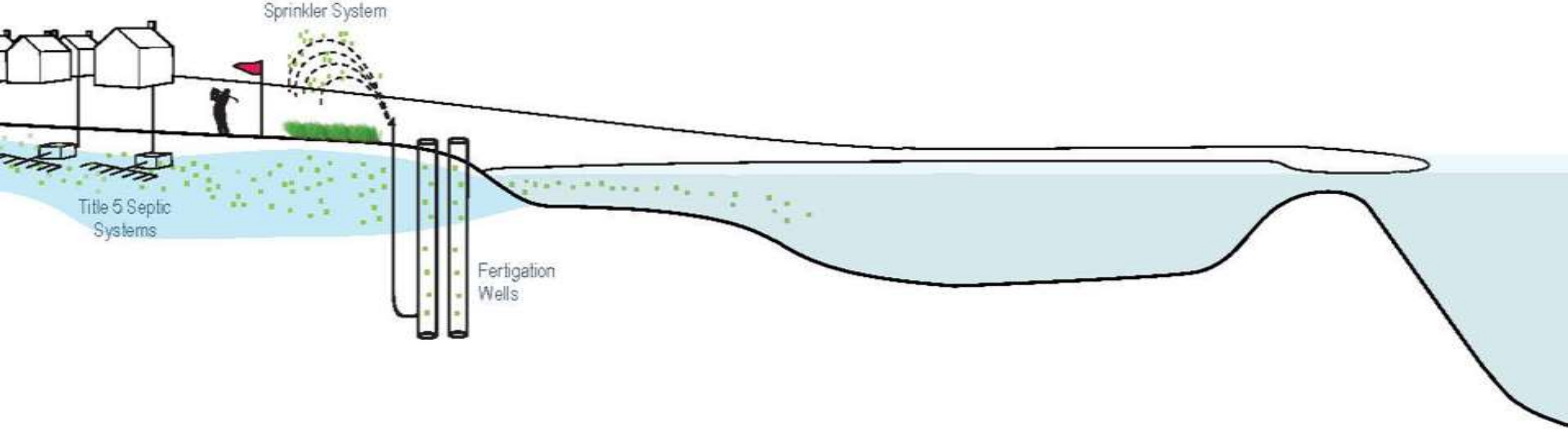


Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Phytobuffers

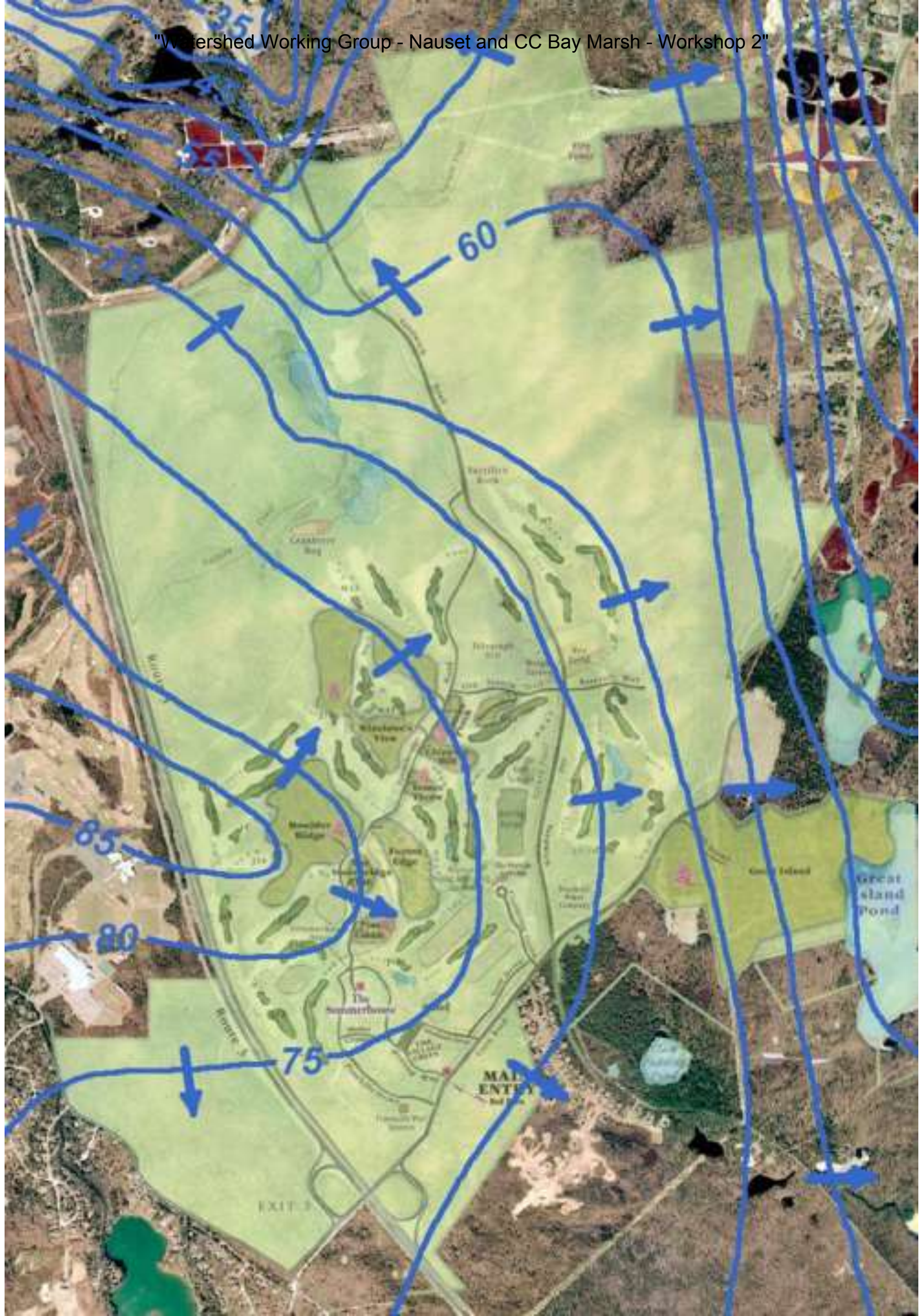
Precedent: Phytobuffer - Kavcee, WY
Source: Sand Creek Consultants

