Cape Cod 208 Area Water Quality Planning
Upper Cape, West/South Watershed Working Group
Second Meeting

Falmouth Town Hall
59 Town Hall Square, Falmouth, MA 02540
October 25, 2013
8:30 a.m.-12:30 p.m.

Agenda

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

Upper Cape West & South

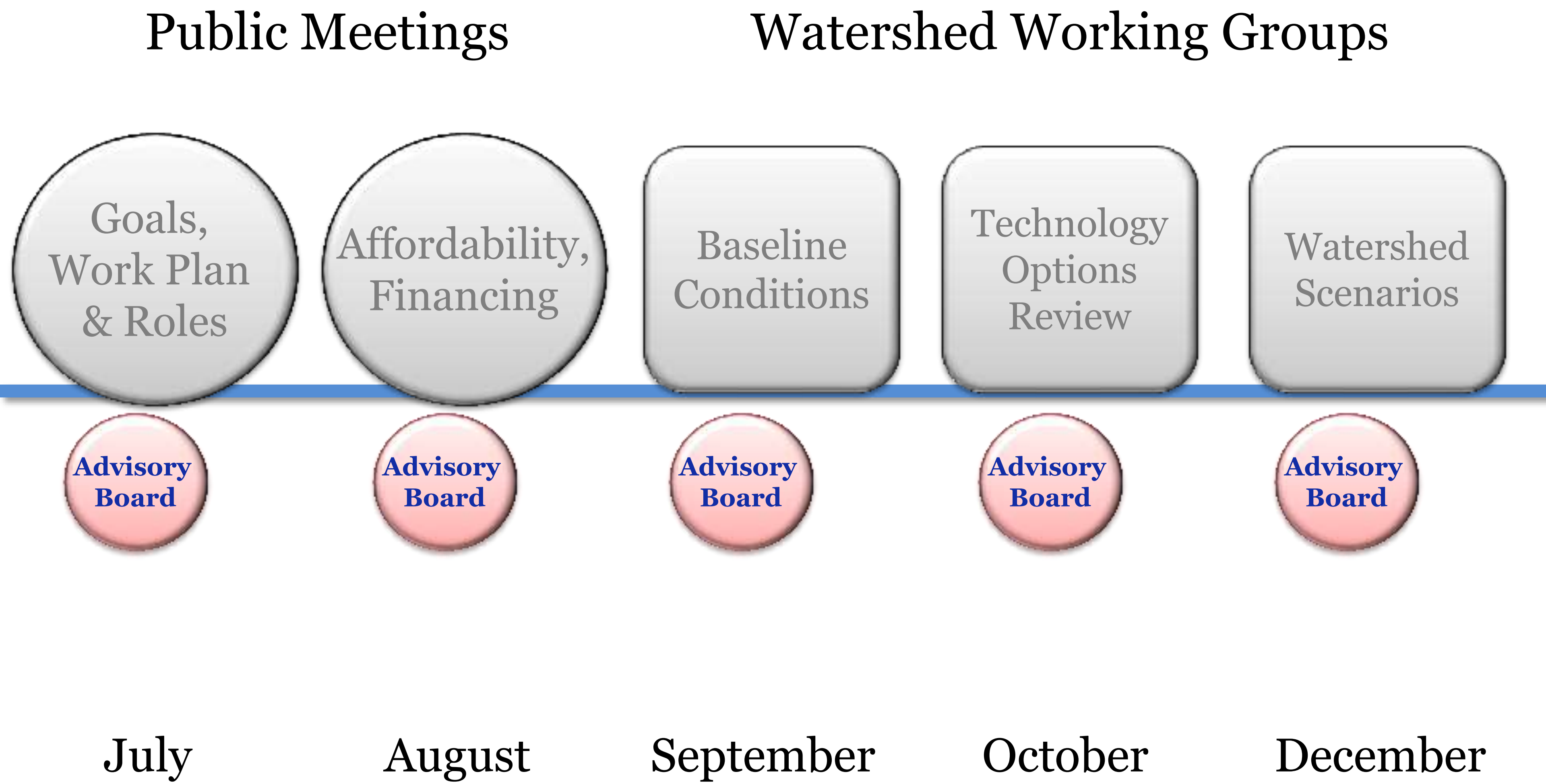
Technologies and Approaches

What is the stakeholder process?

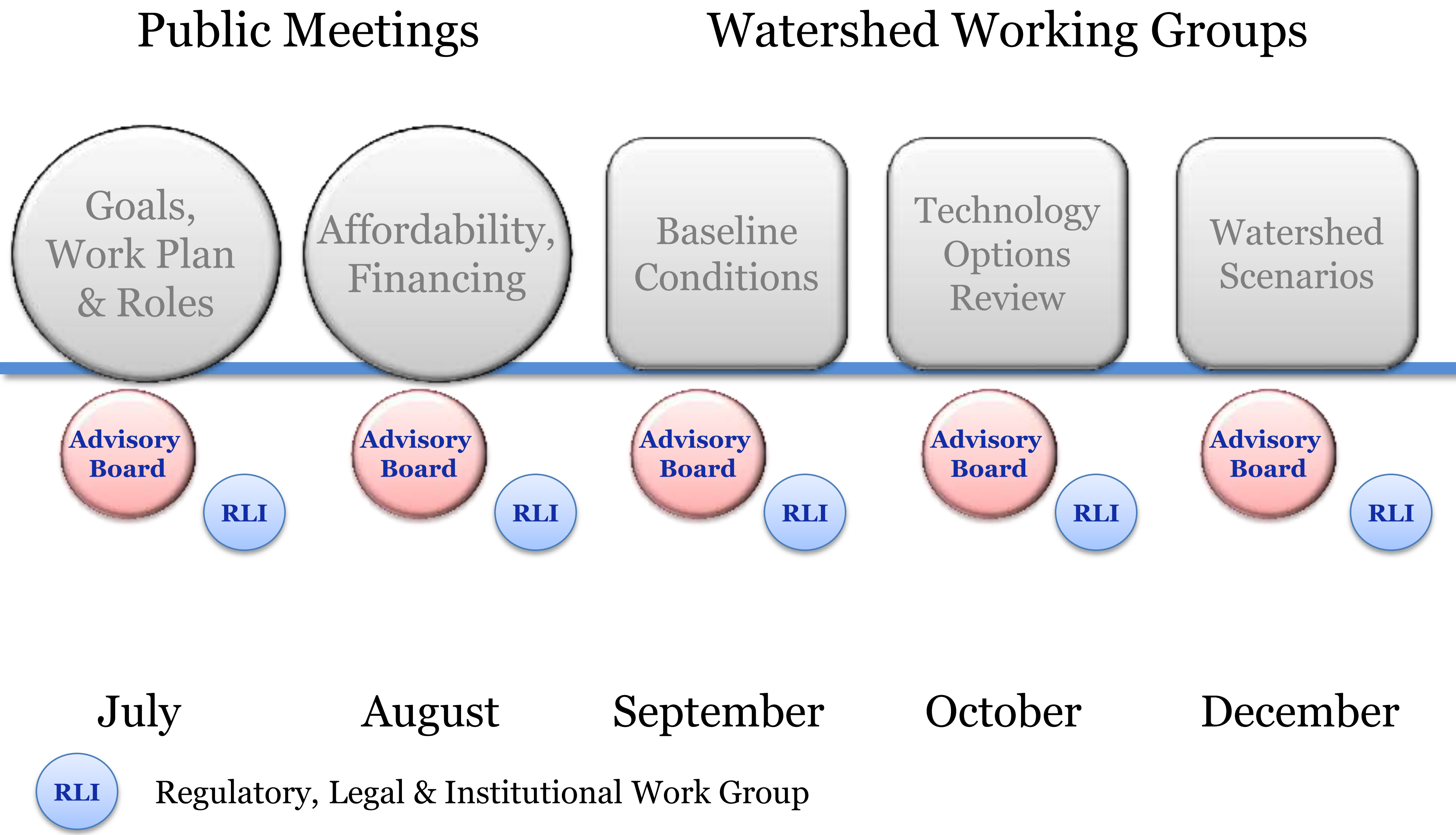
Public Meetings | Watershed Working Groups