Phytobuffers



Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Fertigation Wells

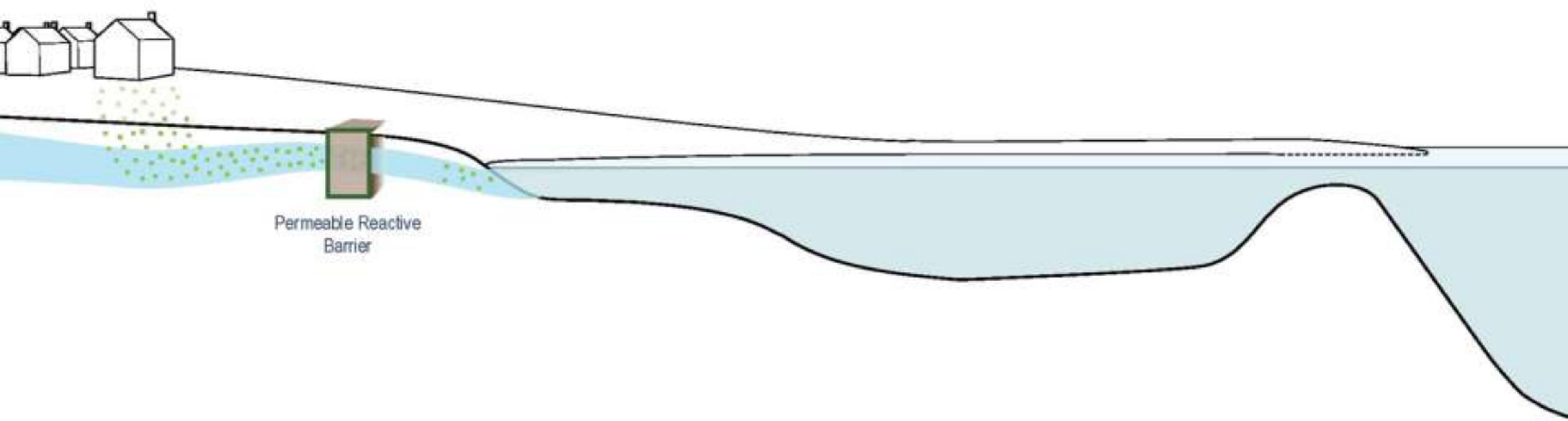


Precedent:
Pine Hills
Plymouth, MA

Precedent:
Pine Hills
Plymouth, MA

Precedent:
Pine Hills
Plymouth, MA

Precedent:
Pine Hills
Plymouth, MA



Scale: SITE / NEIGHBORHOOD / WATERSHED
Target: EXISTING WATER BODIES

Permeable Reactive Barrier

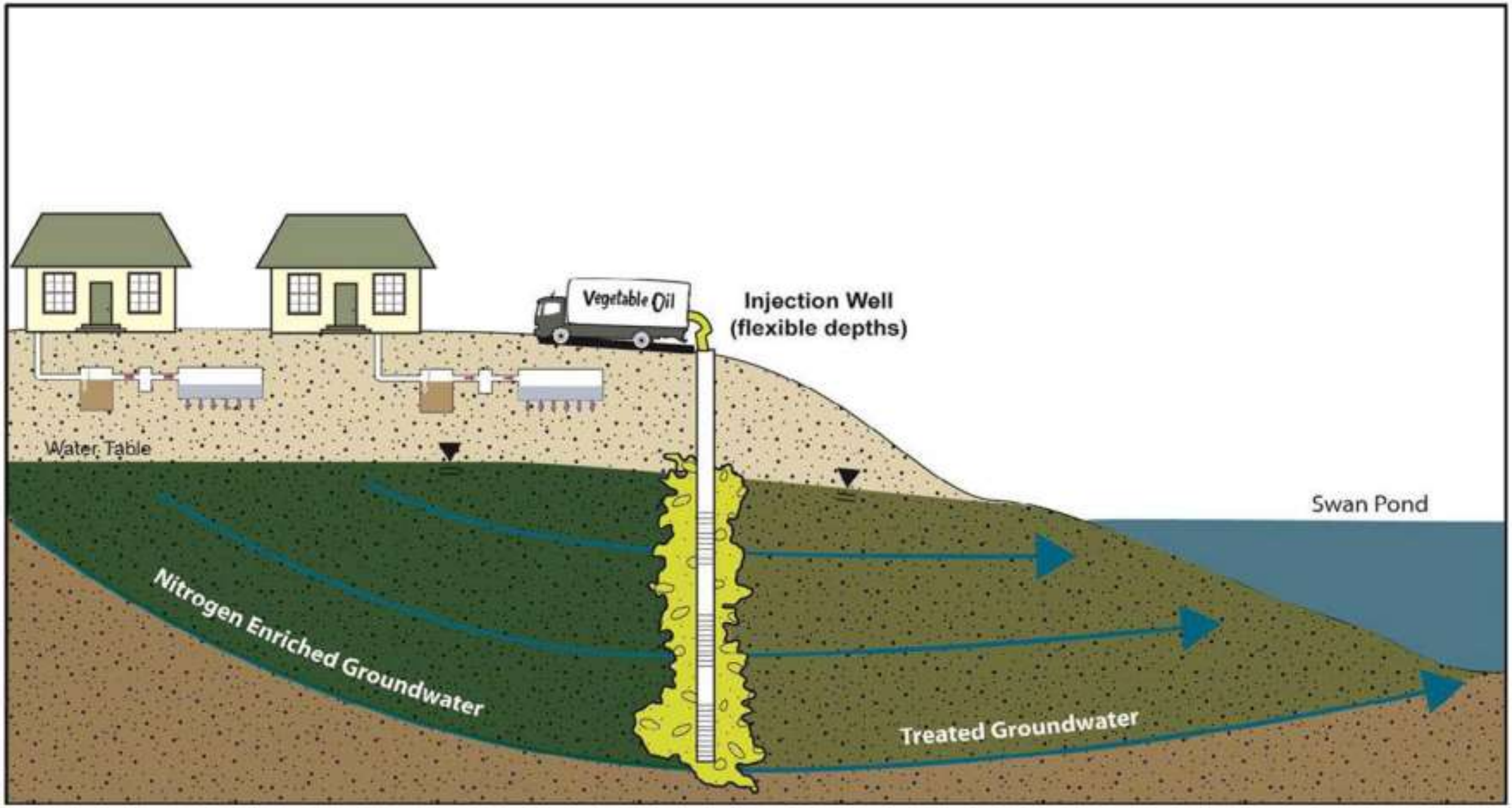
PRB

Precedent: Falmouth PRB

Source: Mike Domenica

Permeable Reactive Barrier

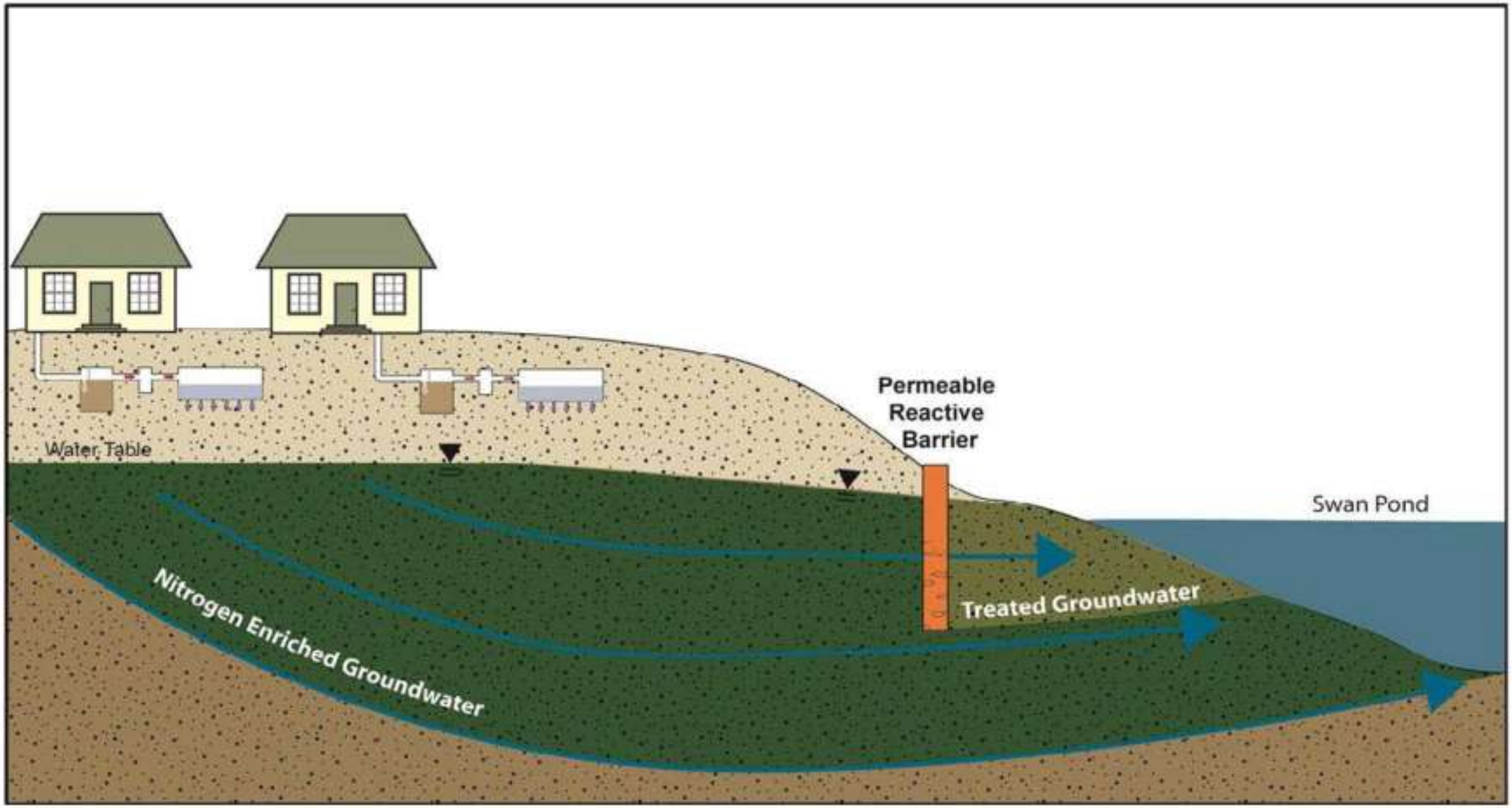
PRB



Precedent: PRB
Source: Horsley Witten Group Inc.

Permeable Reactive Barrier

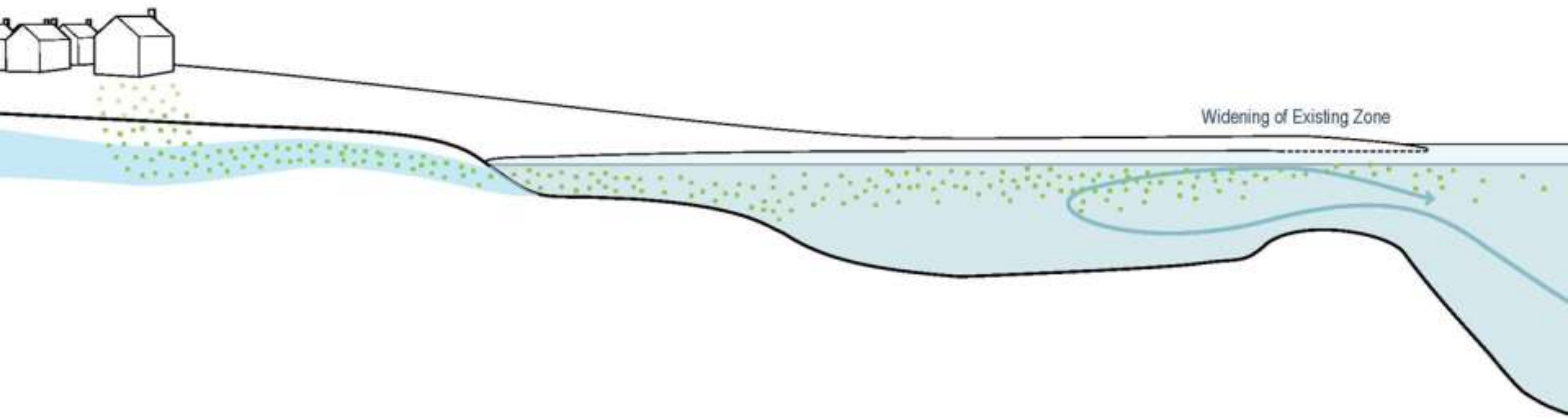
PRB



Precedent: PRB
Source: Horsley Witten Group Inc.

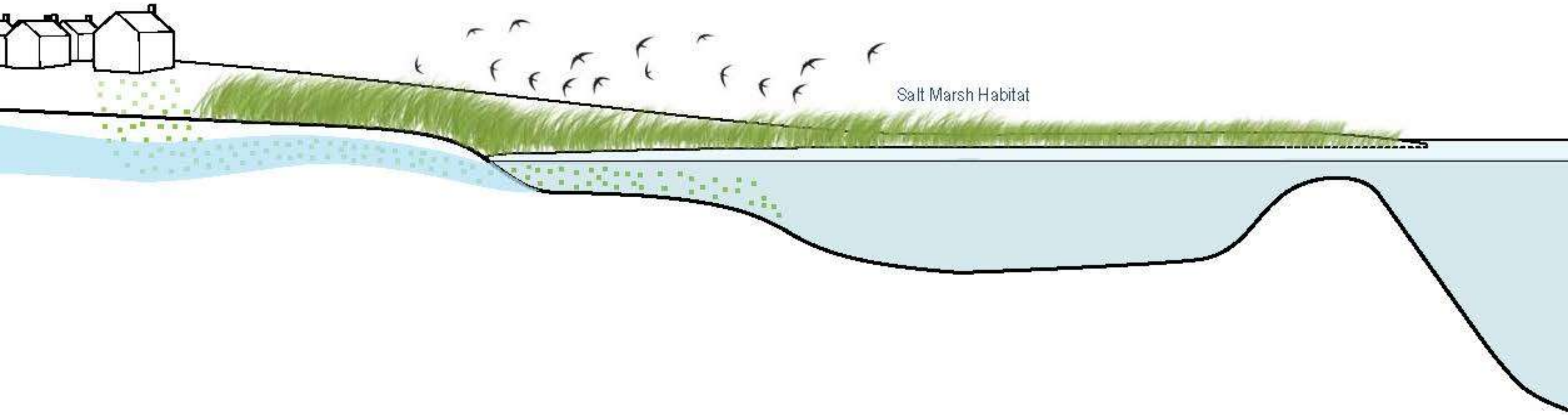
Permeable Reactive Barrier

PRB



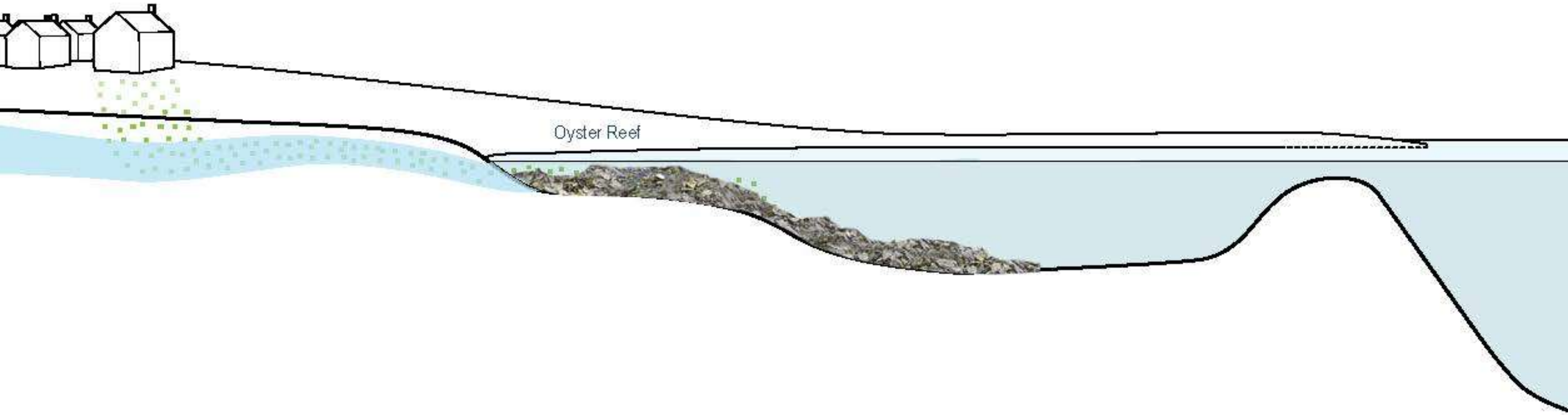
Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Inlet and Culvert Widening



Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Salt Marsh Habitat Restoration



Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Shellfish Habitat Restoration

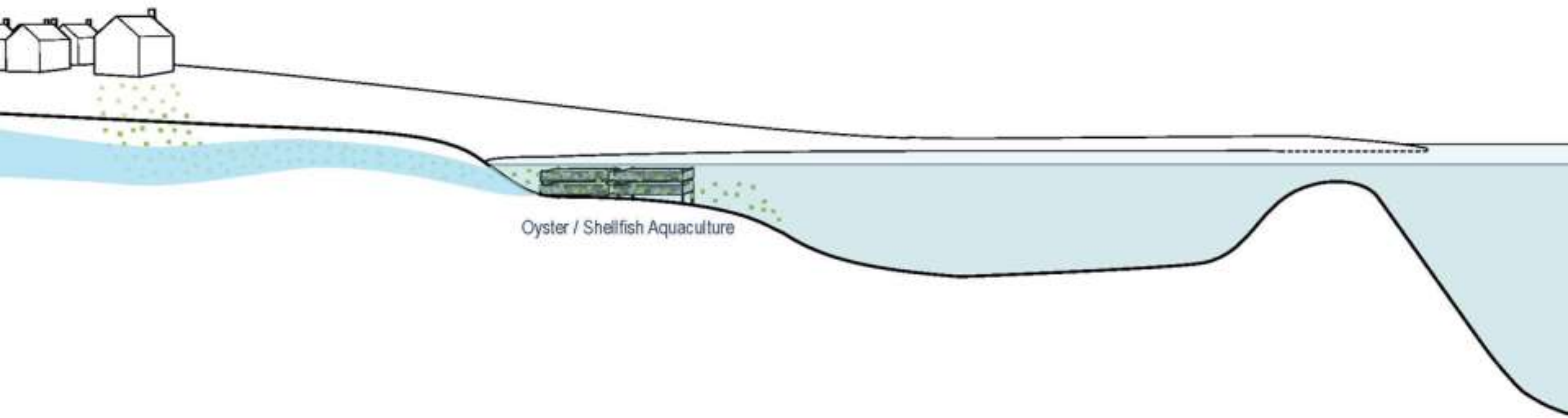
Precedent: Wellfleet Oyster Restoration Project