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

208 Planning Process



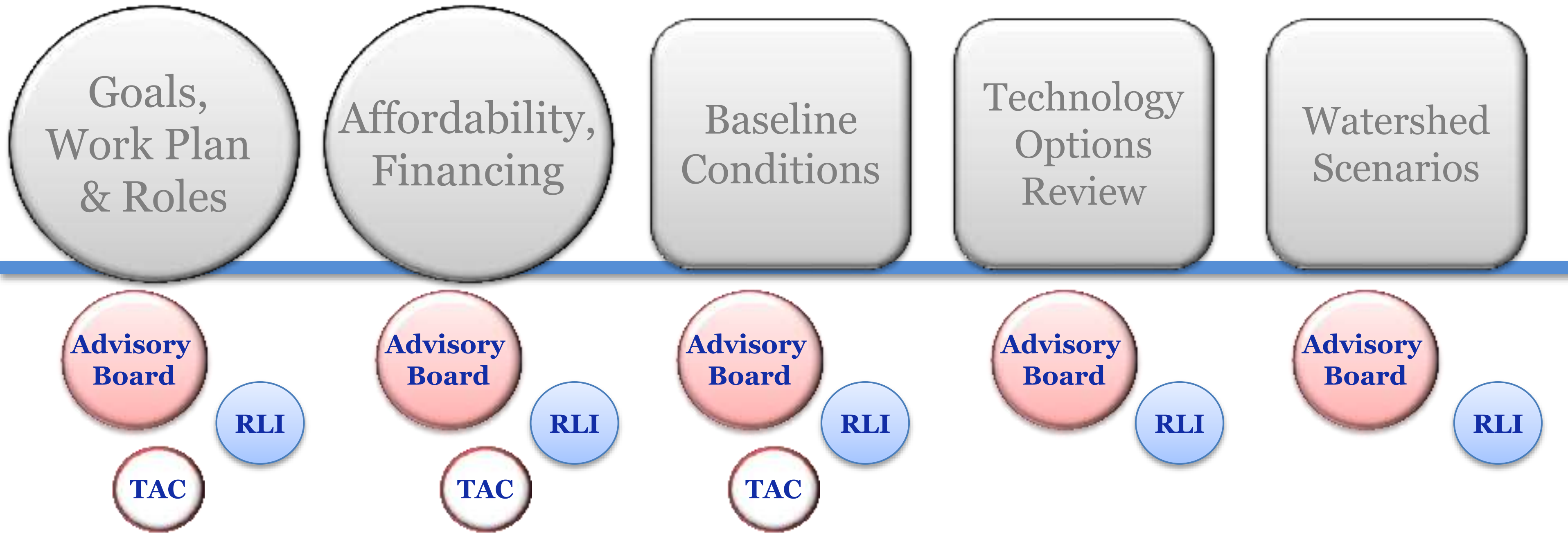
208 Planning Process



208 Planning Process

Public Meetings

Watershed Working Groups

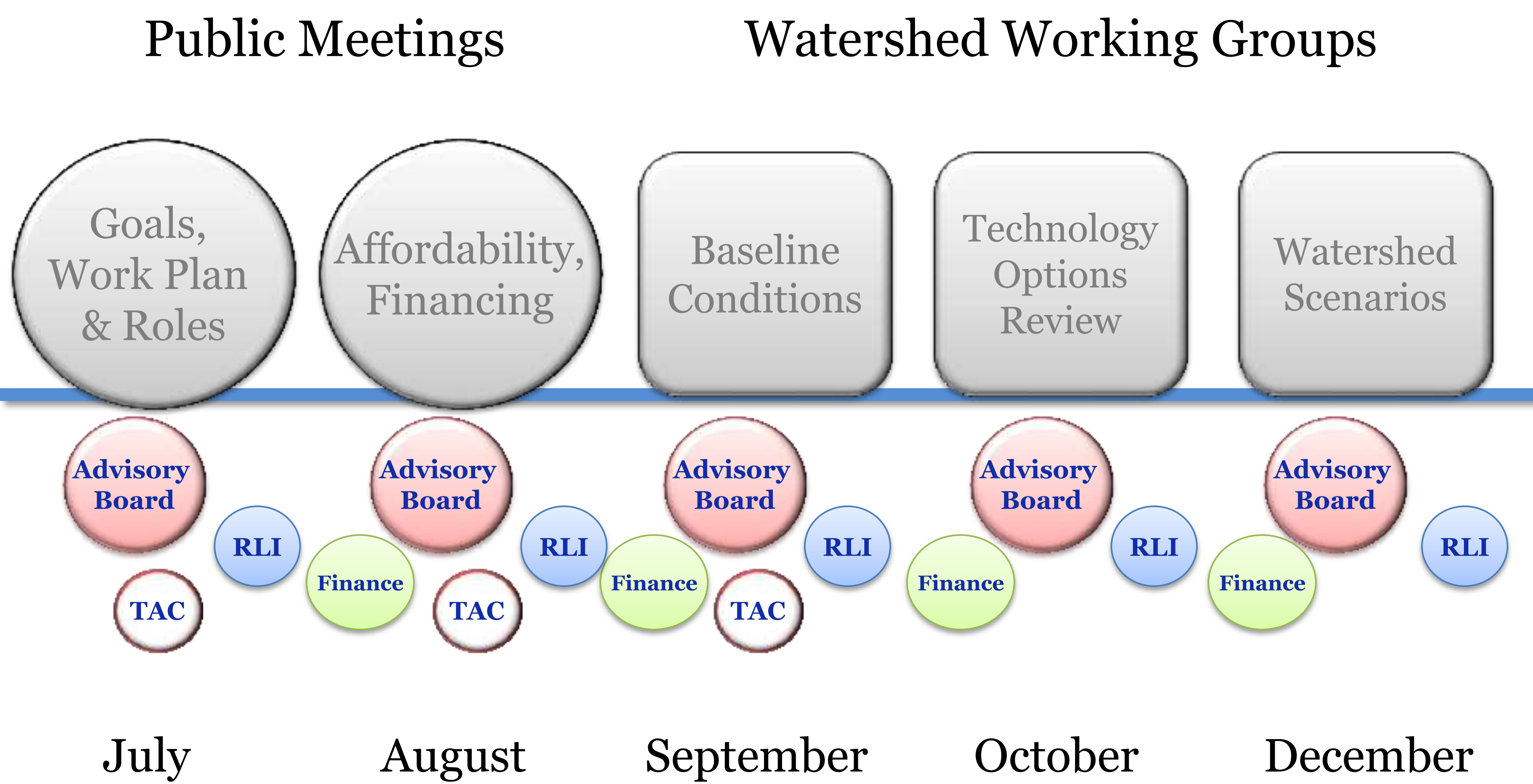


July | August | September | October | December

RLI — Regulatory, Legal & Institutional Work Group

TAC — Technical Advisory Committee of Cape Cod Water Protection Collaborative

208 Planning Process



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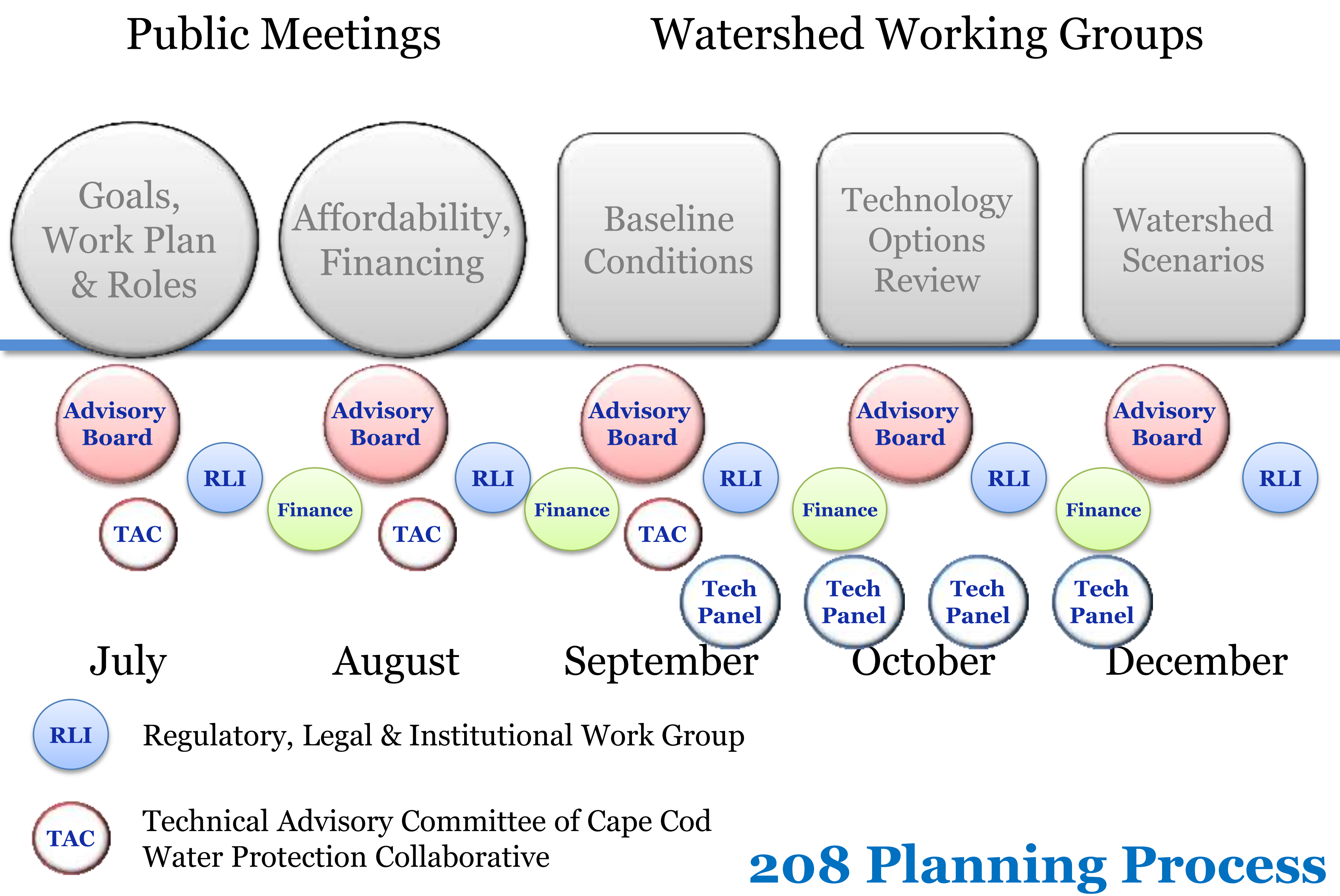

Public Meetings
Watershed Working Groups
Goals, Work Plan & Roles
Affordability, Financing
Baseline Conditions
Technology Options Review
Watershed Scenarios
Advisory Board
RLI
TAC
Finance
Tech Panel
July
August
September
October
December
RLI Regulatory, Legal & Institutional Work Group
TAC Technical 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

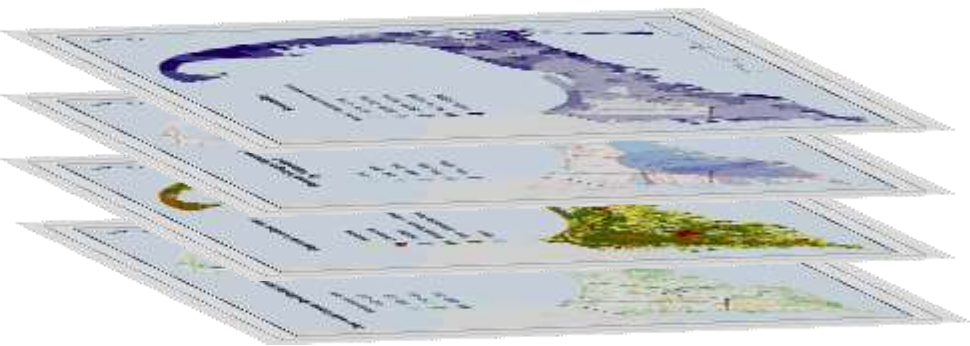
11 Working Group Meetings: Sept 18-27

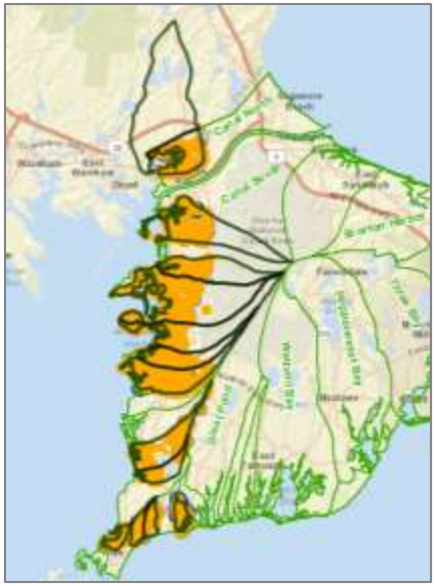
Technology Options Review

11 Working Group Meetings: Oct 21-Nov 5

Watershed Scenarios

11 Working Group Meetings: Dec 2-11





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Baseline Conditions

11 Working Group Meetings: Sept 18-27

Technology Options Review

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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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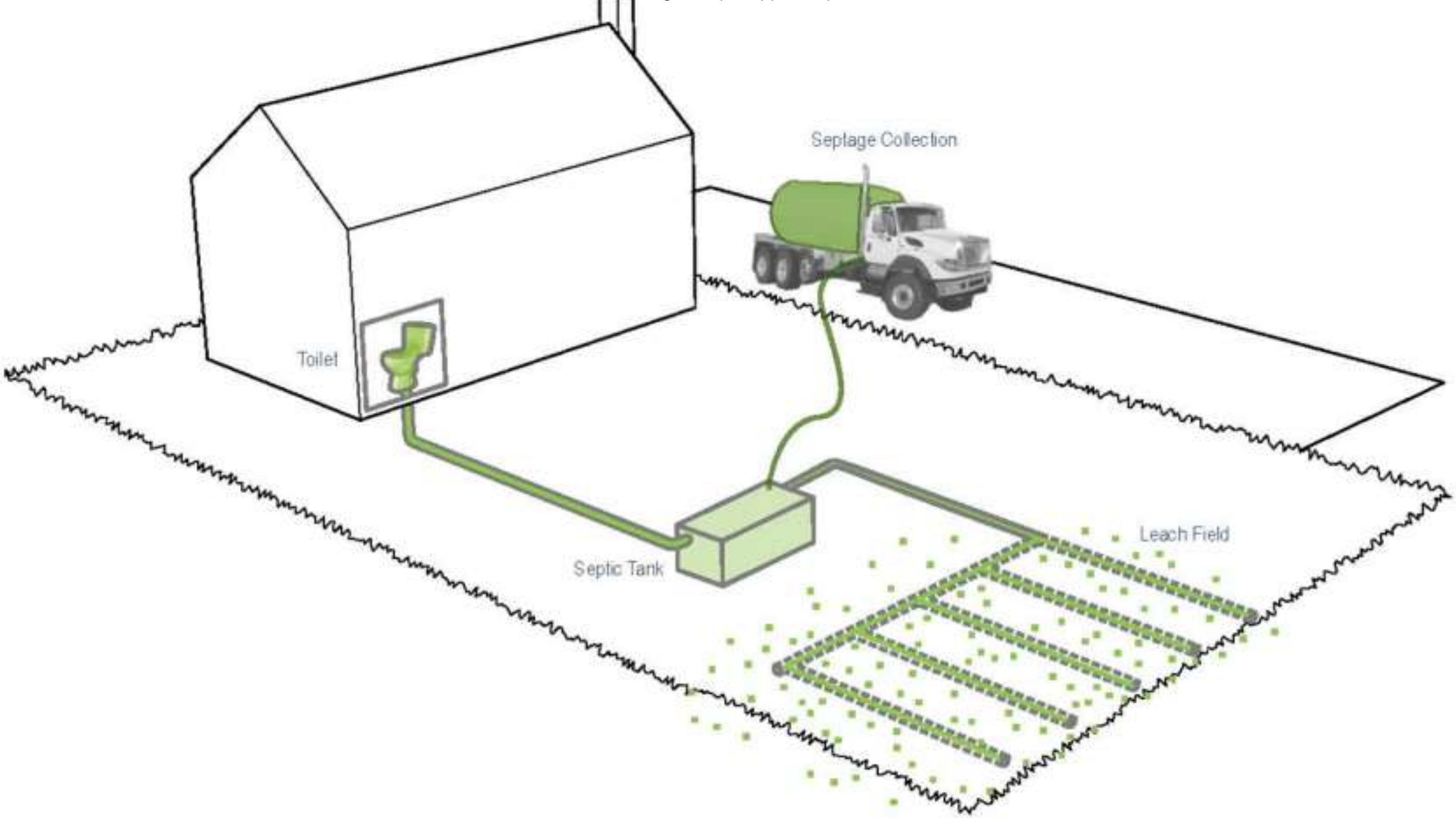
- Certain technologies or approaches will be effective at **preventing** nutrients from entering the water body. Others will be effective at **reducing** or **remediating** nutrients that are already in the groundwater or water body.
- Regulatory programs can address nutrient controls for both existing development and future development.