Source: Anamarija Francik

Shellfish Habitat Restoration

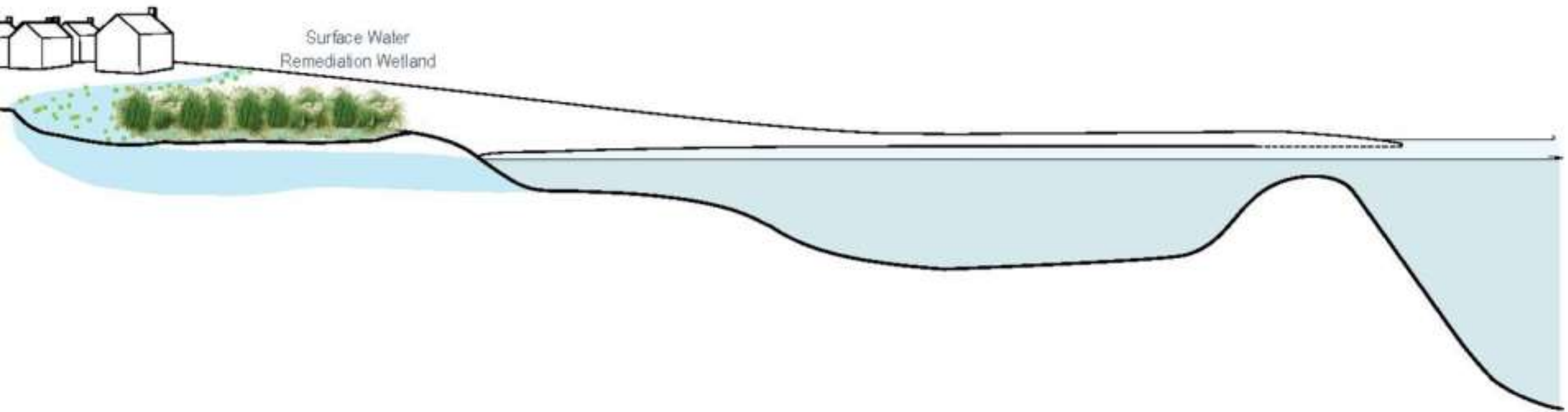
Precedent: Wellfleet Oyster Restoration Project
Source: Anamarija Francik

Shellfish Habitat Restoration



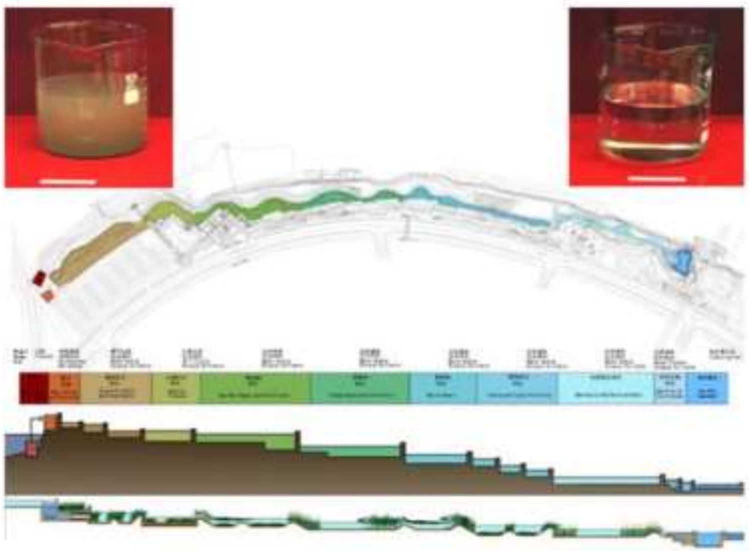
Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Aquaculture / Shellfish Farming



Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

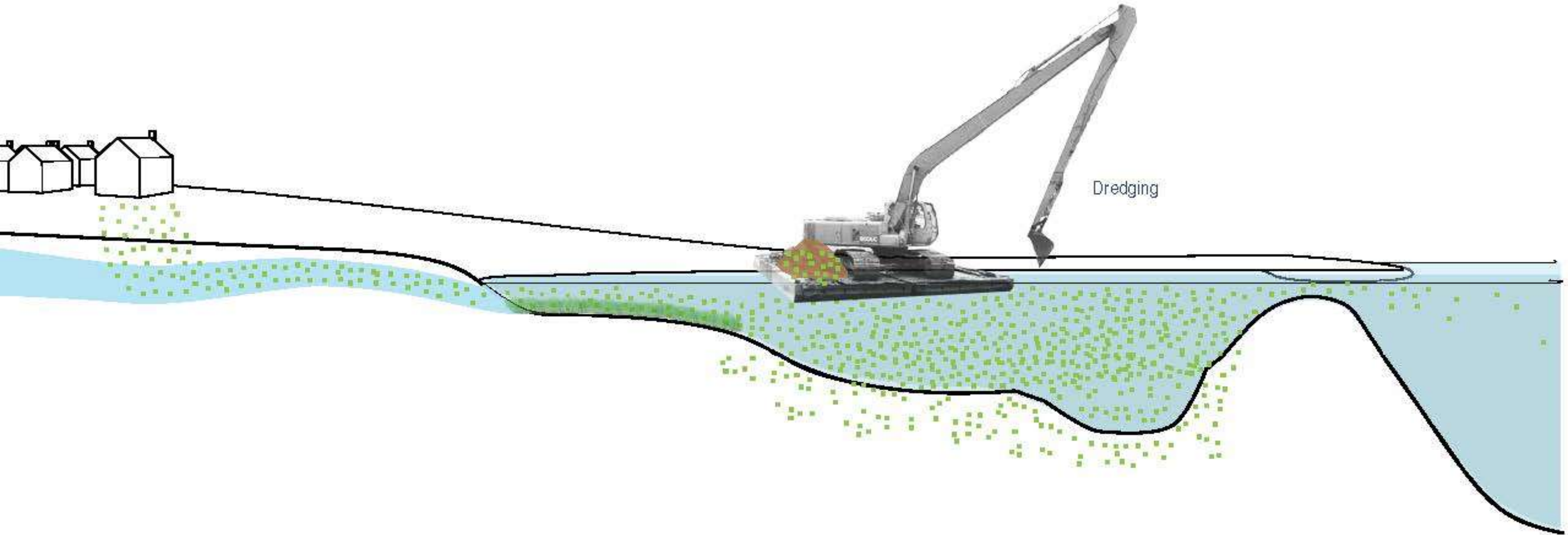
Surface Water
Remediation Wetlands



Precedent: Shanghai Houton Park

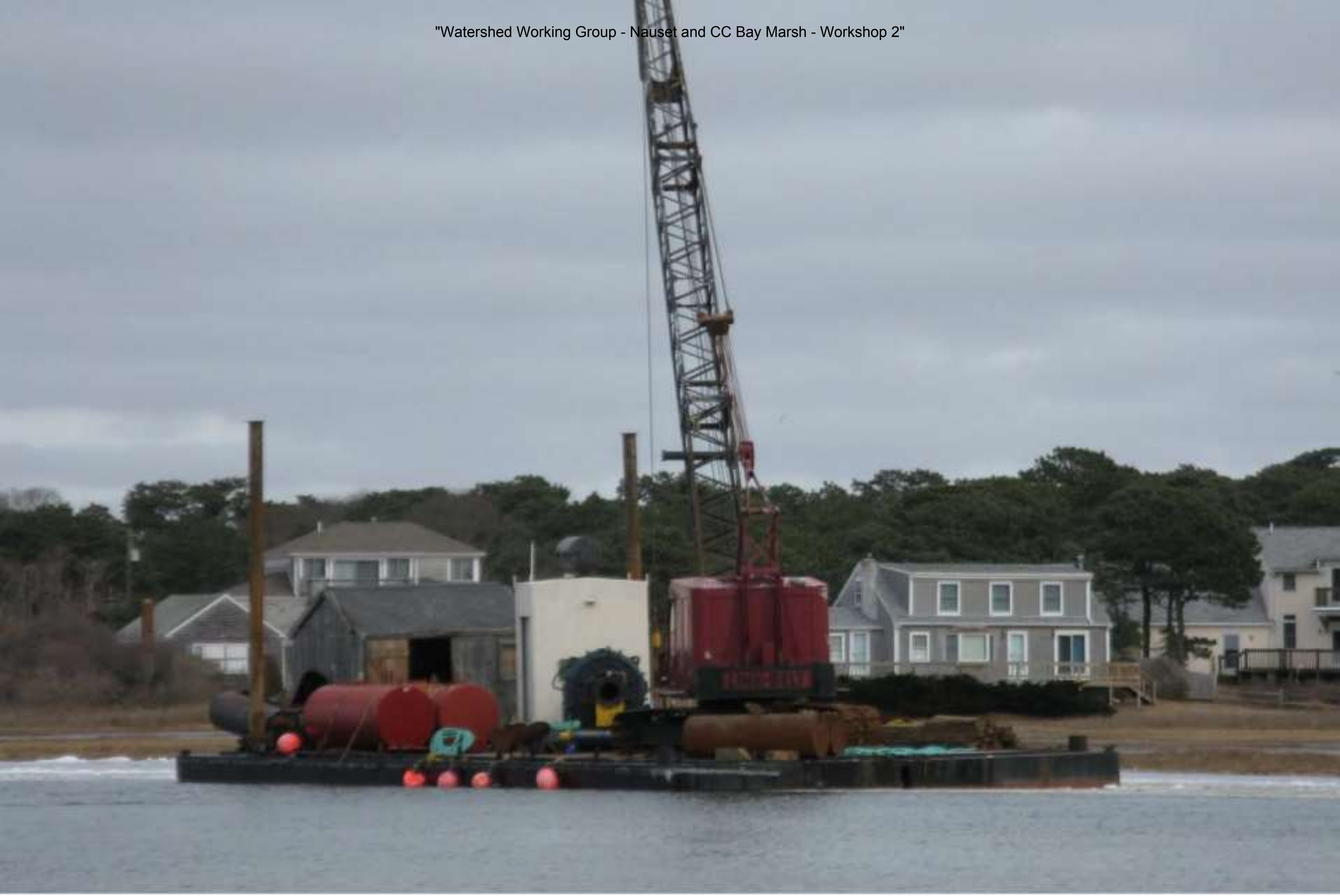
Source: Turenscape

Surface Water Remediation Wetlands



Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Pond and Estuary Dredging



Precedent: Pond and Estuary Dredging - Dennis, MA

Source: Cape Cod Times

Solutions: Cape-Wide

Site Scale | Neighborhood | Watershed | Cape-Wide

Neighborhood:
- Compact Development

Watershed:
- Remediation of Existing Development
- Transfer of Development Rights

Cape-Wide:
- Fertilizer Management
- Stormwater BMPs

Site Scale:
- Standard Title 5 Systems
- I/A Title 5 Systems
- I/A Enhanced Systems
- Toilets: Urine Diverting
- Toilets: Composting
- Toilets: Packaging

Neighborhood:
- Cluster & Satellite Treatment Systems
- STEP/STEG Collection

Watershed:
- Conventional Treatment
- Advanced Treatment
- Wastewater Collection Systems
- Effluent Disposal Systems

Neighborhood – Watershed:
- Constructed Wetlands: Surface Flow
- Constructed Wetlands: Subsurface Flow

Site Scale – Neighborhood:
- Stormwater: Bioretention / Soil Media Filters

Watershed:
- Effluent Disposal: Out of Watershed/Ocean Outfall

Neighborhood:
- Stormwater: Wetlands

Watershed:
- Phytoirrigation

Site Scale – Watershed:
- Eco-Machines & Living Machines

Site Scale – Neighborhood:
- Phytobuffers
- Permeable Reactive Barrier

Watershed:
- Fertigation Wells
- Shellfish and Salt Marsh Habitat Restoration
- Aquaculture/Shellfish Farming

Neighborhood – Watershed:
- Inlet / Culvert Widening
- Pond and Estuary Dredging
- Surface Water Remediation Wetlands