"Watershed Working Group - Upper Cape West/South"

Solutions: Site

Site Scale | Neighborhood | Watershed | Cape-Wide

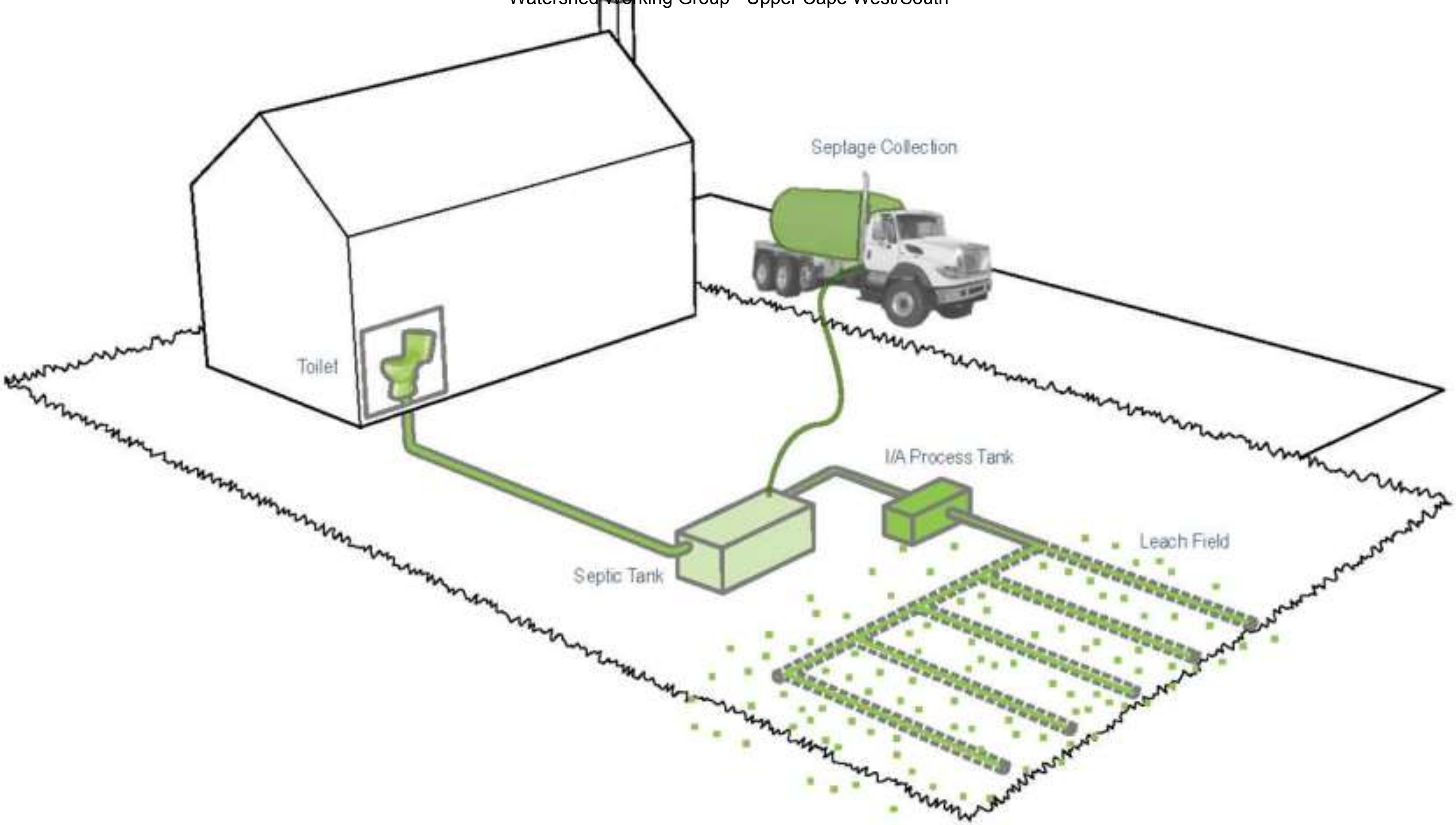
- Compact Development
- Remediation of Existing Development
- Fertilizer Management
- Transfer of Development Rights
- Stormwater BMPs
- Standard Title 5 Systems
- Cluster & Satellite Treatment Systems
- Conventional Treatment
- I/A Title 5 Systems
- STEP/STEG Collection
- Advanced Treatment
- I/A Enhanced 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: SITE
Target: WASTEWATER