Scale: CAPE-WIDE
Target: REGULATORY

Compact Development

Scale: CAPE-WIDE
Target: REGULATORY

Fertilizer Management

N+P+K MGMT

Scale: CAPE-WIDE
Target: REGULATORY

Remediation of Existing Development

Scale: CAPE-WIDE
Target: REGULATORY

Transfer of Development Rights

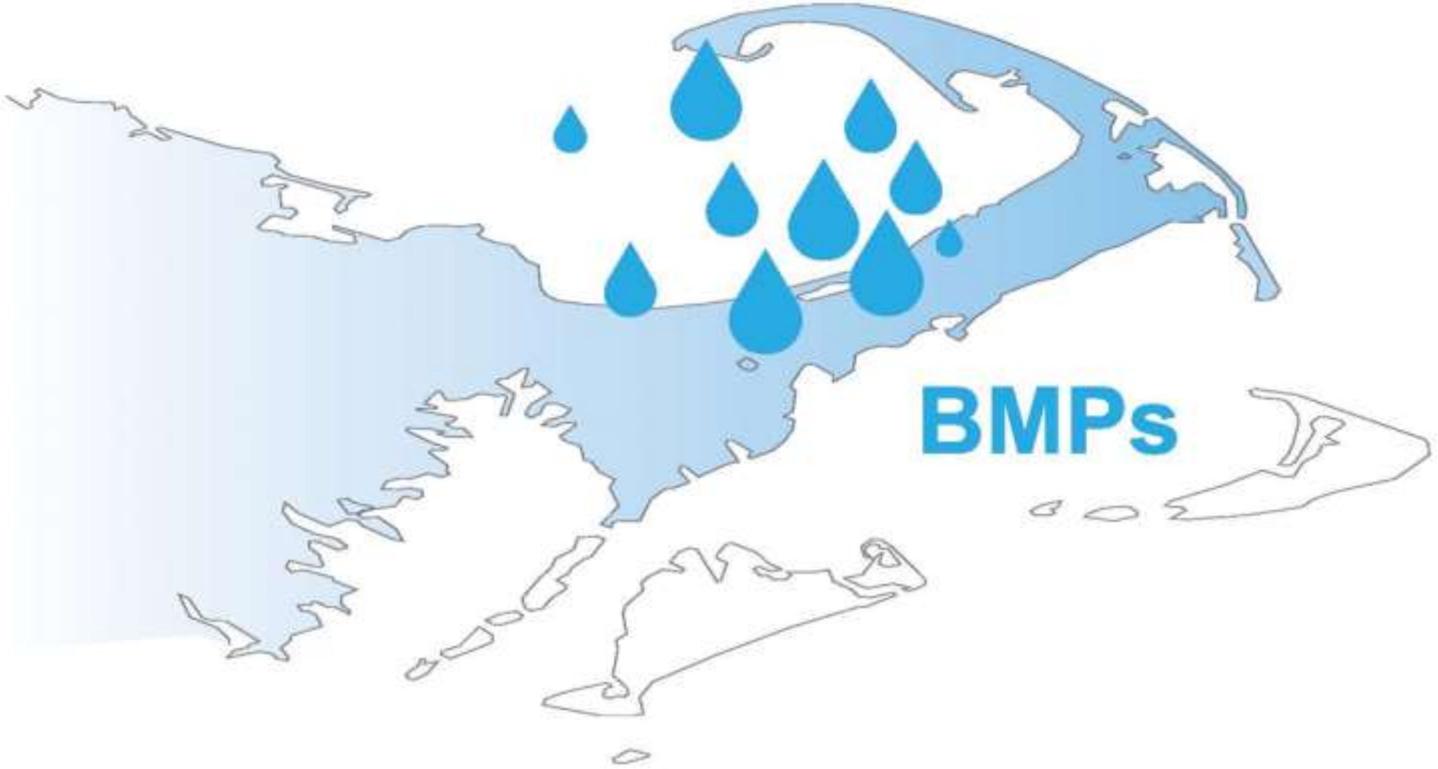
TDR

Transfer of Developments Rights
The Concept

Owner of "sending" parcel sells development rights in exchange for permanent conservation easement.

Owner of "receiving" parcel buys development rights to build at densities higher than allowed under base zoning.

Source: Massachusetts Smart Growth Toolkit



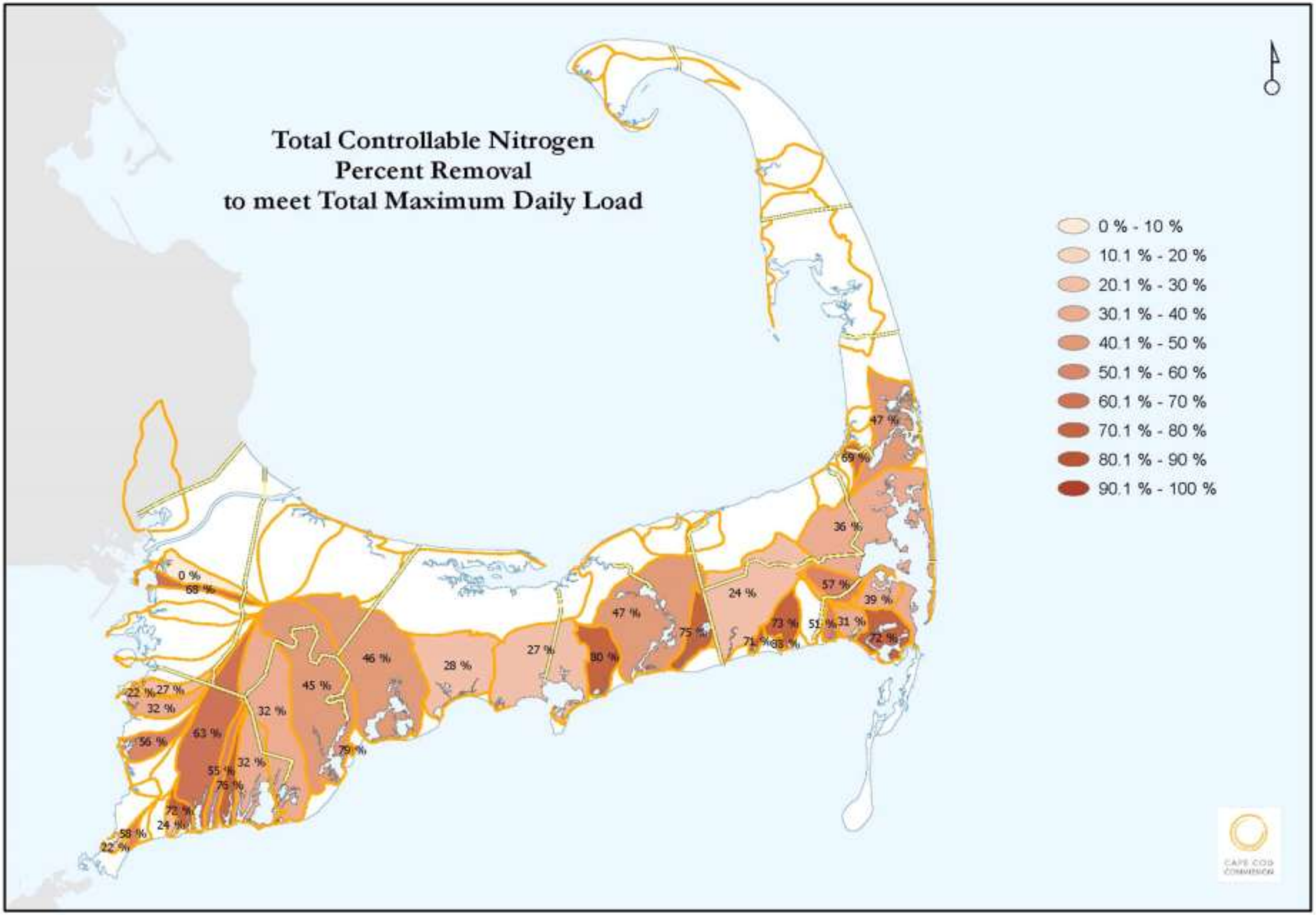
Scale: CAPE-WIDE
Target: REGULATORY

Stormwater BMPs

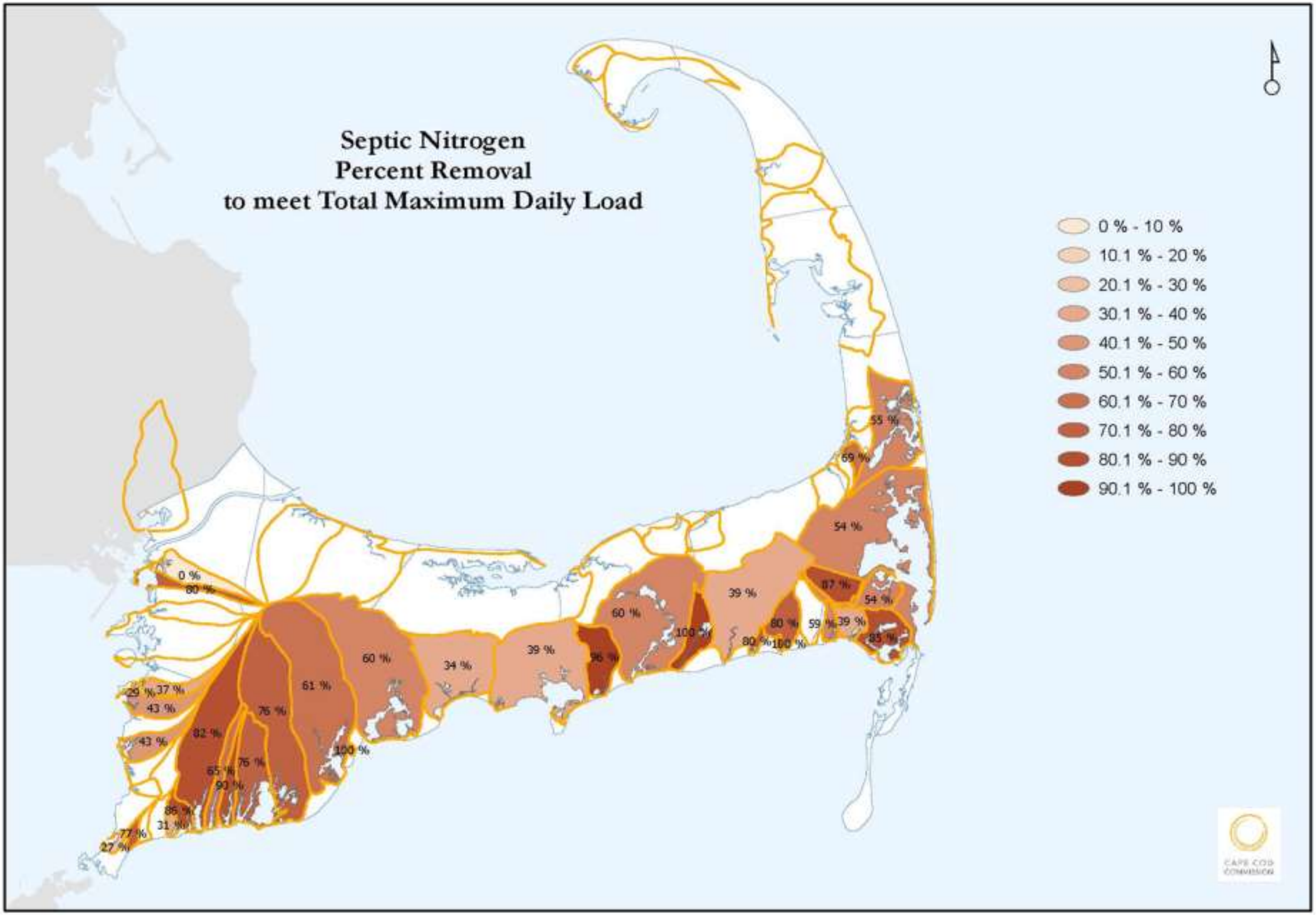
BMPs

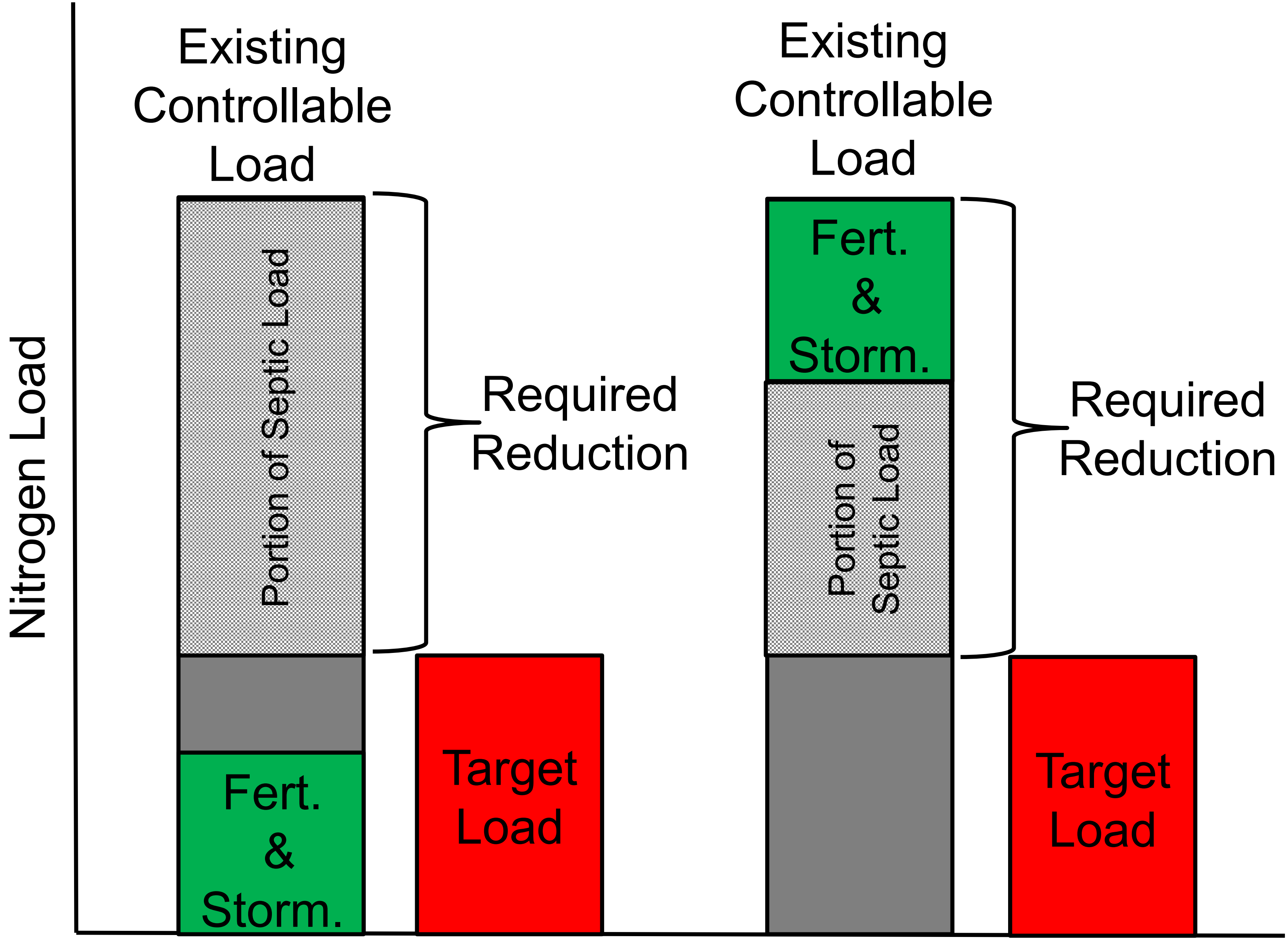

Site Scale | Neighborhood | Watershed | Cape-Wide
Solutions
Compact Development
Remediation of Existing Development
N+P+K MGMT
Fertilizer Management
TDR
Transfer of Development Rights
BMPs
Stormwater BMPs
Title 5
Standard Title 5 Systems
Cluster & Satellite Treatment Systems
Conventional Treatment
IA
I/A Title 5 Systems
STEP/STEG
STEP/STEG Collection
Advanced Treatment
Enhanced IA
I/A Enhanced Systems
Wastewater Collection Systems
Toilets: Urine Diverting
Effluent Disposal Systems
Toilets: Composting
Constructed Wetlands: Surface Flow
Toilets: Packaging
Constructed Wetlands: Subsurface Flow
Stormwater: Bioretention / Soil Media Filters
Effluent Disposal: Out of Watershed/Ocean Outfall
Stormwater: Wetlands
Phytoirrigation
EM
Eco-Machines & Living Machines
Phytobuffers
N+P
Fertigation Wells
PRB
Permeable Reactive Barrier
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
R
Surface Water Remediation Wetlands

"Watershed Working Group - Nauset and CC Bay Marsh - Workshop 2"


Total Controllable Nitrogen
Percent Removal
to meet Total Maximum Daily Load
0 % - 10 %
10.1 % - 20 %
20.1 % - 30 %
30.1 % - 40 %
40.1 % - 50 %
50.1 % - 60 %
60.1 % - 70 %
70.1 % - 80 %
80.1 % - 90 %
90.1 % - 100 %

"Watershed Working Group - Nauset and CC Bay Marsh - Workshop 2"




Nitrogen Load
Existing Controllable Load
Portion of Septic Load
Fert. & Storm.
Required Reduction
Target Load
Existing Controllable Load
Fert. & Storm.
Portion of Septic Load
Required Reduction
Target Load

Wastewater | Existing Water Bodies | Regulatory

Problem Solving Approach

1 Nitrogen Targets/Goals

Present Load: X kg/day − **Target**: Y kg/day = **Reduction Required**: N kg/day

2 Other Wastewater Management Needs

A. Title 5 Problem Areas
B. Pond Recharge Areas

3 Low Barrier to Implementation

A. Fertilizer Management
B. Stormwater Mitigation

4 Watershed/Embayment Options

A. Permeable Reactive Barriers
B. Inlet/Culvert Openings
C. Constructed Wetlands
D. Aquaculture

5 Alternative On-Site Options

A. Eco-toilets (UD & Compost)
B. I/A Technologies
C. Enhanced I/A Technologies
D. Shared Systems

6 Priority Collection/High-Density Areas

A. Greater Than 1 Dwelling Unit/acre
B. Village Centers
C. Economic Centers
D. Growth Incentive Zones

7 Supplemental Sewering

Town Consideration of Alternative Technologies & Approaches

Wellfleet- *Coastal habitat restoration & aquaculture*

Mashpee- *Aquaculture & Expanding Existing Systems*

Brewster- *PRB & Bioswales*

Orleans- *Fertilizer Control By-Law*

Harwich- *Muddy Creek & Cold Brook Natural Attenuation*

Falmouth- *Aquaculture*
Inlet Widening
Eco-Toilet Demonstration Project
PRBs
Stormwater Management (Little Pond Watershed)
Fertilizer Control By-Law
Subsurface Nitrogen Removal Septic Systems

Triple Bottom Line

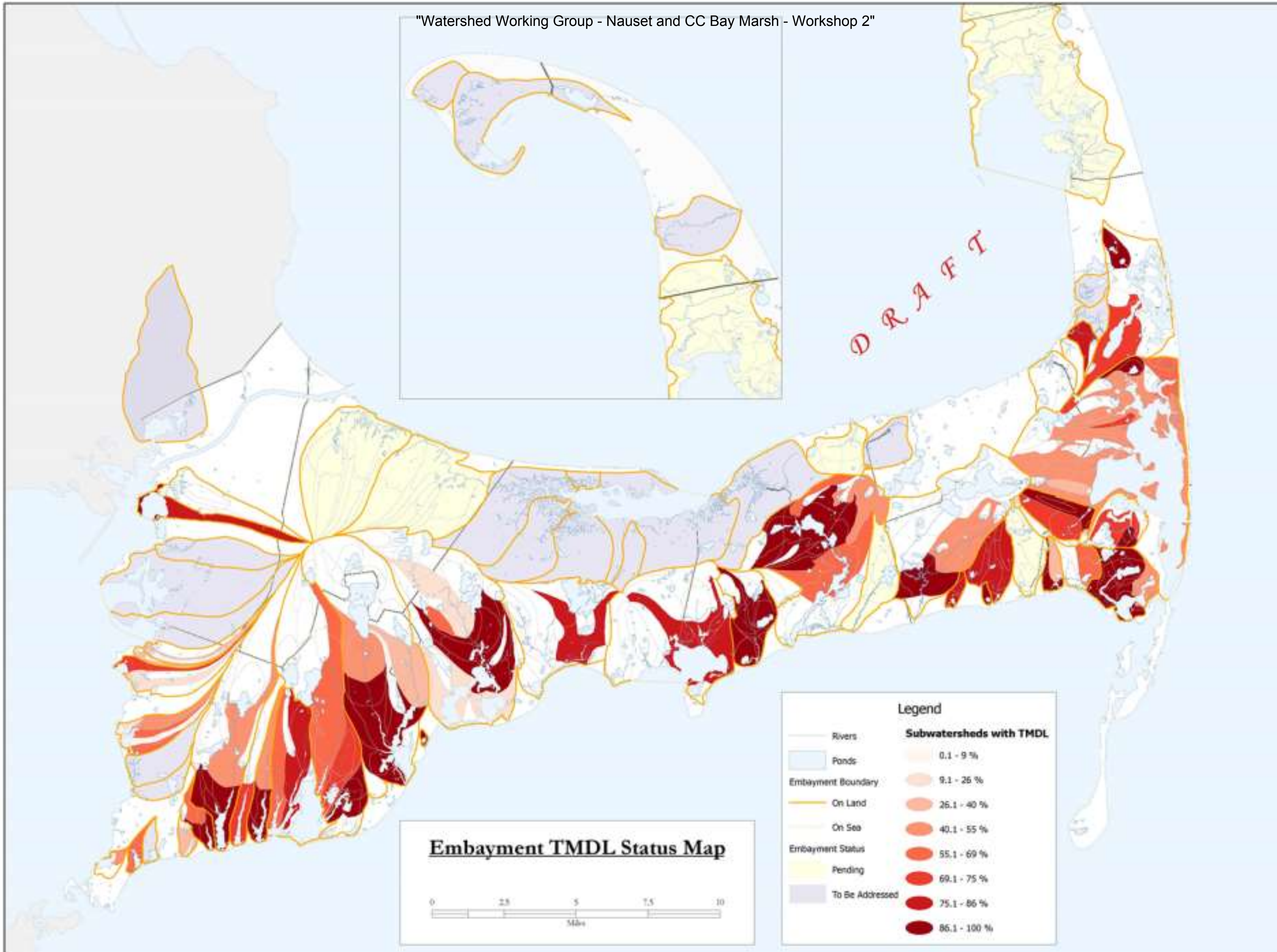
Impacts of Technologies and Approaches

Environmental

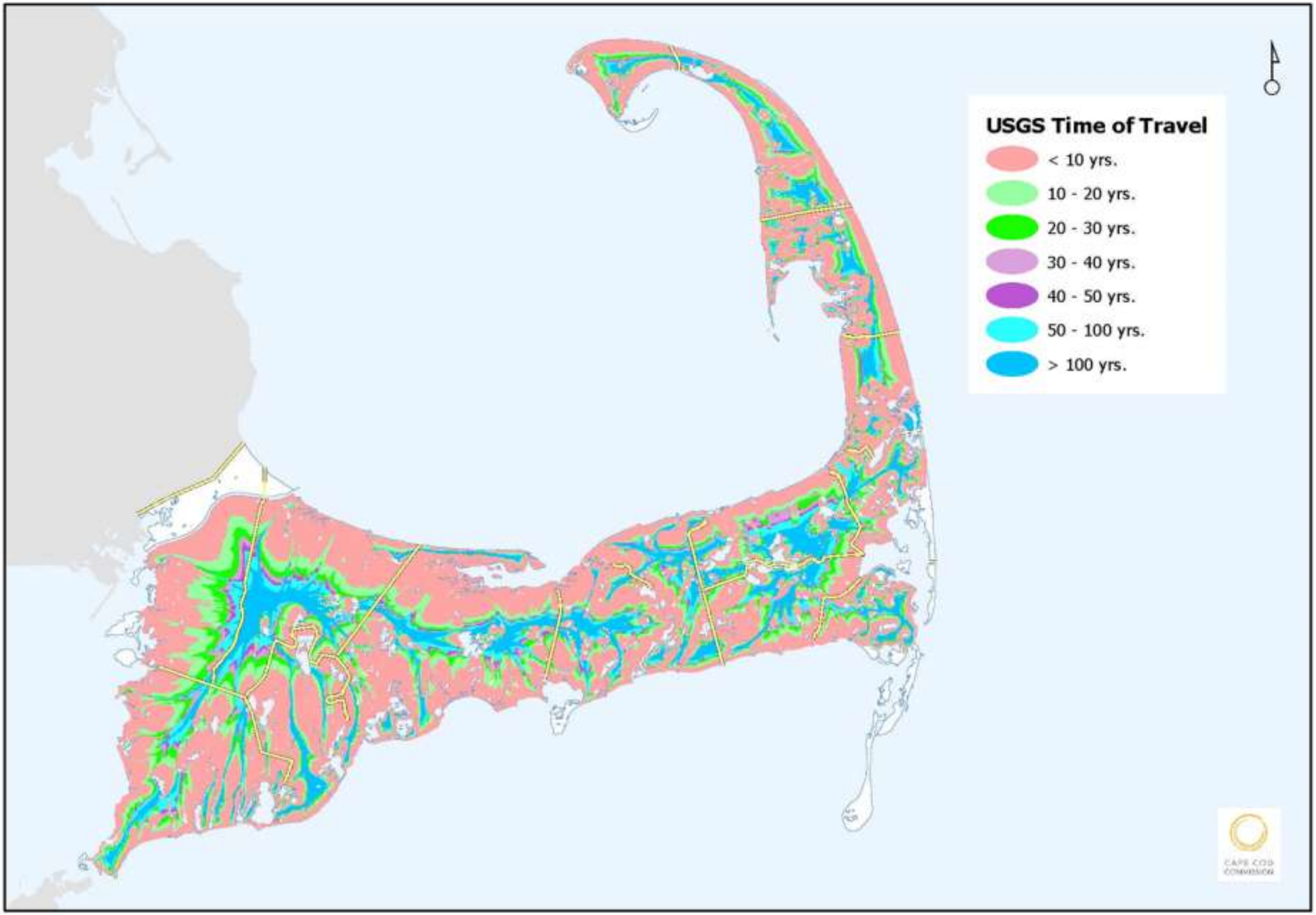
Economic

Social

"Watershed Working Group - Nauset and CC Bay Marsh - Workshop 2"



"Watershed Working Group - Nauset and CC Bay Marsh - Workshop 2"



Technology Selection: Process and Principles

- 100% septic removal subwatershed
- Scale: On-Site vs. Collection System vs. Natural System
- Nutrient intervention and time of travel
- Permitting Status
- Land use and Impacts of Growth

Preparing for Meeting 3 and Beyond

- Review tools and alternatives analysis approach
- Evaluating scenarios for meeting water quality goals
- Attend the November 13th meeting:

6:00
Cape Cod Museum of Art
Dennis, MA

Cape Cod 208 Area Water Quality Planning
Nauset and Cape Cod Bay Marsh Watershed Working Group

Meeting Two
Monday, October 22, 2013
8:30 am- 12:30 pm
Eastham Town Hall, 2500 State Highway
Eastham, Massachusetts 02642

Meeting Summary Prepared by the Consensus Building Institute

I. ACTION ITEMS

Working Group

- Next meeting: Meeting Three
  Wednesday, December 4, 2013
  8:30AM -12:30PM
  Eastham Town Hall, 2500 State Highway, Eastham, Massachusetts 02642
- Send Stacie any additional comments on Meeting One Summary (by Oct 28)
- Review the Technology Matrix and continue to prepare thoughts about which technologies/approaches they would like to learn more about for application in the Nauset and Cape Cod Bay Marsh Watershed. Different scenarios and options will be discussed during Meeting Three.