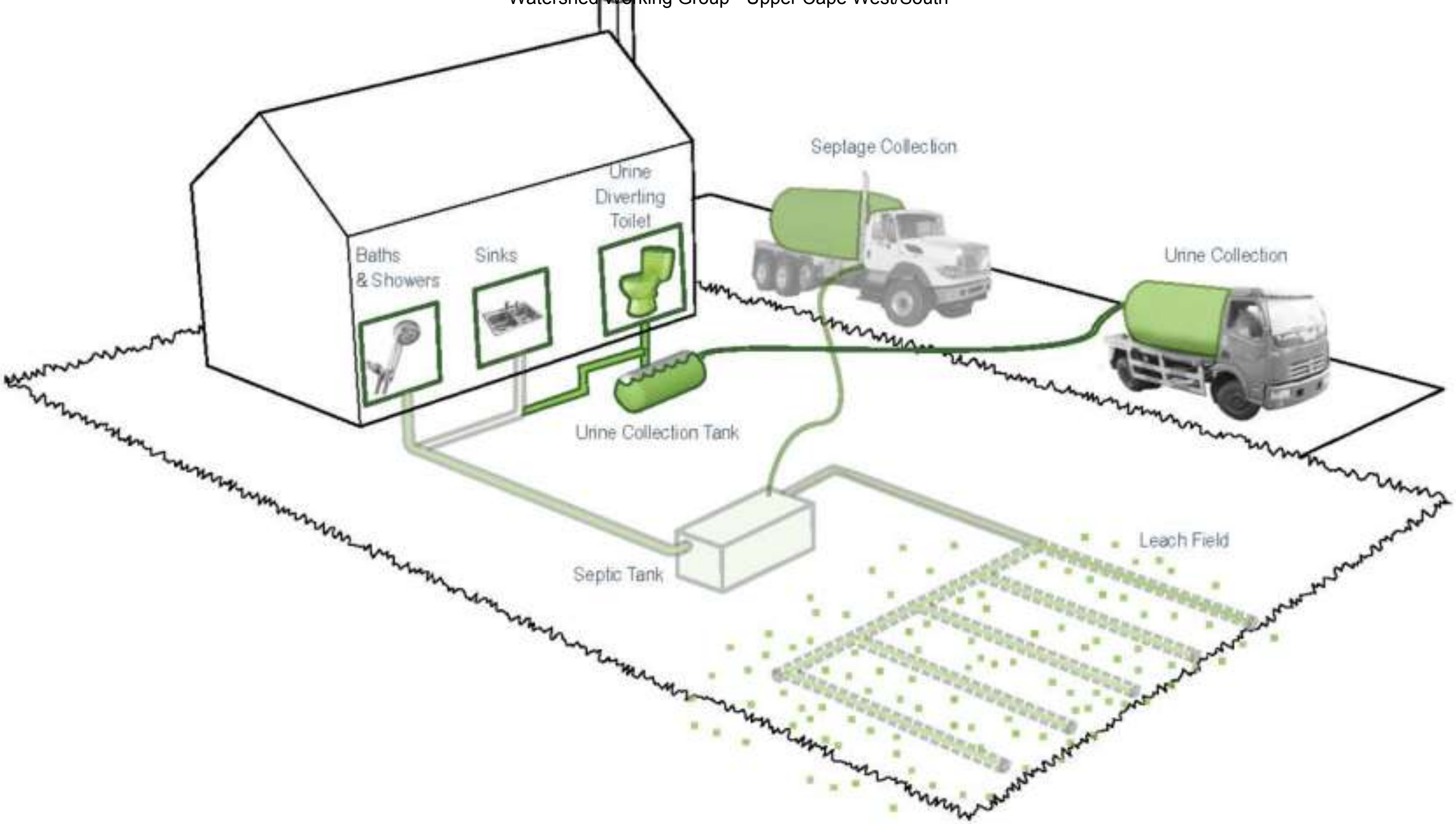
Standard Title 5 Systems

Title 5



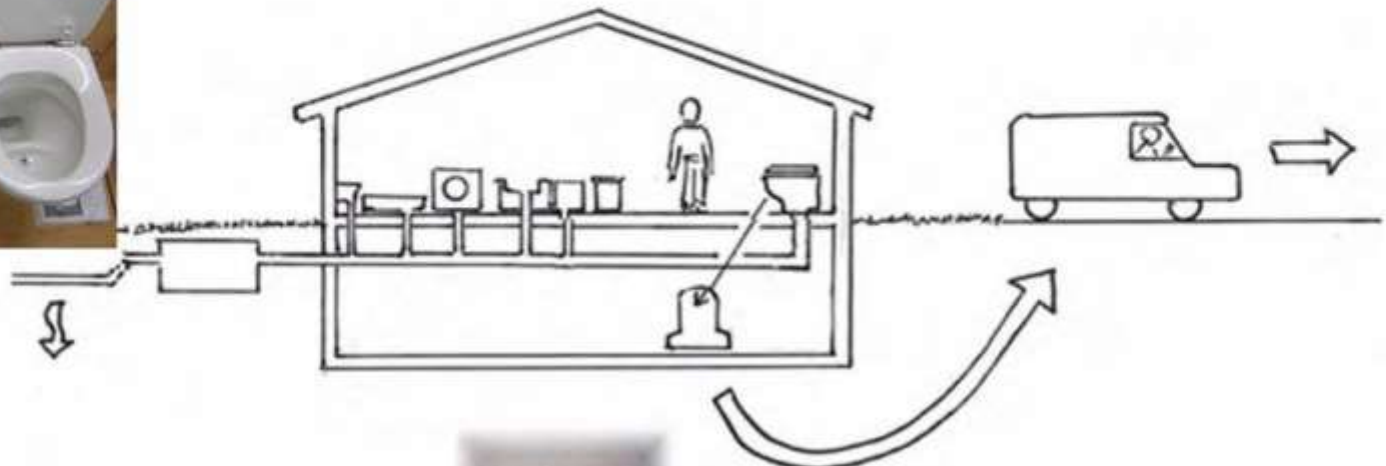
Scale: SITE
Target: WASTEWATER

I/A Title 5 Systems



Scale: SITE
Target: WASTEWATER

Toilets: Urine Diverting



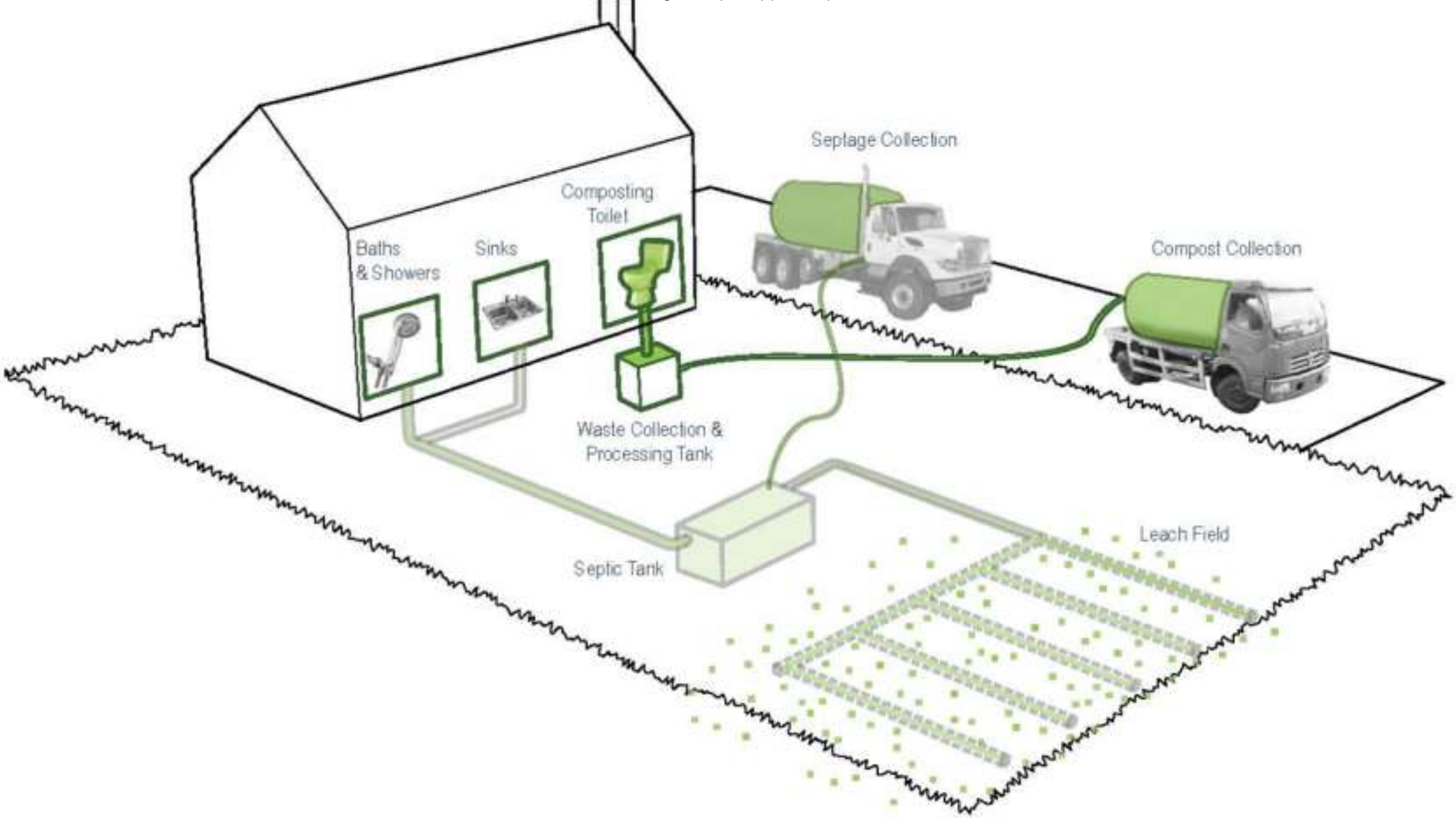
Waterless
Urinal

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
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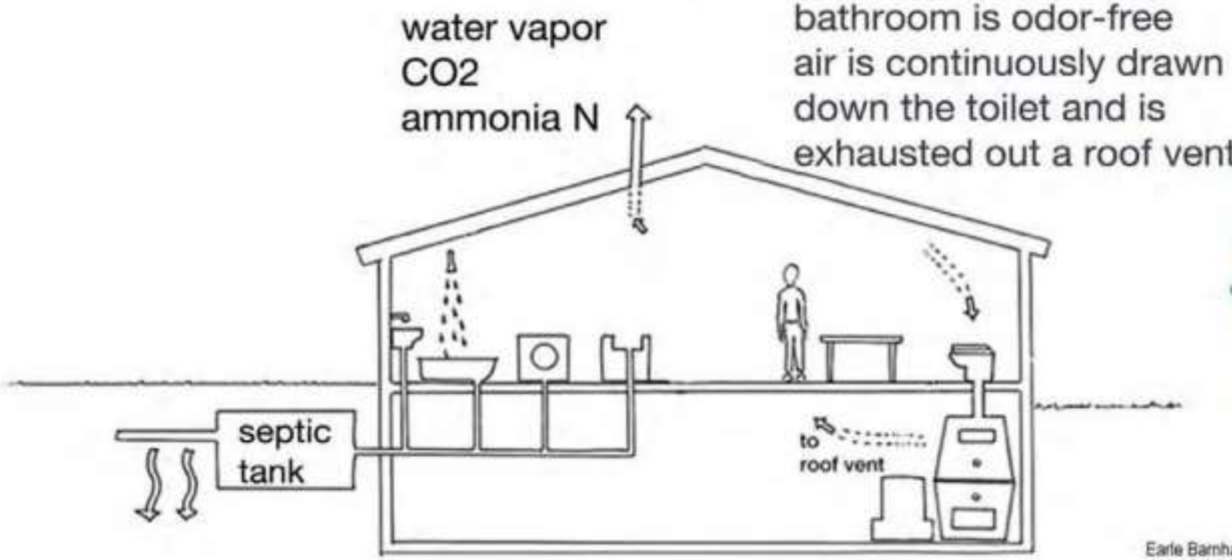
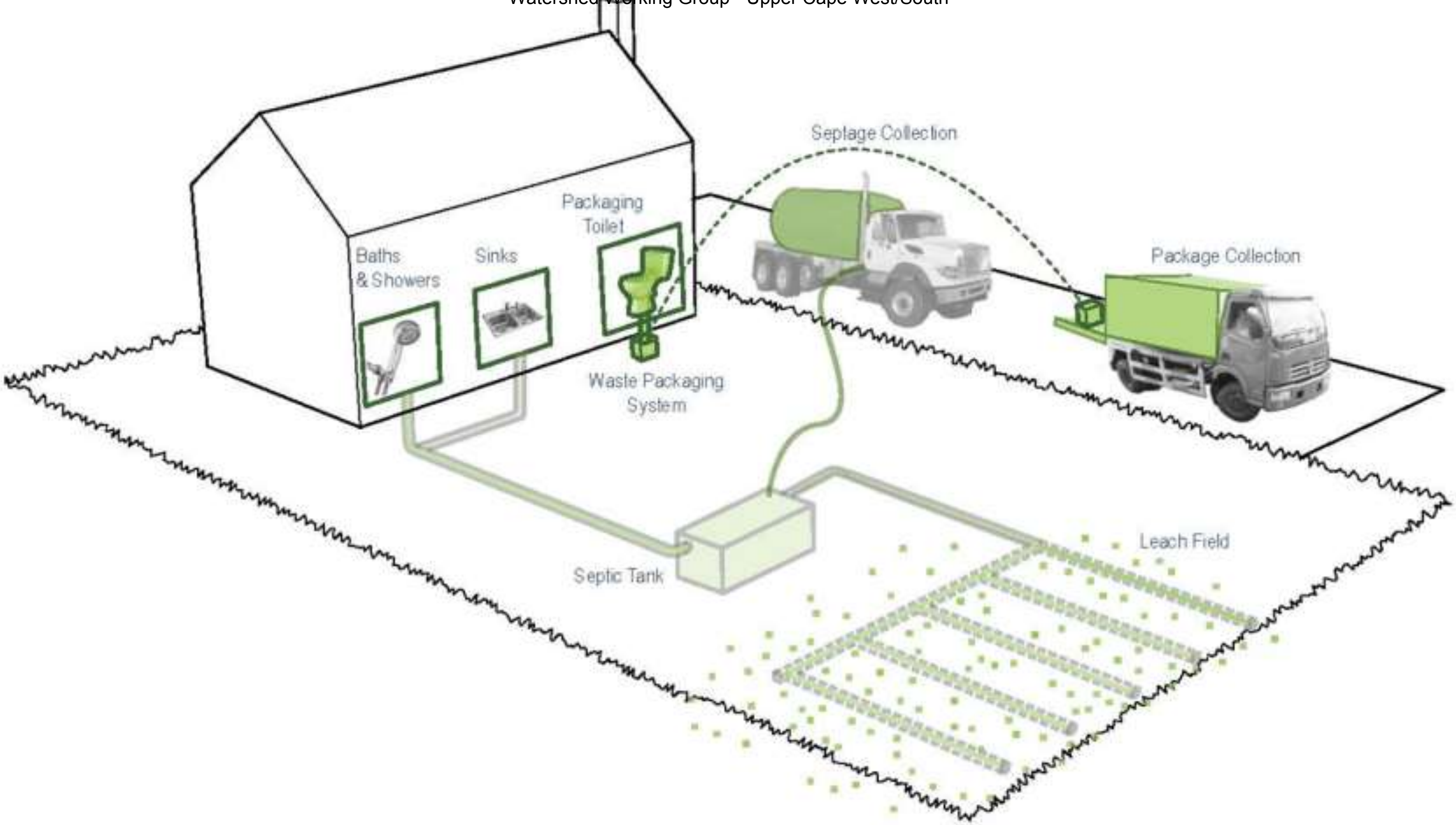
Toilets: Composting



Source: Earle Barnhart, The Green Center Inc.

Toilets: Composting

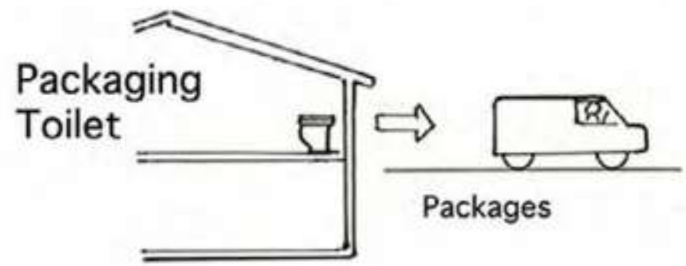


Scale: SITE
Target: WASTEWATER

Toilets: Packaging

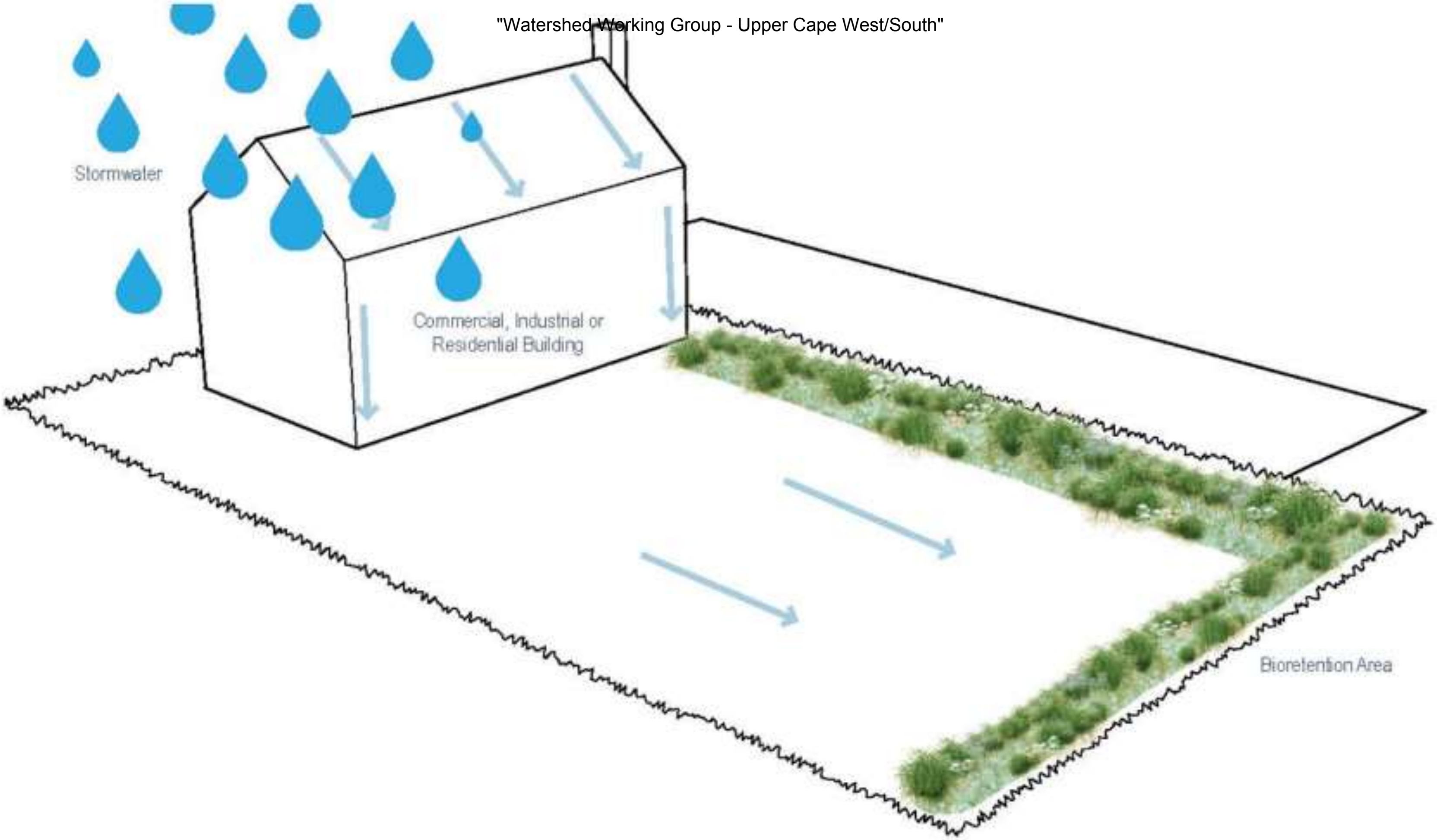
PACTO®

LOOWATT



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

"Watershed Working Group - Upper Cape West/South"