Consensus Building Institute

- Send link with presentation to participants
- Finalize Meeting One summary (by Oct 28)
- Draft and solicit feedback from Working Group on Meeting Two summary

Cape Cod Commission

- Share Technology Matrix with Working Groups
- Share updated Chronologies with Working Groups
- Post George Huefelder's data on the website.
- Add information about incinerating toilets to the fact sheet and matrix.

II. WELCOME, REVIEW 208 GOALS AND PROCESS AND THE GOALS OF MEETING

Ms. Patty Daley, Deputy Director at the Cape Cod Commission and Area Manager for the Nauset and Cape Cod Bay Marsh Watershed Working Group, and Ms. Erin Perry, Special Project Coordinator, welcomed participants and offered an overview of the 208 Update stakeholder process.[1] In July, public meetings were held across the Cape to present the 208 Plan Update goals, work plan, and participant roles. Public meetings were also held in August to present information on the affordability and financing of the comprehensive 208 Plan Update. The first meetings of the eleven Watershed Working Groups were held in September and focused on baseline conditions in each of the watersheds. The second meetings of the Watershed Working Groups will be held in October and early November and are focused on exploring technology options and approaches. The third meetings of the Watershed Working Groups will be held in December and focus on evaluating watershed scenarios which will be informed by Working Groups' discussions about baseline conditions, priority areas, and technology options/approaches. This conversation will also be informed by information shared in the Technology Matrix, which was developed by the Cape Cod Commission with technical input from the Technical Advisory Committee of the Cape Cod Water Protection Collaborative and the Technology Panel. The Technology Matrix builds on the information presented in the Technology Fact Sheets, which Working Group members reviewed in advance of the meeting[2]. Once it is finalized by the Cape Cod Commission, the Technology Matrix will be shared with Working Group Members.

Ms. Perry shared the 208 Plan team's progress since Meeting One which includes:

- Meeting materials distributed to stakeholders and available at http://watersheds.capecodcommission.org
- GIS data layers accessible at: http://watersheds.capecodcommission.org
- Chronologies are being updated and will be made available soon

Ms. Perry also shared that the second round of Cape2O game is launching on October 22 and encouraged Working Group members to participate in the interactive, online game which provides valuable education and input to the Cape Cod Commission. She announced that there will also be a Cape Cod wide event on November 13 at the Cape Cod Center for the Arts in Dennis. Participants from across the eleven Watershed Working Groups and the public are invited to attend the event which will include: Wrap up of "Cape2-O: ur in charge!"; a summary of planning process to date; and a discussion of the stakeholder role in the second 6 months of the 208 planning process.

Ms. Perry described the goal of today's meeting:

- To develop a shared understanding of the potential technologies and approaches identified to date , and the benefits and limitations of each; to explore the environmental, economic, and community impacts of a range of categories of solutions;

[1] The PowerPoint Presentation made at this meeting is available at: http://watersheds.capecodcommission.org/index.php/watersheds/lower-cape/nauset-and-cape-cod-bay

[2] Technology Fact Sheets are available at: http://watersheds.capecodcommission.org/index.php/watersheds/lower-cape/nauset-and-cape-cod-bay

and to identify priorities and considerations for applying technologies and approaches to remediate water quality impairments in your watershed.

Ms. Daley noted that during the September meetings, all the Watershed Working Groups had robust discussions about the buildout the Commission plans to use for the 208 Plan Update. She indicated that the Commission is reaching out to Towns to further discuss how the plan will address buildout.

Ms. Stacie Smith, the facilitator from the Consensus Building Institute, reviewed the agenda, the ground rules, action items from the previous meeting, and led introductions. A participant list is found in Appendix A. Ms. Smith thanked group members for the comments on the draft meeting summary and indicated that revisions will be made to correct inaccuracies, address omissions, or to clarify statements made in the meeting.

Participants' questions and comments about the 208 Plan Update goals and process are below (in *italics)*:

- *The Orleans buildout numbers in the CWMP are inaccurate and will lead to greater costs. The meeting to discuss buildout should be transparent and open to all concerned parties.* Ms. Daley said a review of the buildout discussion with towns could be incorporated into the December meeting when the group will look at various scenarios.
- *Are meeting notes and slides available from the other Watershed Working Groups, the October 3 meeting, the financial meetings, and the technology panel meetings?* Ms. Daley said all meeting notes from other working groups, the financial meetings, and the technology panels are on the website or should be there soon. A video of the first and second technology panel meeting is also available. Ms. Smith commented that a meeting summary was not produced for the October 3 meeting. Ms. Daley said the Commission took notes during the meeting and plans to respond in writing to the questions and concerns that were raised, and that the slides will be made available upon request.

III. RANGE OF POSSIBLE SOLUTIONS

Ms. Daley led the discussion of the range of possible solutions. As Working Groups learn more and consider the pros and cons of the technologies and approaches, she encouraged participants keep in mind that:

- The Cape Cod Commission undertook a comprehensive analysis of nutrient control technologies and approaches. This analysis is distilled into: the Technology Fact Sheets, which present various summary information on the technologies being considered; the Technology Matrix, which includes additional information on site requirements, construction, project and operation and maintenance costs (in units of cost per pound of nitrogen removed), reference information, and regulatory comments; and ongoing input from stakeholders on the public acceptance of technology options and approaches.
- Not all of the technologies and approaches will be applicable to Cape Cod or to all

watersheds in Cape Cod.
- Some technologies seem very promising and we would like to hear which of these the group members think could be useful for demonstration and pilot projects.
- Workshop 3 will embark on hands on problem solving in each watershed to meet target load reductions.
- Certain technologies or approaches will be effective at preventing nutrients from entering the water body. Others will be effective at reducing or remediating nutrients that are already in the groundwater or water body.
- Regulatory programs can address nutrient controls for both existing development and future development.

Ms. Daley offered a brief overview of the technologies and approaches. The following section briefly describes each technology. Participants' asked questions and made comments about the technologies after each technology scale. Their questions and comments (in *italics)* have been placed under the appropriate technology or in the general comments and questions section following this section:

Site level technologies/approaches

Standard Title V System*:* This is a standard septic system that consists of a septic tank and soil adsorption system (leaching field). The system was primarily designed to address public health concerns related to waste in drinking water (e.g. pathogens such as coliform bacteria); they were not designed to remove nutrients (e.g. nitrogen).

I/A Title V System: Innovative/Alternative (I/A) on-site nutrient reducing systems typically consist of standard septic system components augmented to remove more nutrients than a standard Title 5. I/A systems refer to a class of systems intended to be designed as recirculating sand filter (RSF) equivalents by meeting the same treatment limits in a smaller footprint. The Cape Cod Commission is beginning to map IA systems and estimates there are about 1500 existing systems on the Cape. A GIS layer will be added to the 208 Plan Reference Map to show their locations.[3]

Urine Diverting Toilets: Urine diversion systems send urine into a holding tank where the urine is stored and periodically collected by a servicing company. The servicing company empties the tank for disposal or conversion to a fertilizer. Through these means, the nitrogen from the urine may be removed from the watershed. With urine diverting toilets, the remainder of the human waste and all other water uses (sink and shower) continue to go to the septic system. (Case example, Falmouth, MA).

Composting Toilets: A toilet system which separates human waste from shower, sink and other household water uses. The composting toilets use no or minimal water. The human waste

[3] The 208 Plan Reference Map is available at: http://watersheds.capecodcommission.org/docs/frames/

captured by the composting toilets is decomposed and turned into compost. The compost generated is removed from the site and nutrients can be recycled. Composting toilets require the replacement of existing toilet(s) and room in the basement for a container to capture and compost the human waste. Household water use (sink and shower uses) continue to flow to the septic system. (Case example, Falmouth, MA).

Packaging Toilets: A packaging toilet encapsulates human waste in a durable material for removal from the site. The package is stored beneath the toilet and removed and taken away when full. The servicing company that picks up the packages can recycle the nutrients.

Stormwater Bioretention: Bioretention systems utilize natural plant and soil functions to capture and treat stormwater runoff for a variety of contaminants including nutrients. A typical system consists of an underdrain/gravel layer, a layer of bioretention soil mix (a mix of sand, compost, woodchips and loam), and a surface layer containing appropriate plantings. The treated water can be discharged into a water body or used for open space irrigation after treatment. The reclaimed water can also be discharged into a subsurface infiltration system for discharge to the groundwater. (Case example, Portland, OR).

Participants' questions and comments about the site level technologies are indicated below (in *italics)*:

- *Why are incinerating toilets not considered in these options?* Ms. Daley said incinerating toilets could be investigated and added to the matrix.

Neighborhood level technologies/approaches

Cluster and satellite treatment systems: A cluster or satellite system is a collection and treatment system treating wastewater flows from multiple properties.

STEP/STEG collection: Septic Tank Effluent Pumping (STEP) and Septic Tank Effluent Gravity (STEG) systems convey liquid wastewater from on-site septic tanks to sewer systems; Only the liquid component of the wastewater may be conveyed by pumps or by gravity.

Eco machines and living machines: Living or Eco-Machines are natural systems that treat septic tank effluent or primarily treated wastewater. In these systems, aeration and clarification chambers are combined with constructed wetlands to treat the influent. The wetlands are a series of chambers allowing for microbial communities to engage with and treat the wastewater. Plants are often suspended on racks with their roots systems doing the work. Solids removal is generally onsite, after which water is pumped through the gravel filled cells (similar to subsurface wetlands.) This process transfers more oxygen to the wastewater and completes the pollutant removal process. (Case example, South Burlington, VT).

Stormwater wetlands: Constructed wetlands provide aerobic chambers followed by subsurface anaerobic chambers that facilitate nitrification followed by de-nitrification, respectively. This process mimics that of natural systems coupled with engineering design guaranteeing residence time within a chamber containing anaerobic conditions. (Case example, China).

Participants' questions and comments about the neighborhood level technologies are indicated below (in *italics)*:

- *What are the space and environmental requirements for each system, such as whether or not artificial wetlands would be created or existing wetlands would be utilized?* Ms. Daley responded that the technology matrix includes land use requirements for each individual technology and approach.
- *It would be useful to include information to understand when the scale of the system makes it cost effective.*
- *Is nitrogen from atmospheric deposition a large source of nitrogen on the Cape? If so, it heightens the importance of doing something on natural systems based technology.* Ms. Daley said some of this information is viewable in the slides from the September meeting and agreed with the value of addressing non-controllable sources of nitrogen.

Watershed level technologies/approaches

Conventional treatment: A conventional wastewater treatment facility typically treats wastewater collected from homes and businesses. A groundwater discharge permit is required. Treatment generally results in less than 10 mg/L Nitrogen.

Constructed wetlands: surface flow: After primary treatment in a septic tank or wastewater treatment facility or secondary treatment at a wastewater treatment facility, water is fed into a surface flow constructed wetland. Surface flow constructed wetlands closely mimic the ecosystem of a natural wetland by utilizing water loving plants to filter wastewater through their root zone, a planted medium, and open water zones. Surface flow wetlands are systems where open water is exposed much like in a natural marsh. The reclaimed water from the wetland can be discharged into a water body or used for open space irrigation after treatment as well as discharged into a leach field. (Case example, Albany, OR).

- *Another potential disadvantage to add to the list on the constructed wetlands is the possible impact of freshwater effluent on a saline marsh.* Mr. Cambareri said this is a concern and thoughtful placement of the technology would be required. Additionally, it may be a question of how much additional freshwater could be added without changing the ecosystem since the aquifer discharges freshwater into the system, too.

Constructed wetlands: subsurface flow: After primary treatment in a septic tank or wastewater treatment facility or secondary treatment at a wastewater treatment facility, wastewater is treated by pumping water slowly through subsurface gravel beds where it is filtered through plant root zones and soil media. Water flows 3-8" under the surface to prevent public exposure to wastewater and mosquito breeding. A combination of horizontal and vertical flow subsurface systems must be utilized to provide total nitrogen removal. This solution can also offer opportunities for recreation activities on land above the subsurface system. (Case example, Thailand – it was noted that this example is underperforming due to illicit contributions).

Effluent disposal: out of watershed: Effluent disposal can take a variety of forms, including infiltration basins, a Soil Absorption System, Injection Wells or Wick Wells. These disposal methods place highly treated effluent back into groundwater. Effluent Transport out of the watershed has the advantage of removing the nitrogen load to another watershed. Transport to another watershed requires the receiving watershed to be able to accommodate the additional nitrogen load.

Effluent disposal: ocean outfall: Similar to out of watershed effluent disposal, highly treated effluent is transported out of the watershed and into the ocean. This solution requires changes in regulatory restrictions and a high level of regulatory oversight. The solution is considered due to limited land availability for disposal on Cape Cod.

Phytoirrigation: After secondary treatment, wastewater treatment facility effluent is irrigated onto plants to remove nutrients and other contaminates. Fast growing poplar and willow trees are typically used. (Case example, Woodburn, OR).

Participants' questions and comments about the watershed level technologies are indicated below (in *italics)*:

- *How well do some of these systems remove nitrogen?* Mr. Owen responded that in general, these systems reduce nitrogen concentrations to less than 10 mg/L, but this depends on the size of the treatment area. The larger the acreage per amount of flow, the greater the treatment reduction.
- *Percolation rates through the soil could also be an advantage or disadvantage if it impacts the efficiency of a treatment technology.*

Neighborhood or Watershed level technologies/approaches

Phytobuffers: Using trees with a deep root system to capture nutrients in the soil, particularly willows and poplars (or native plant alternatives.) Green plants with deep tap roots are planted as a buffer to intercept existing groundwater. The plants and their associated microorganisms reduce contamination in soils and ground water. Often phytohydraulics causes the groundwater plume to be redirected and pulled towards the plants. (Case example, Kavcee, WY).

Fertigation wells: Fertigation wells can capture nutrient enriched groundwater, typically from a wastewater treatment facility discharge, and recycle it back to irrigated and fertilized turf grass areas. These irrigated areas include golf courses, athletic fields and lawns. Fertigation can significantly reduce nutrient loads to downgradient surface waters while reducing fertilizer costs to the irrigated areas. (Case example, Plymouth, MA).

Permeable reactive barrier (PRB): A permeable reactive barrier (PRB) is an in-situ (installed within the aquifer) treatment zone designed to intercept nitrogen enriched groundwater. Through use of a carbon source, microbes in the groundwater uptake the nitrogen, denitrifying the groundwater. PRB systems typically use vertical trenches, sequences of bored columns or injection methods to introduce the carbon source into the groundwater to reduce the nitrogen load to an estuary, removing it from the watershed. (Case example, Falmouth, MA).

- *The TMDLs in Eastham will require 100 percent removal of phosphorous. Will PRBs address phosphorus in pond systems?* Mr. Cambareri said it may be possible to implement surface PRBs to capture phosphorous instead of digging deep trenches or injection wells. Mr. Scott Horsley, Area Manager for the Outer Cape, said PRBs could also be implemented along roadways to avoid permitting issues in wetlands. Ms. Daley mentioned the Cape Cod Commission is using GIS to identify roadways perpendicular to water flow where it may be feasible to install PRBs.
- *How do the costs associated with a mile of PRB compare to a mile of sewer?* Mr. Cambareri said the cost comparison is difficult to make since costs would be site specific. Mr. Horsley said it is like comparing apples to oranges--PRB would be approximately $800 per foot while sewer would be approximately $150 per foot to install, but this does not compare the total costs of treatment per unit of nitrogen. Density is the key since it is easier to treat areas of higher density.
- *How long does a PRB last? Does it have a carrying capacity?* Mr. Owens responded that current data suggests they will last a long time because the wood and mulch placed in PRBs is slow to decay. Mr. Horsley said the estimate is that material will work for 20 years or more, and the environment on the Cape seems to indicate the material would endure for some time, but it is unclear exactly how long a PRB will last.

Inlet and culvert widening: Re-engineering and reconstruction of bridge or culvert openings to increase the tidal flux through the culvert or inlet. This solution generally works better with a larger tidal range but could be feasible on both the Cape Cod Bay side (approximately nine feet tidal range) and Nantucket Sound side (approximately 3 feet of tidal range).

- *What are the parameters necessary to make culvert widening an effective method of reducing nutrients?* Mr. Owen said the MEP project looked for opportunities to widen culverts to achieve reductions or increase assimilative capacity. Not all projects to widen culverts will work, but another benefit of widening a culvert is habitat restoration. Another participant said *the DEP requires detailed hydraulic studies to determine whether or not culvert widening would achieve target levels.*

Salt marsh habitat restoration: Salt marsh is one of the most productive ecosystems in the world, surpassing rainforest in productivity per acre. Approximately 65% of historic salt marsh has been lost in MA. Salt marshes cycle and remove nitrogen as well as provide critical habitat and spawning sanctuary for a wide variety of birds, mammals and marine life in addition to hosting a range of plant species and important biogeochemical processes. The capacity of salt marsh to intercept nitrogen is significant and well researched worldwide. Substantial areas of former salt marsh on the Cape are either under consideration for restoration or could be restored providing storm surge and coastal flooding protection in addition to water quality benefits in certain watersheds.

Shellfish habitat restoration: Oyster reefs were historically one of the main consumers and recyclers of nitrogen in the coastal environment on Cape Cod. According to the Nature Conservancy, populations have declined by 95%. In conjunction with the natural transition from land to sea in estuaries, bays and inlets; salt marsh, oyster reef and eel grass function as critical buffer that can reduce eutrophication. Restoring Oyster populations leads to increased shellfish productivity as well as improved commercial and recreational fisheries for other species, increased protection from shoreline erosion and flooding, and buffering from ocean acidification. (Case example, Wellfleet, MA).

Aquaculture / shellfish farming: Oysters, has been proposed as a potential method for reducing nitrogen levels and eutrophication in estuaries. Nitrogen removal rates from Oysters have been well documented and the harvest of oysters physically removes the nitrogen they sequester in addition to the nitrogen removed by their biological cycling which puts nitrogen directly back into the atmosphere. Aquaculture can be done on man-made structures (e.g. cages, floating bags) or natural reefs.

- *A disadvantage of shellfish is that they are living animals, which are subject to pathogens and other variables that could negatively impact the entire population. Although they are efficient at removing nitrogen, it is not wise to use them as the primary component of a water quality program due to their susceptibility to other environmental factors.* Ms. Daley said this point gets to the idea that some technologies may be useful when paired with other technologies, but may be less valuable if used independently.
- *How does the DEP give nitrogen reduction credits for shellfish?* Mr. Cambareri responded that credit has yet to be given to shellfish. However, the DEP is aware that groups want to use shellfish and other in-situ technologies like wetlands, aquaculture, and PRBs to reduce nitrogen and receive credits. A DEP regulatory group is currently drafting guidance for how to permit and monitor these systems to determine the amount of credit that could be received.

Surface water remediation wetlands: Constructed to aid in water quality improvements to surface water bodies, usually streams or rivers. Water is pumped or allowed to flow naturally through treatment cells containing wetlands Surface water remediation wetlands are often used in combination with groundwater recharge or potable water reuse systems. Surface water remediation wetlands are generally used with Free-Water Surface wetlands due to their larger size, and lower capital and O+M Costs. (Case example, China).

Pond and estuary dredging: Lakes, ponds, streams and estuaries store nutrients within their sediments. These sediments tend to accumulate over time. Subsequently, these nutrients can be release into the overlying water column and can become a major source of nitrogen and phosphorus. Dredging and removing these sediments and accumulated nutrients removes the nutrients from the water body and potentially the watershed. (Case example, Dennis, MA).

- It was noted that dredge material can be difficult to dispose of due to heavy metal or hydrocarbon components.

Cape-wide level technologies/approaches

Compact development: Both Compact Development and Open Space Residential Development (OSRD) of subdivisions result in smaller lots and less maintained lawn acres. The higher density development reduces wastewater collection costs while providing a common disposal area. Compact development is also referred to as “Smart Growth”.

Fertilizer management: Managing fertilizer application rates to lawns, golf courses, athletic facilities and cranberry bogs. Residential lawn loading rates could be reduced on existing developed parcels through an intensive public education/outreach program. This could include a “Cape Cod Lawn” branding program, replacing some turf areas with native vegetation, establishing naturally-vegetated buffer strips on waterfront lots, and reducing application rates. Fertilizer loading rates for new development could be accomplished by reducing lot sizes (cluster development), by restricting lawn sizes and/or by incorporating more naturally-vegetated open space areas. Municipalities could directly reduce fertilizer applications on athletic fields and other properties. Golf courses can significantly reduce nitrogen loading rates by using slow-release fertilizers and reducing application rates in rough areas. Cranberry bog fertilizer exports from the bogs can be reduced using tail water recovery systems. Site-specific assessments are needed to estimate load reductions.

Regarding the fertilizer regulation on Cape Cod, Ms. Daley said the Cape Cod Commission designated a cape-wide Fertilizer Management District of Critical Planning Concern (DCPC) which authorizes the towns to adopt local fertilizer management regulations (state law prohibits local fertilizer management except under the DCPC). The DCPC does not require towns to adopt fertilizer regulations, but paves the way for their adoption. Barnstable County will be conducting a public education process around fertilizer use.

Remediation of existing development: Existing developments or schools with excess wastewater treatment capacity allow existing nearby developments to connect to their underutilized wastewater treatment infrastructure. A town can operate the wastewater treatment facility if the existing owner prefers to not take the responsibility for treating the off-site wastewater. An example of this is the Kingman Marina in Bourne, which was permitted to expand its development footprint in exchange for hooking up adjacent, existing homes to its wastewater treatment facility.

Transfer of development rights: A regulatory strategy that transfers development and development rights from one property (sending area) to another (receiving area) to direct growth and associated nutrient loading away from sensitive receiving watersheds or water bodies. The protected parcels (sending areas) receive a deed restriction that limits the level of future development. The deed restriction can limit the number of homes or tie development to the availability to future wastewater treatment facility infrastructure.

Stormwater best management practices (BMP): Non-Structural Stormwater strategies include: street sweeping, maintenance of stormwater utilities, education and public outreach programs, land use planning, and impervious cover reduction and control.

General questions and comments:

- Group members discussed the nutrient removal rates indicated on the fact sheets and suggested the need for more detailed information. One member requested clarification on the sources of the data and questioned whether the reduction levels would be the same on the Cape as they were in the test locations. Mr. Mark Owen, Consultant from AECOM, said the baseline data is from several different sources, including the DEP, but reduction rates vary across the studies. Variability in reduction rates is also likely to occur across multiple systems of the same make and model. For Title V I/A systems, nitrogen reduction percentages are based on raw influent concentrations of 40 mg/L. A member noted George Heufelder's research on effectiveness of I/A systems, which showed that they had the potential to be very effective. Members suggested that his data should be incorporated in the analysis rather than just listing average nutrient removal rates. A TAC member, who helped develop the fact sheets, explained that they tried to provide a range of nutrient removal rates for each system to account for the variability, for purposes of discussion, and recognized that averages do not provide the full story. Ms. Daley said the Cape Cod Commission can post George Heufelder's I/A data to the website.
- Group members also suggested including the following information on the fact sheets or at least using the information to inform their decisions: Capital costs of each techonology compared to capital costs of a typical Title V system; costs of operating and maintaining a technology; whether or not the technology requires electricity, and; seasonal variability that may impact system operation. Tom Cambareri, Cape Cod Commission Water Resources Program Manager, said the Commission has the capital cost information and will share it with the watershed working groups. Ms. Daley noted that the technologies matrix will include a cost per pound of nitrogen removal by technology.
- *The DEP indicated to the town of Orleans that hitting a specific nutrient concentration level is not as important as restoring water quality in the estuary.* Ms. Smith said that hopefully a regional conversation with the DEP rather than town-by-town conversations will lead to more clarity on how to achieve water quality targets.
- *The DEP approach tends to direct communities to centralized sewer systems, but the towns reject this due to cost. It is commendable the Cape Cod Commission is looking at alternative options to address this issue. Regarding the ultimate goal of the DEP and EPA, the desired condition they are seeking remains undefined, which puts a lot of risk on the towns. The Cape Cod Commission should ask the DEP to define what success*

means.