Solutions: Neighborhood

Site Scale | Neighborhood | Watershed | Cape-Wide

- Compact Development
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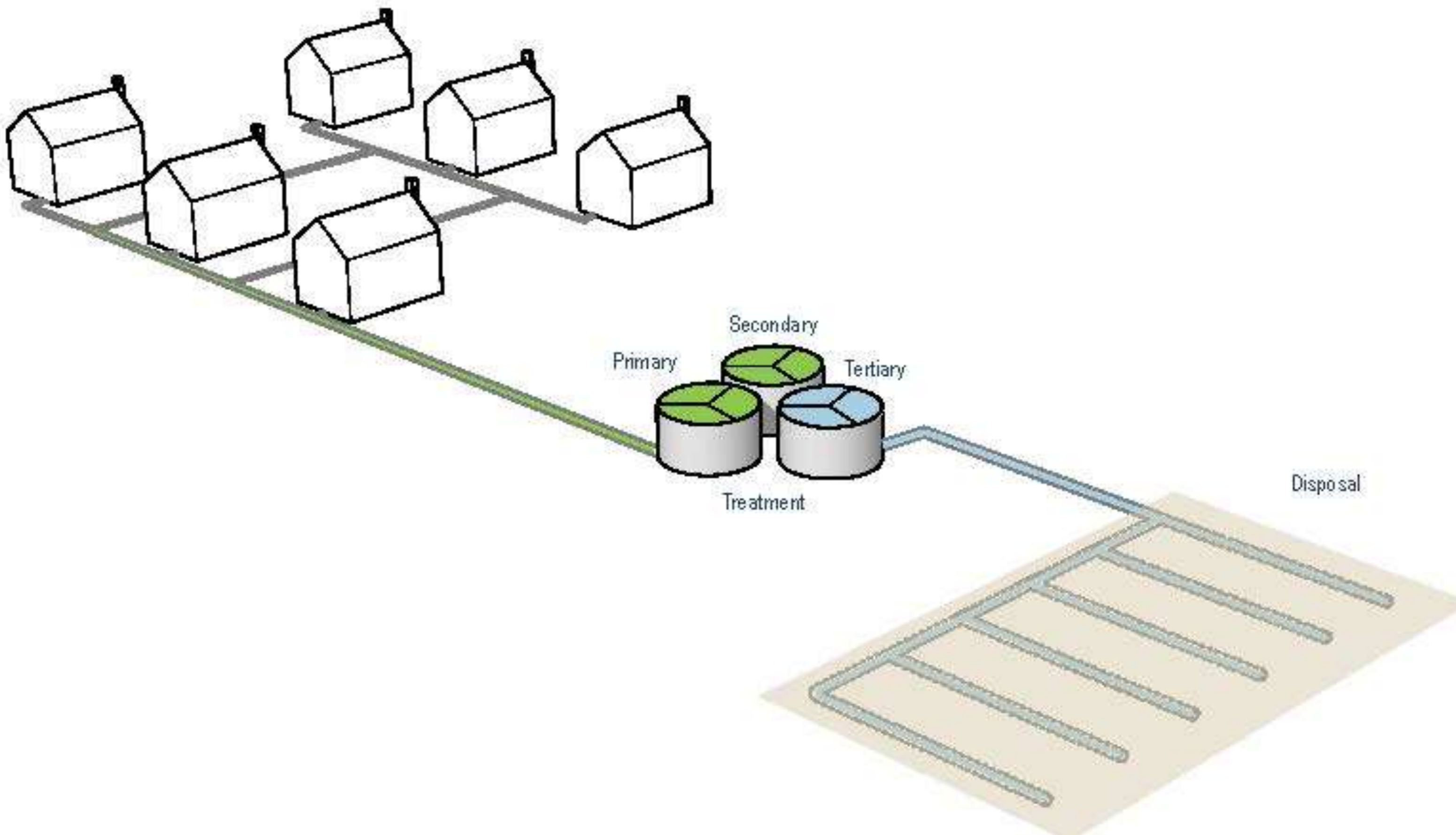
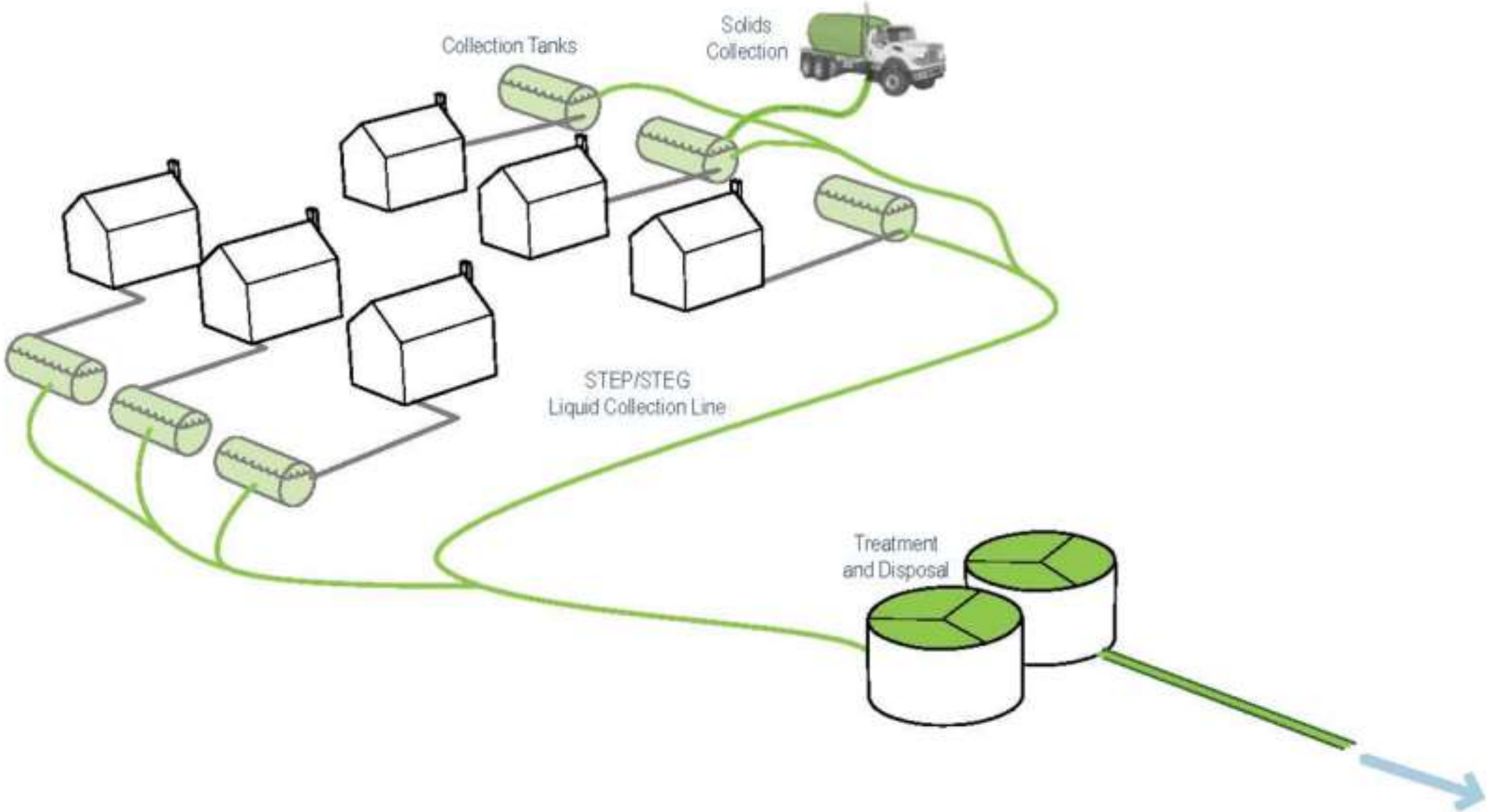