- *Is the Cape Cod National Seashore involved in these discussions?* Ms. Smith responded that the Seashore is being kept up to date on the meetings that are applicable to them, but limited resources prevent them from attending all of the meetings.

IV. PROBLEM SOLVING PROCESS AND PRINCIPLES

Overview of 7-steps for Problem-Solving Process

Ms. Daley reiterated that the goal the Working Groups is to develop remediation options that would achieve water quality targets with a focus on first targeting low cost, low barrier options to reduce nitrogen and then considering more costly and traditional options later (e.g. installing sewers). She then described the alternatives screening process the group will apply. The process is as follows:

1) Establish targets and articulate project goals.
2) Identify priority geographic areas (e.g. high nitrogen reduction areas, Title V problem areas, pond recharge areas).
3) Determine which management activities should definitely be implemented. These might be the easiest and least costly management activities that should be undertaken regardless of other management actions (e.g. fertilizer management and stormwater mitigation – two approaches that Cape Cod towns are already actively pursuing).
4) Assess alternative options to implement at the watershed or embayment scale (e.g. innovative and lower-cost solutions)
5) Assess options to implement at the site-level
6) Examine priority collection/high density areas
7) Consider traditional sewers or other grey infrastructure management options

She further explained that the Working Groups will focus on the total controllable nitrogen load. The technologies and approaches selected should aim to reduce the total controllable nitrogen load by identifying options that reduce the portion of *septic* load that requires reduction. For example, the portion of septic load that requires reduction could be made smaller if towns implement fertilizer and stormwater solutions first. Additionally, the percentages of controllable nitrogen that need to be removed to meet TMDLs change depending on the characteristics of the watershed.

She noted that in many instances, one of the solutions may not achieve the TMDL, but multiple solutions paired together could achieve the goal. For example, many towns are already using and pairing some of the technology options and approaches:

- Wellfleet- *Coastal habitat restoration & aquaculture*
- Mashpee- *Aquaculture & Expanding Existing Systems*
- Brewster- *PRB & Bioswales*
- Orleans- *Fertilizer Control By-Law*
- Harwich- *Muddy Creek & Cold Brook Natural Attenuation*

- Falmouth- *Aquaculture, Inlet Widening, Eco-Toilet Demonstration Project, PRBs, Stormwater Management (Little Pond Watershed), Fertilizer Control By-Law, Subsurface Nitrogen Removal Septic System*

(It is noted that both Harwich and Chatham are participating in the Muddy Creek restoration effort.)

Categories of Solutions and their Impacts on the Environment, Economy, and Community

Ms. Daley commented that evaluation of the technologies and approaches would be informed by their impacts (positive and negative) on the environment, economy, and community (also known as the Triple Bottom Line). Ms. Smith asked participants which solutions they thought were promising and to identify the issues they foresee, while keeping in mind the environmental, economic, and community impacts of the possible technologies and approaches. She also invited them to share criteria that might help the group evaluate the technologies. Working Group members noted the following, which have been organized here into categories:

Environmental:

- Speed or time it takes for results to be realized – Some approaches can be implemented more quickly and may show results faster than other approaches.

Economic:

- Cost is really important, so would like to maximize lower-cost opportunities . Really like the 7-step approach, to the extent it corresponds with cost-effectiveness.
- Mechanisms to incentivize participation – approaches requiring resident actions will need to offer incentives, such as exemptions on property taxes for early adopters/risk takers who install eco toilets, or a cost-mechanism that charges based on the nutrients discharged by their system
- Affordability – The cost of implementing the measure must be reasonable.
- Opportunity to leverage economies of scale – Could regional management and oversight of operations and maintenance help reach the ultimate performance level of technologies while reducing the economic burden faced by any single town?

Social:

- Social acceptability – consideration of whether or not people will adopt a practice (i.e., installation of eco toilets in upscale homes), be agreeable to seeing it in the environment (e.g., oyster bags floating in the water), or buy into the trade offs between the cost and the benefits.
- Lifestyle impacts on system function – The seasonality of residency could impact a system's functioning.
- Adaptability to fluctuations in occupancy – Systems that are installed should be able to accommodate greater or fewer occupants as properties change hands.

- Education – education of residents is a critical component of the success of any approach, and especially ones that require citizen participation both short and long term. The education needs to be continuous because of frequent turn-over. It should include getting them to accept new ideas and understand the impacts of their actions (e.g., fertilizer and their ponds.)

Implementation

- Need a bundle of solutions, not just one at a time.
- Different sub-watersheds will require different approaches – Some locations may still require removal of 100% of the nitrogen from septic systems, even with successful reduction of nutrients from fertilizers and stormwater.
- Consideration of Operations and Maintenance as well as installation – some of the site-based systems really require oversight for O&M. May need a town or regional function to establish accountability for upkeep. Costs would include enforcement and monitoring
- Priority actions that can be implemented as soon as possible – Towns and residents will favor options that are easy to implement and least expensive. Some of these options may include stormwater and aquaculture projects. What actions are most easily implemented by residents? By towns? Which actions will be most easily and quickly permitted by the DEP? How can we work with DEP to be more agile while still protecting the public?

Additional Factors

- Secondary benefits/opportunities – Ideal approaches will produce multiple benefits (for example, nutrient reduction and help nature.)
- Retrofit for already constructed buildings vs. new development – Given costs of retrofitting, some technologies are more likely to be adopted by (or required for) new development (for example, eco-toilets.)
- Balance risks of new technology – Greater flexibility and opportunity to speed approval and credit for new technologies is important. At the same time, homeowners will want assurance that they money they invest into a new system will achieve the reductions required by state agencies. Also, some towns might be more risk adverse than others.
- Seasonality of use – need to consider impacts of a range of habitation patterns when considering site-based technologies, to make sure they are compatible, and keep in mind that usage might change.
- We should be weighing costs and benefits, including risks, for leaders and for the public.

Ms. Daley showed a GIS map of percolation rates in the soils of Cape Cod. She noted that much of the Cape is within a rather quick groundwater travel time of less than 10 years. She said this may influence considerations about the type of technologies that are more attuned to a quick fix and rapid restoration versus a longer term solution. Ms. Smith asked the group if this would lead the group to think that certain technologies may be more or less valuable or useful in a specific location. Group members responded with the following comments:

- *Some areas, such as those in blue may require specific treatments due to density. But overall, we will need a whole spectrum of solutions since nutrients are already in the ground.*
- *It may make sense to focus on areas immediately up gradient of a water body, especially when thinking about applying fertilizer regulations. We could use technical information to identify and prioritize these areas.*

The group then discussed fertilizer use regulations and the importance of public education. One member said enforcement of fertilizer use regulations is very difficult. Another member stated that Orleans employs the 100-foot buffer indicated in the wetlands protection act to protect wetlands and water bodies from fertilizer. The town also has a fertilizer regulation that only applies to municipally owned property; but a new town bylaw will provide more general application. Another member stressed the importance of educating the public on the options and their challenges as the Watershed Group develops the plan. The public should also have the opportunity to provide input on the solutions, added the group member. Another member noted that public education will be a continuous, long-term activity as new residents move to the Cape.

Technology Selection: Process and Principles

Ms. Daley presented some of the principles that could guide technology/approaches selection. These process and principles include:

- *100% septic removal subwatershed*: Combinations of technologies can be used to reduce septic load that needs to be removed in some sub-watersheds, though others will require all septic nitrogen plus other nitrogen removal to meet required levels.
- *Scale: On-Site vs. Collection System vs. Natural System*: There will be tradeoffs between the scale of systems that can be used. On-site, collection, and natural systems all have their pros and cons and all require different levels of investment and infrastructure. These tradeoffs will be important from an implementation and public acceptance point of view.
- *Nutrient intervention and time of travel*: Some technologies/approaches intercept nutrients at their point of entry into the system, while others deal with it later on (e.g. once it is in the watershed). There are pros/cons to each approach which need to be considered.
- *Permitting Status*: The level of effort required to permit technologies will be a consideration.
- *Land use and Impacts of Growth*: Unintended consequences and opportunities for planned growth are important to consider.

V. PLANNING FOR THE NEXT MEETING

Meeting Three will be held:
Thursday, December 4, 2013
8:30AM - 12:30PM
Eastham Town Hall, 2500 State Highway, Eastham, Massachusetts 02642

During this meeting the Working Groups will examine various scenarios (i.e. combinations of solutions) and their potential impacts (e.g. nutrient reduction, economic impacts, environmental impacts, social impacts, etc.) and the Cape Cod Commission will use tools to calculate ideas/options and their impacts. Ms. Daley said two analyses will also be presented: one analysis is through the seven step process described above and the second analysis is more a direct engineering perspective to see what a system would look like if required to use only permitted approaches. These two scenarios are bookends to a variety of approaches, which the Working Group will examine during the next meeting. Working Group participants should come prepared to offer their ideas about what solutions they'd like to explore further given their understanding of the baseline conditions, issues, and priorities in this watershed.

VI. PUBLIC COMMENTS

Members of the pubic made the following comments

- A member of the public posed several questions for consideration: *Can permeable barriers be done for individual homes? If there are stringent guidelines within 100 feet of ponds in Orleans, is this not a natural place to put in more stringent guidelines? If so, what might the cost be? At what point do you go to the planning board and ask them to say that the 4th or 5th toilet added to a home must be an ecotoilet? At what point do we engage the planning board and require them to engage with new town residents?* Mr. Horsley responded that PRB could be done on a home basis, but it would be expensive. A group member said the bathrooms question would be decided by the Board of Health on a case by case basis.
- *A member of the public commented that George Huefelder's research shows some IA systems are very effective and resilient and recover quickly from seasonal fluctuations. The commenter referred to the conversation on cost and noted that the EPA is working on this relative to Life Cycle Analysis (LCA). The commenter observed that LCA was not addressed in today's conversation and said that the triple bottom line was named but not really addressed. Noting the outstanding question about DEP's definition of success, he said this is an important piece of the puzzle that needs to be quantified so the town knows what it must achieve. Additionally, the definition is needed before the establishment of baseline data. Commenting on the Technology Panel meetings, he said it was interesting the in-situ nitrogen removal options were the first options the panel reviewed and noted that Falmouth and Wellfleet are doing these types of projects. He then stated that the MEP model is an input output model and that taking a pound of nitrogen out is not the same as putting in a pound. Regarding the October 3 meeting, he commented the meeting was about showing that changes in water bodies are being controlled by nature, not about presenting different data points. He said one way to look*

at controlling nitrogen is to control it by managing nitrogen in-situ to address the TMDL rather than attempting to control nitrogen from entering the system. Ms. Daley said LCA costs would be included in the Technology Matrix.

Appendix A: Attendance

Primary Members:

	Name	**Title**
Local Elected Official	Dale Fuller (for John Hodgson)	Orleans Finance Committee (for Orleans Selectman)
	Sims McGrath	Orleans Selectman
	Martin McDonald	Eastham Selectman
Appointed/Committee	Charles Harris	Eastham, Chair, Water Management Committee
	Judith Bruce	Orleans, Former Wastewater Committee
Town Staff	Thomas Daley	Orleans, DPW Director
	Jane Crowley	Eastham Health Agent
	Sue Leven	Brewster Planner
Environmental and Civic Groups	Ed Daly (for Paul Ammann)	Orleans Citizens Peer Review Group
	Gary Furst	Orleans Water Alliance
	Bruce Taub	Orleans Water Alliance
	Sandy Bayne	Eastham, Orleans Ponds Coalition
	Sandy MacFarlaine	Orleans
	Lynn Bruneau	Orleans Conservation Trust
	Doug Fromm	Orleans CAN
	Amy Costa	Eastham, PCCS
Business	Judy Scanlon	Orleans, Small Farm, Orleans Conservation Trust
	Sid Snow	Orleans Business Owner
Open/Other	Kenneth Ainsworth	Eastham
	Lori Roueche	Orleans

Alternates and Members of the Public:

Katie Blakeley
Don Cameron
Karin Delaney
Jeff Eagles
Cheryl Eisner
Steven Hertz
Charles Ketchuck
Dan Milz
Ed Nash
Ginia Pati
Russell Schell
Len Short