Scale: NEIGHBORHOOD
Target: WASTEWATER

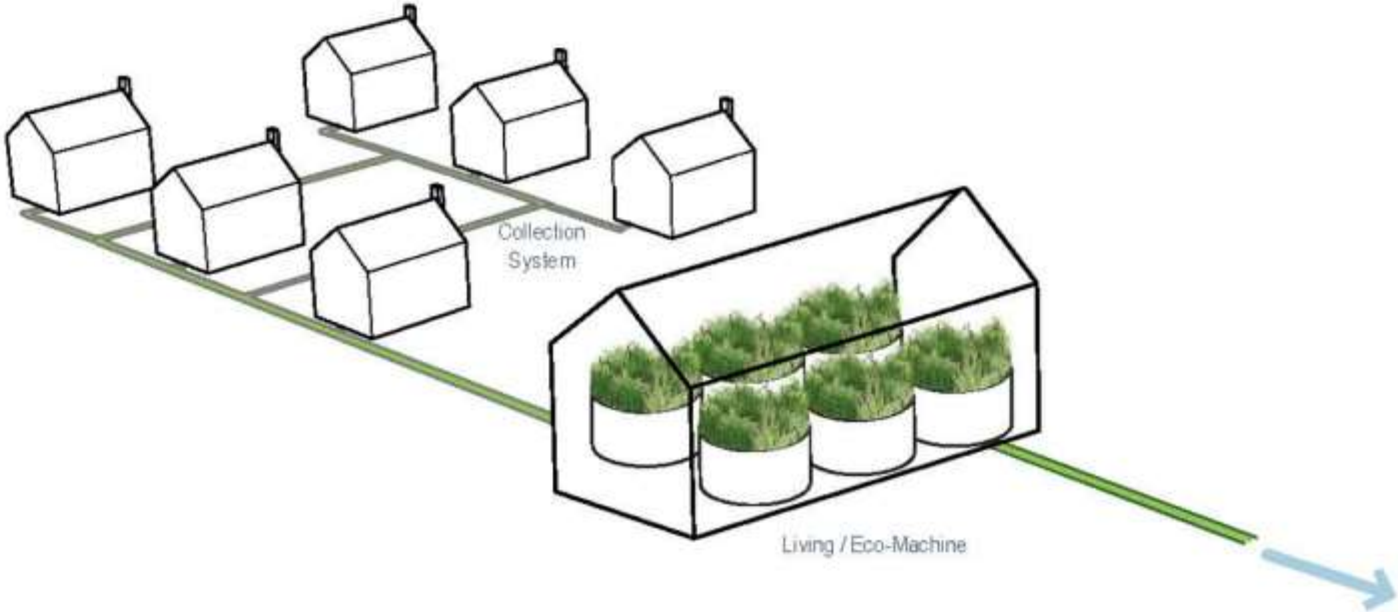
Cluster & Satellite Treatment Systems



Scale: NEIGHBORHOOD
Target: WASTEWATER

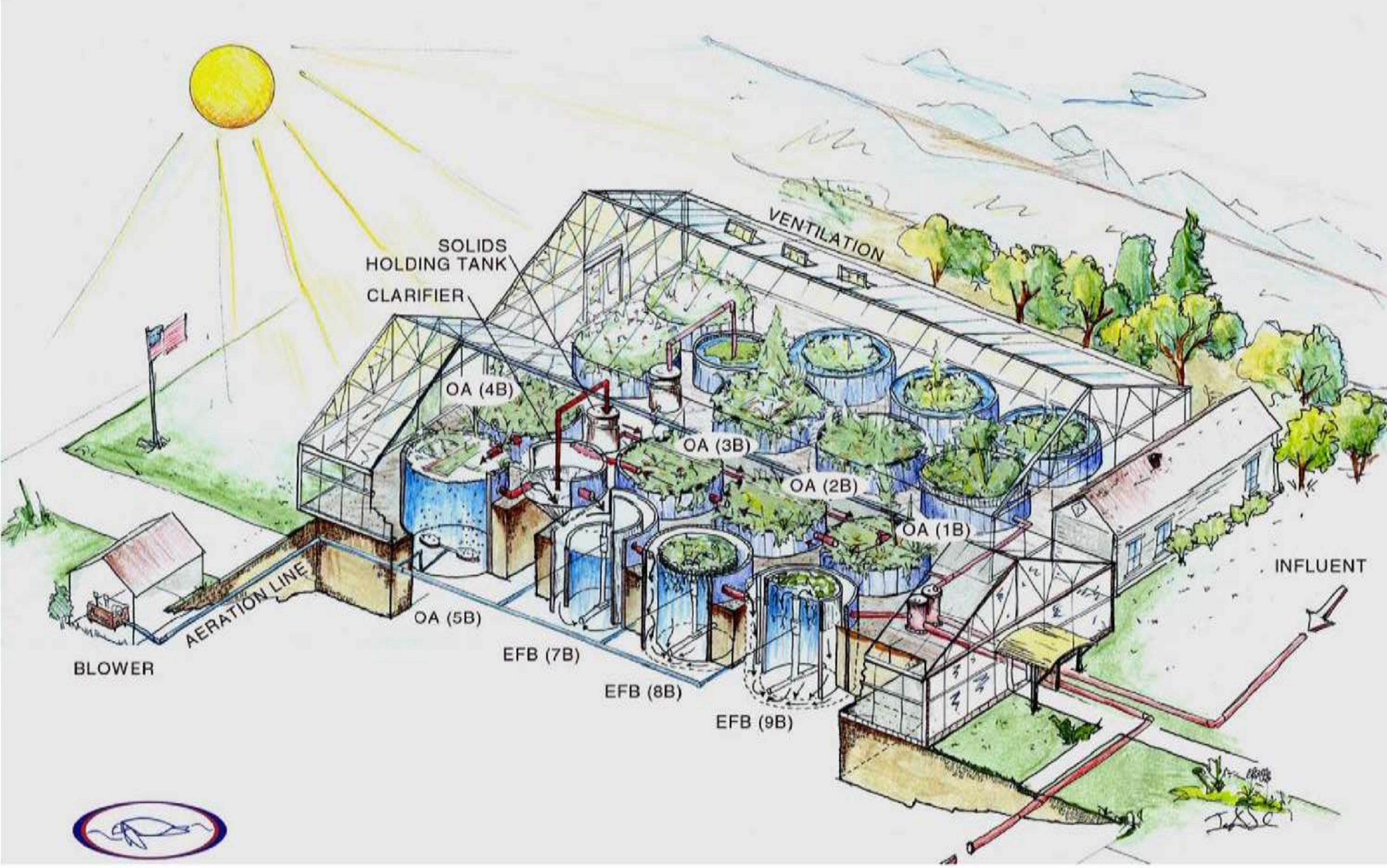
STEP / STEG Collection

STEP/
STEG



Scale: NEIGHBORHOOD
Target: WASTEWATER

Eco-Machines and
Living Machines

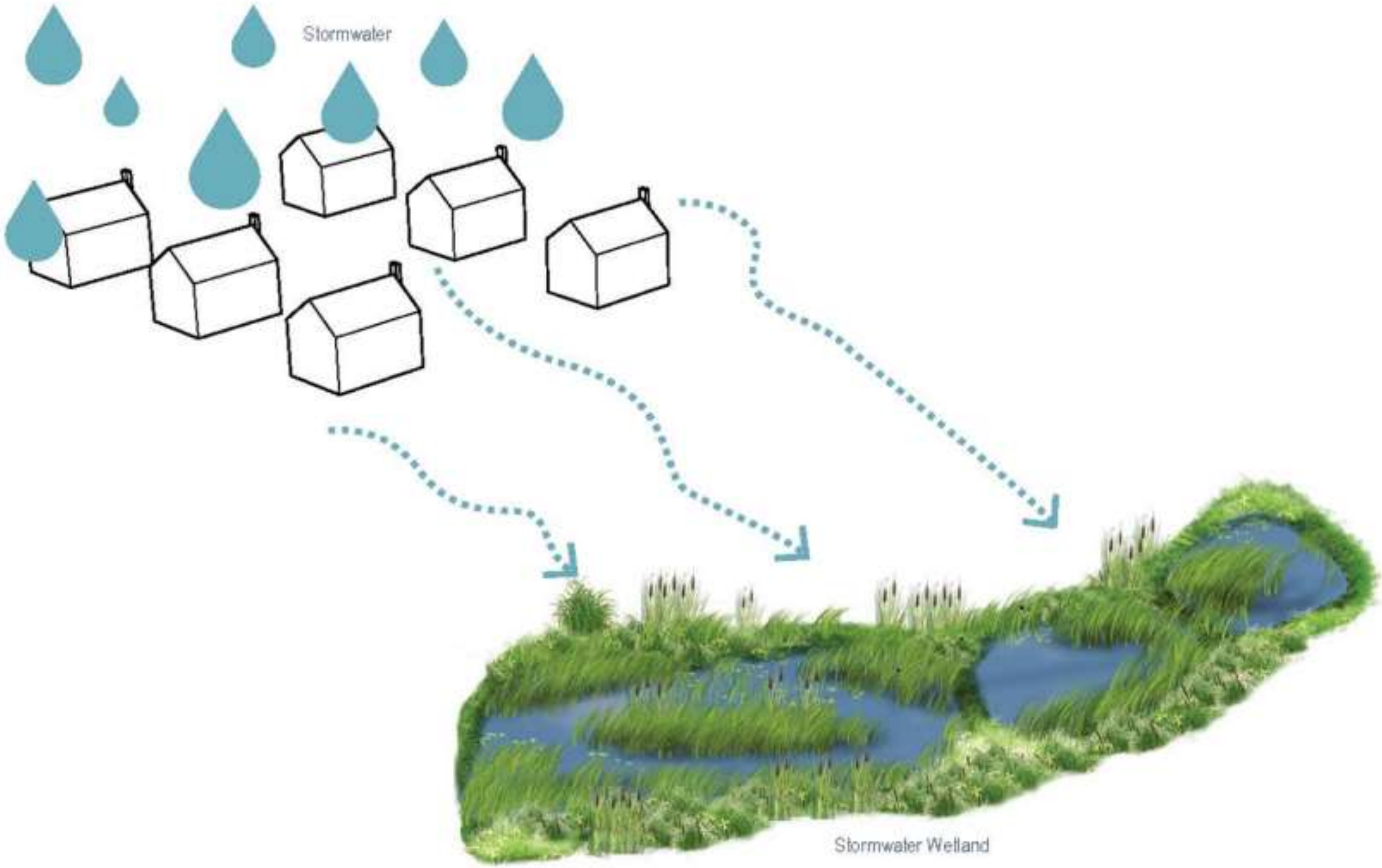


Precedent: Living Machine, South Burlington, VT
Source: Todd Ecological

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



Scale: NEIGHBORHOOD
Target: STORMWATER

Stormwater Wetlands

"Watershed Working Group - Upper Cape West/South"

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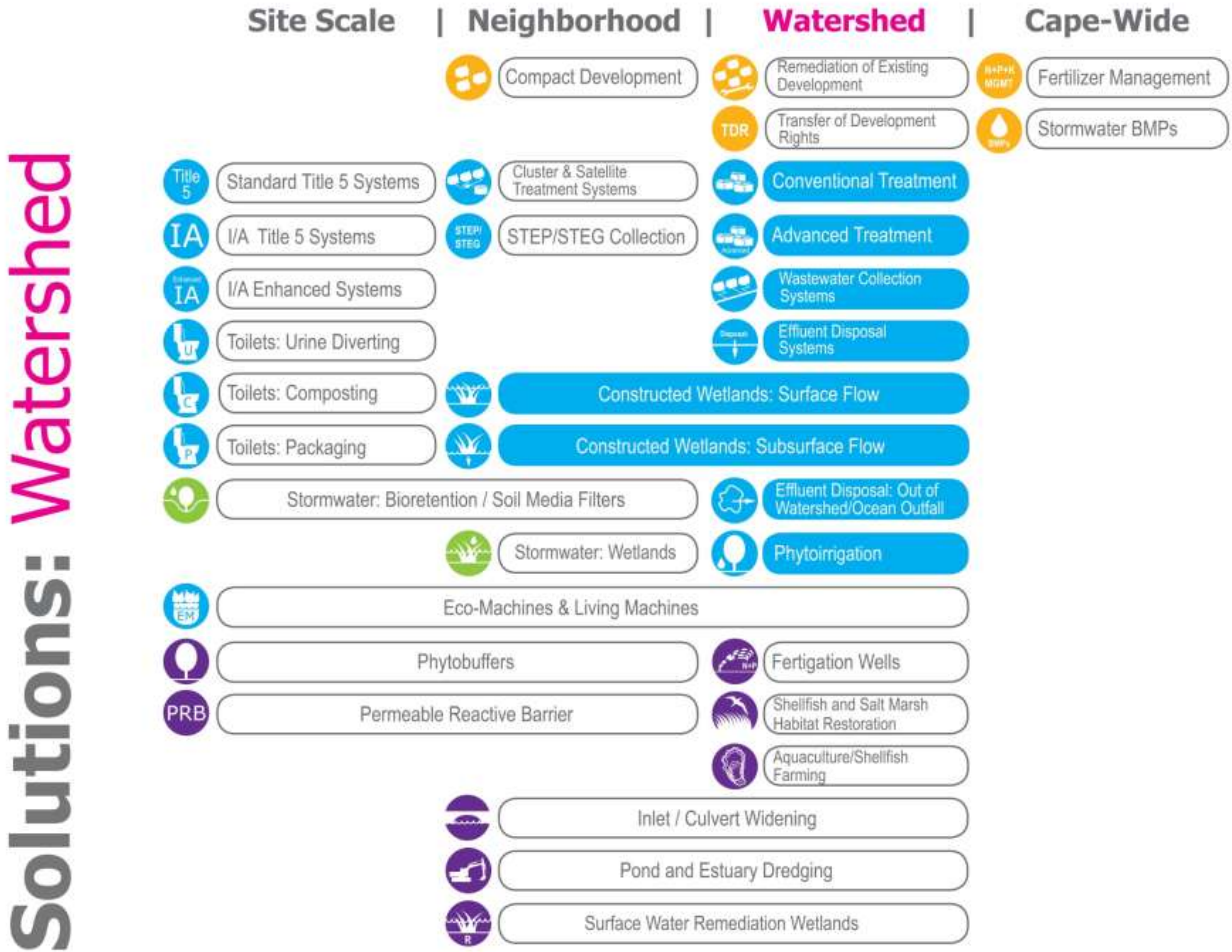
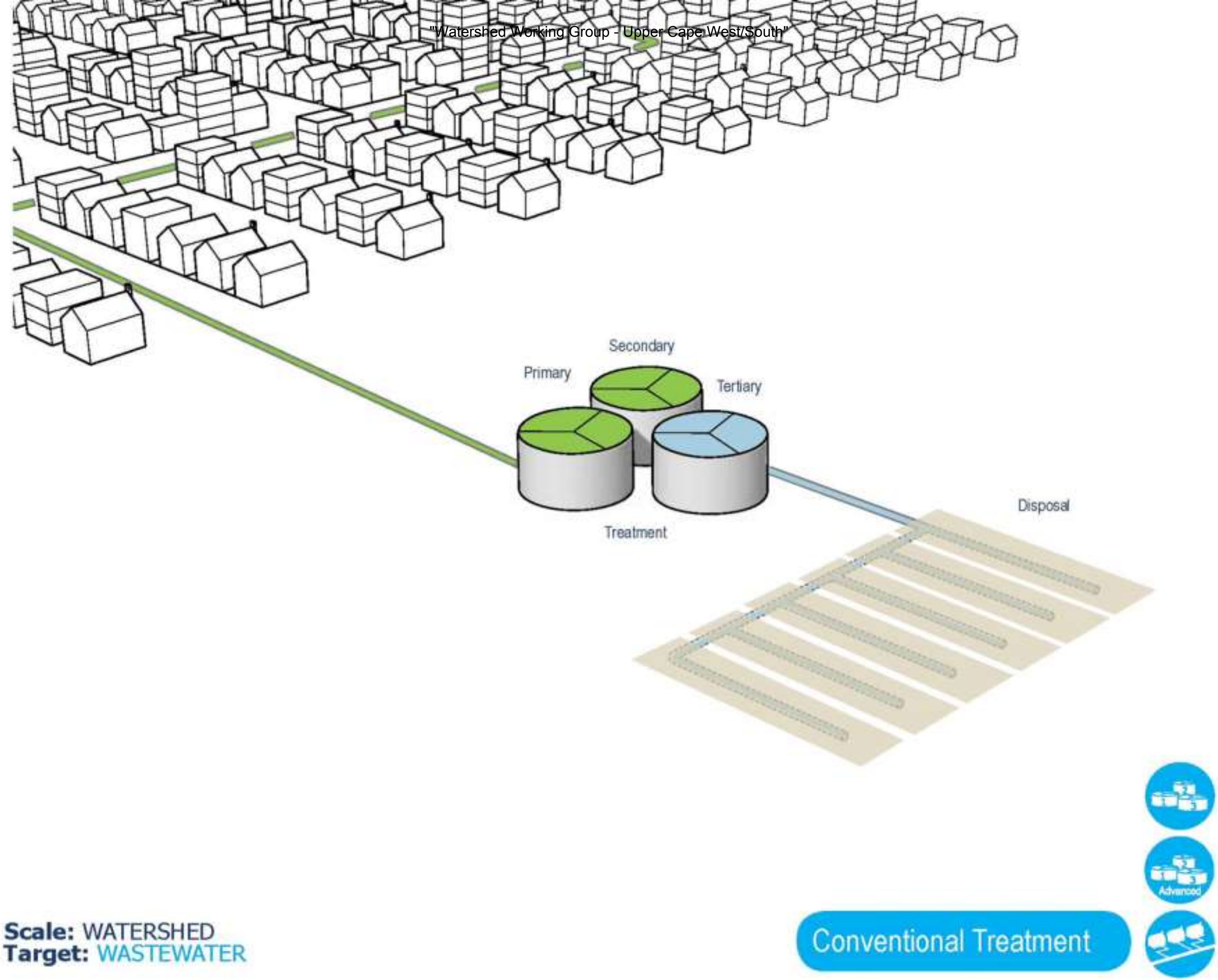
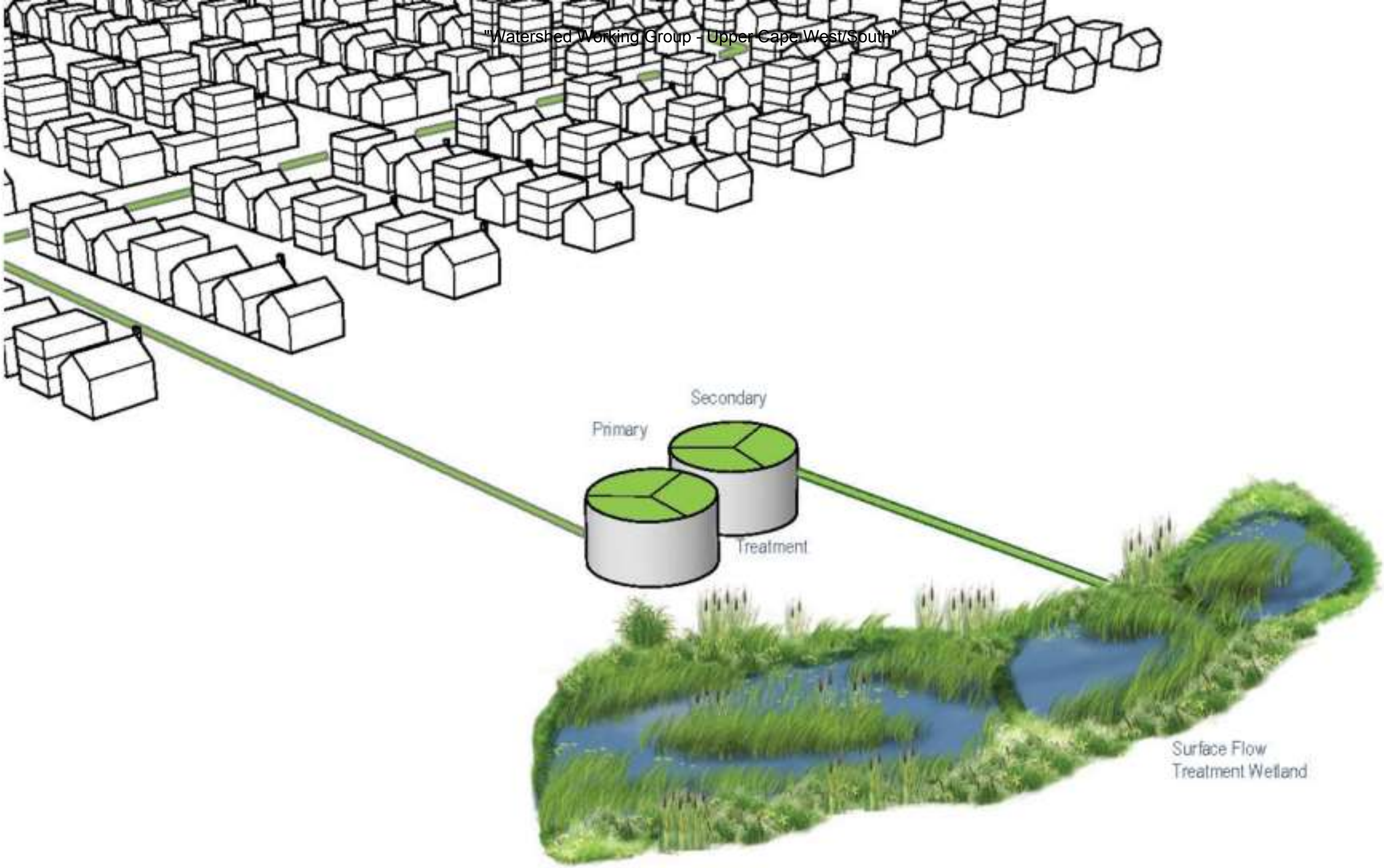




Scale: WATERSHED
Target: WASTEWATER

Conventional Treatment

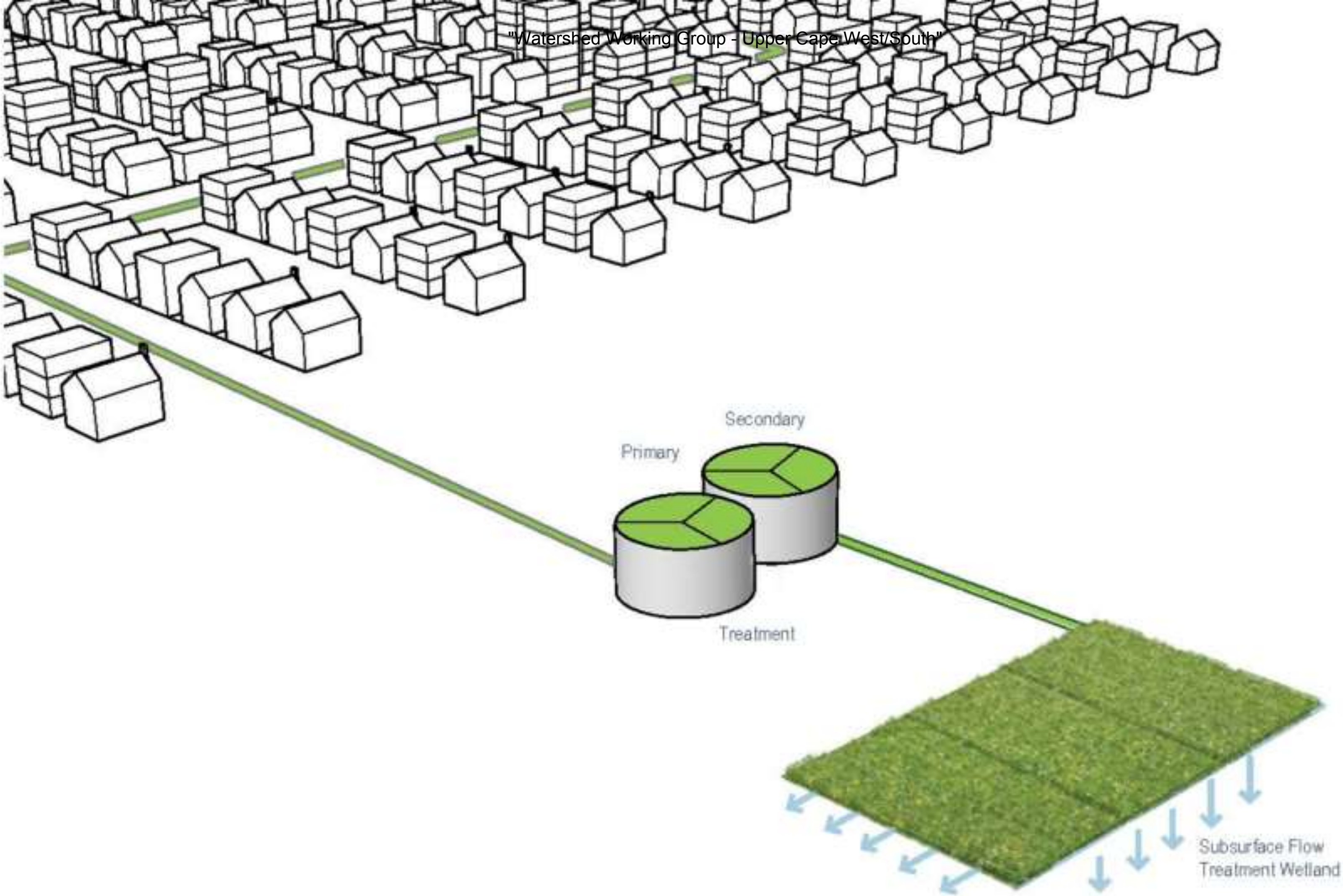


Scale: WATERSHED
Target: WASTEWATER

Constructed Wetlands: Surface Flow

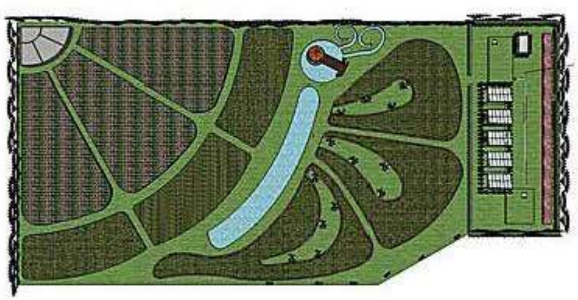
Precedent: Talking Waters Garden - Albany, OR
Source: Kate Kennen

Constructed Wetlands: Surface Flow



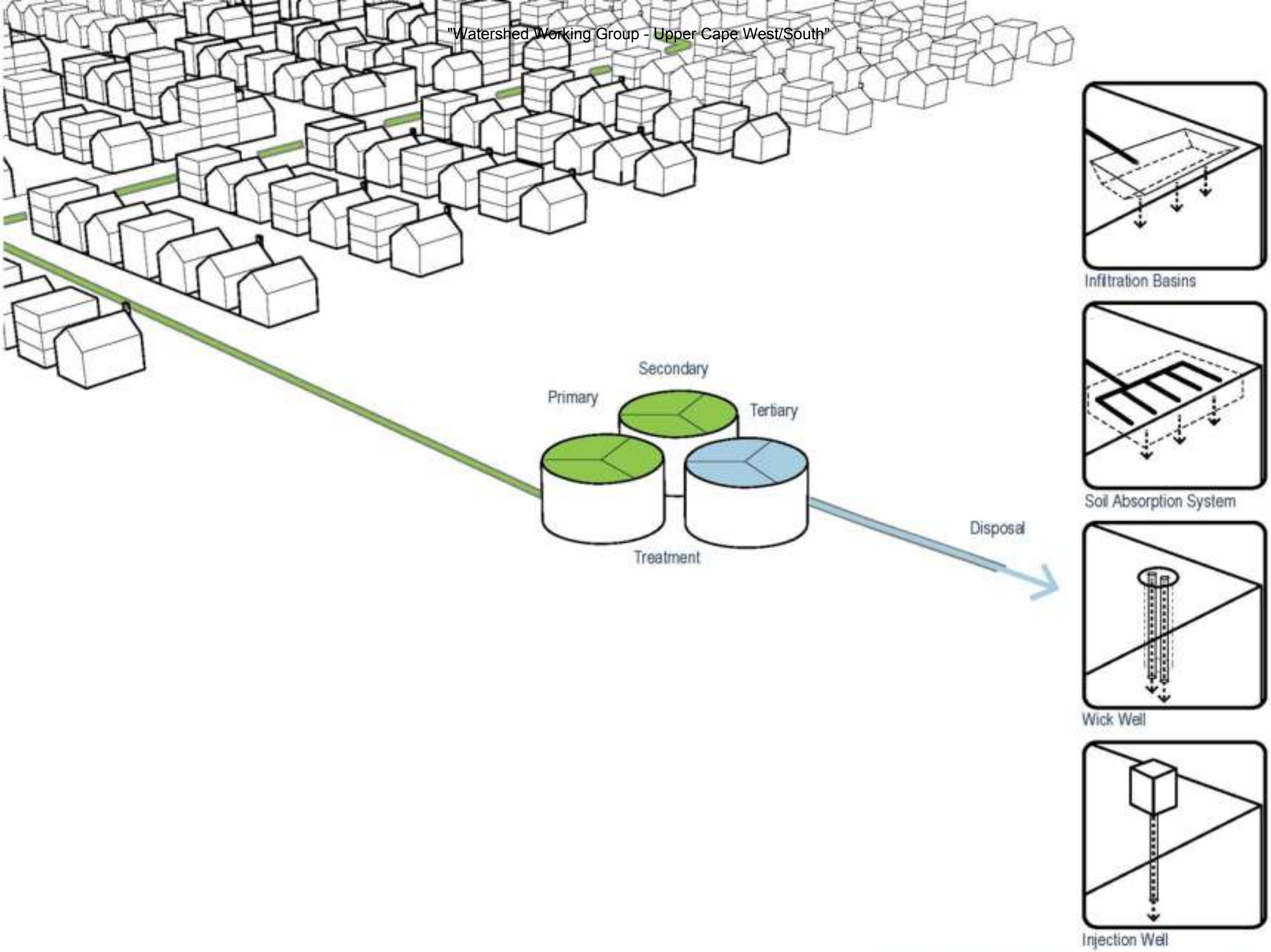
Scale: WATERSHED
Target: WASTEWATER

Constructed Wetlands:
Subsurface Flow



Precedent: Koh Phi Phi Treatment Wetland, Thailand
Source: Hans Brix

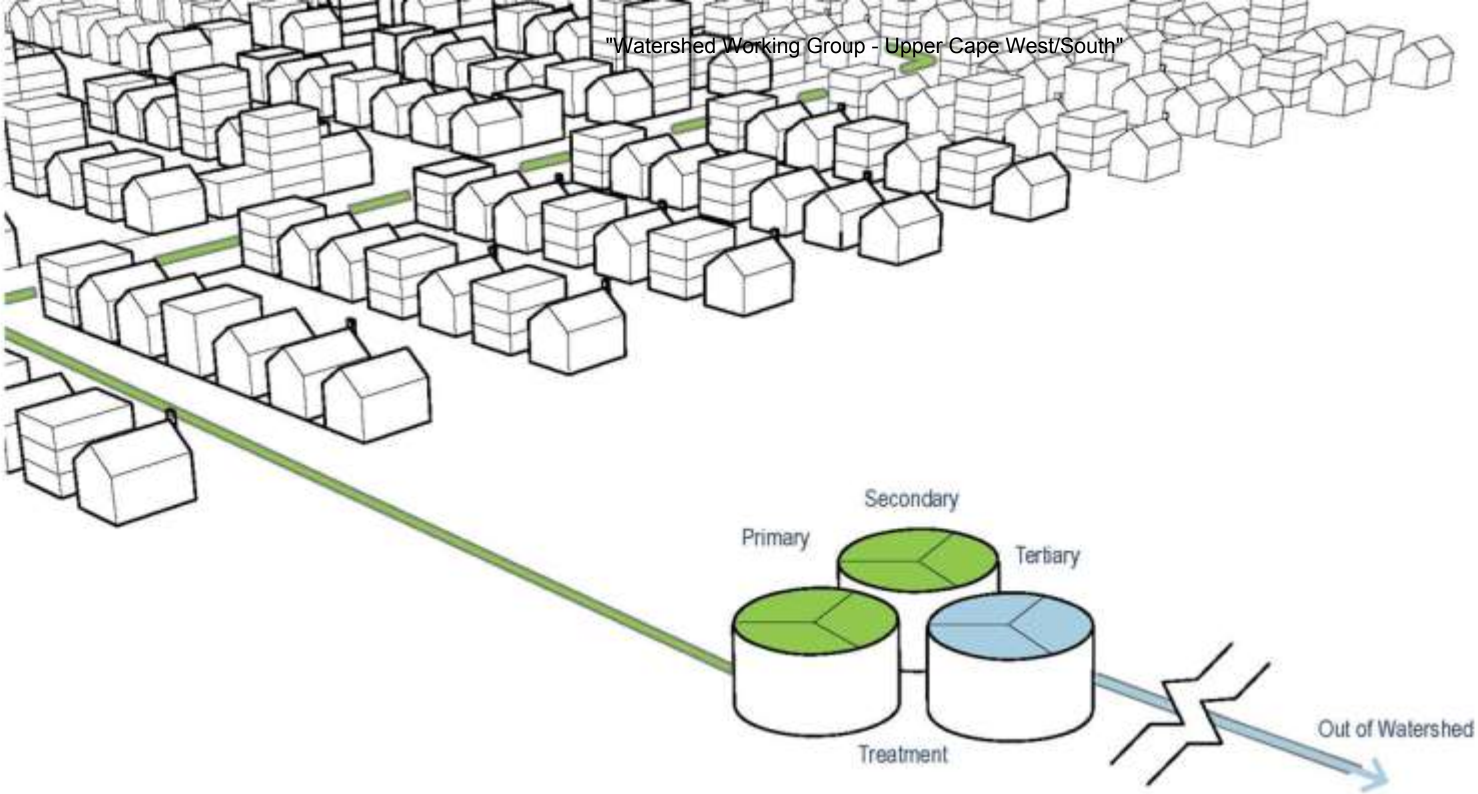
Constructed Wetlands:
Subsurface Flow



Scale: WATERSHED
Target: WASTEWATER

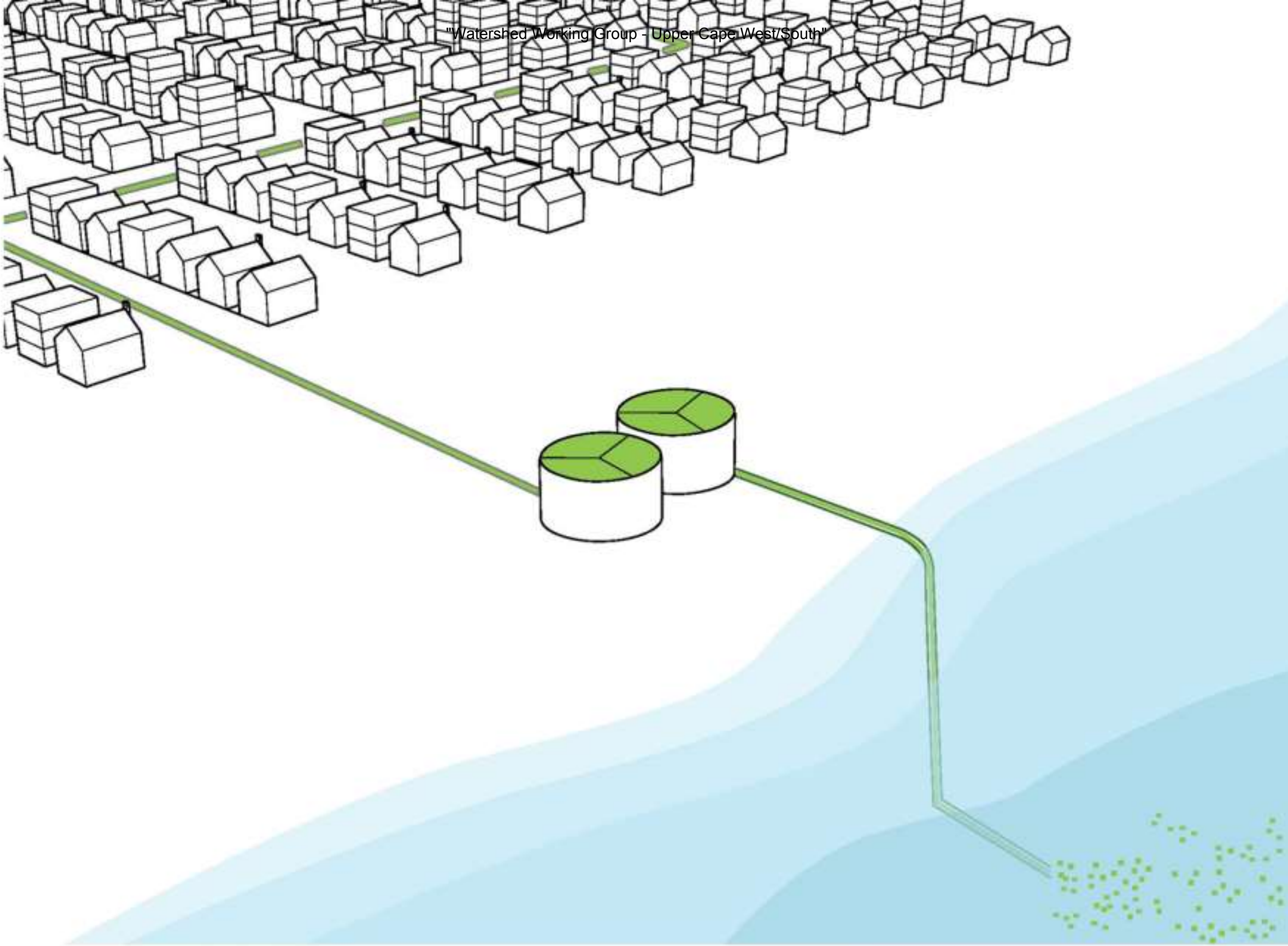
Effluent Disposal Systems

Disposal:



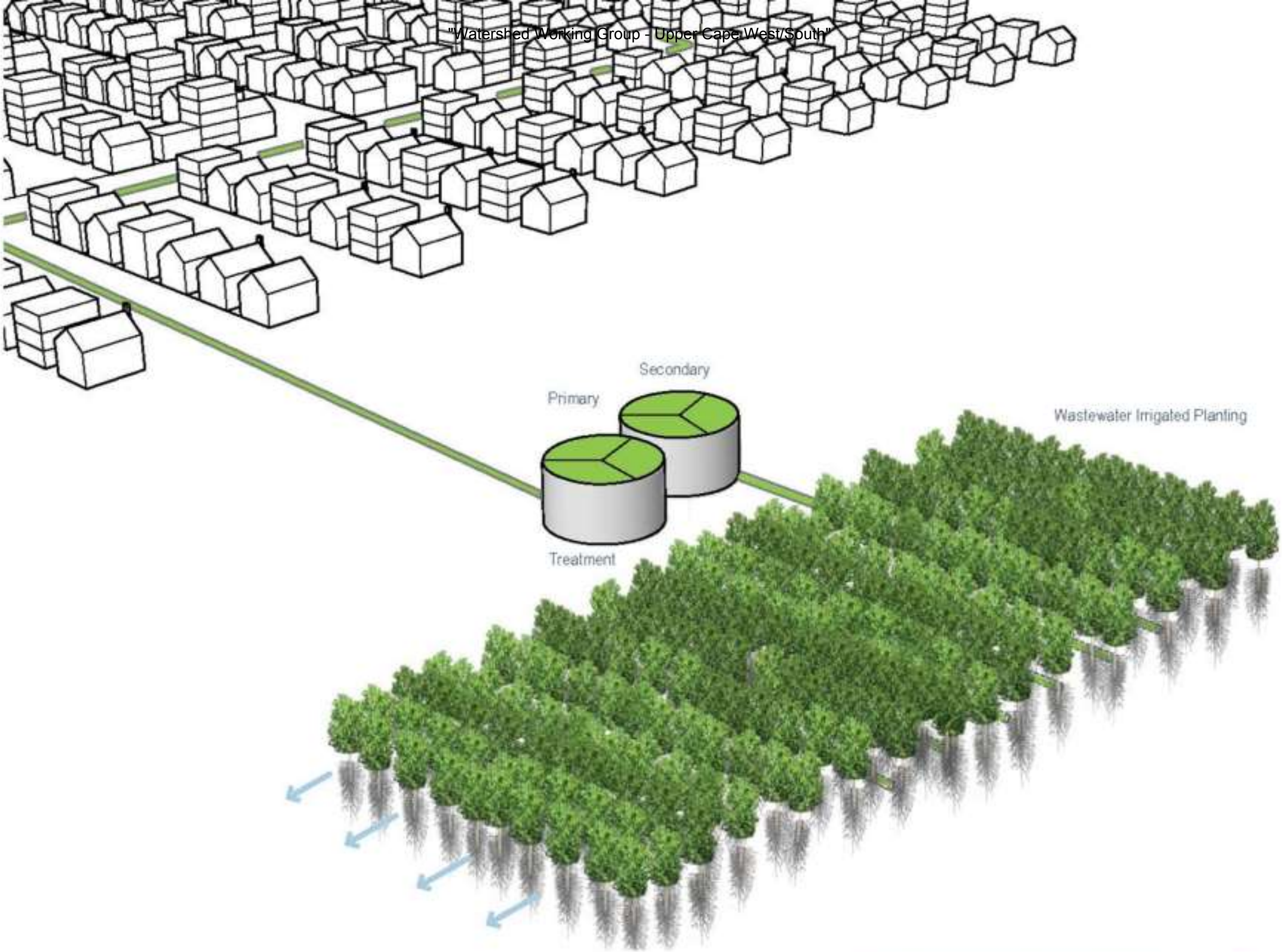
Scale: WATERSHED
Target: WASTEWATER

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

Precedent: Woodburn OR, Wastewater Treatment Facility
Source: CH2MHill

Phytoirrigation


Solutions: Ex. Water
Site Scale | Neighborhood | Watershed | Cape-Wide
Compact Development
Remediation of Existing Development
N+P+K MGMT
Fertilizer Management
TDR
Transfer of Development Rights
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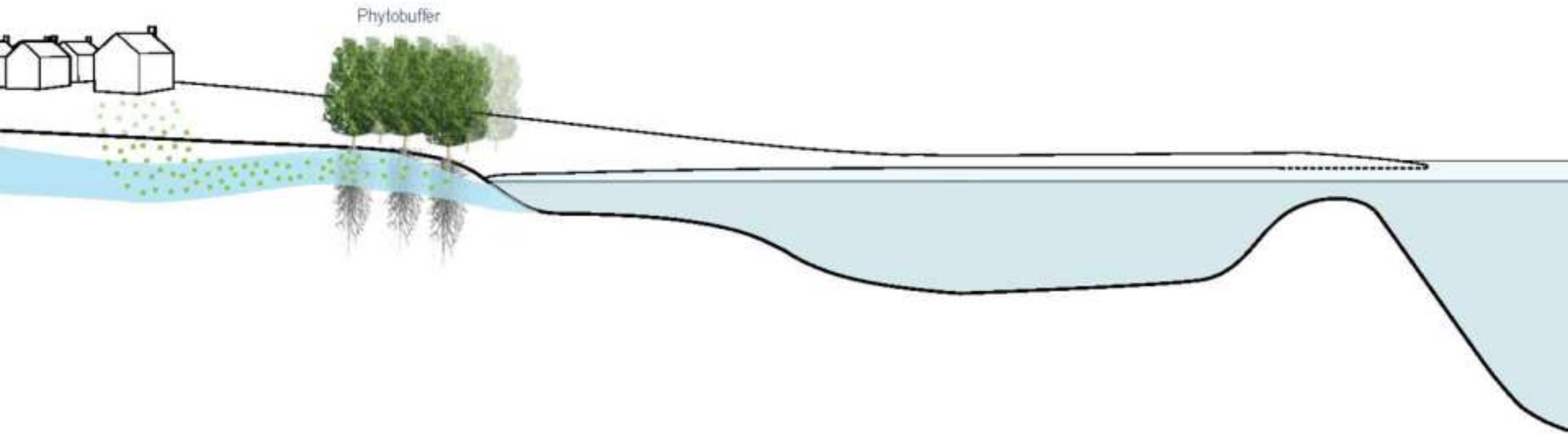
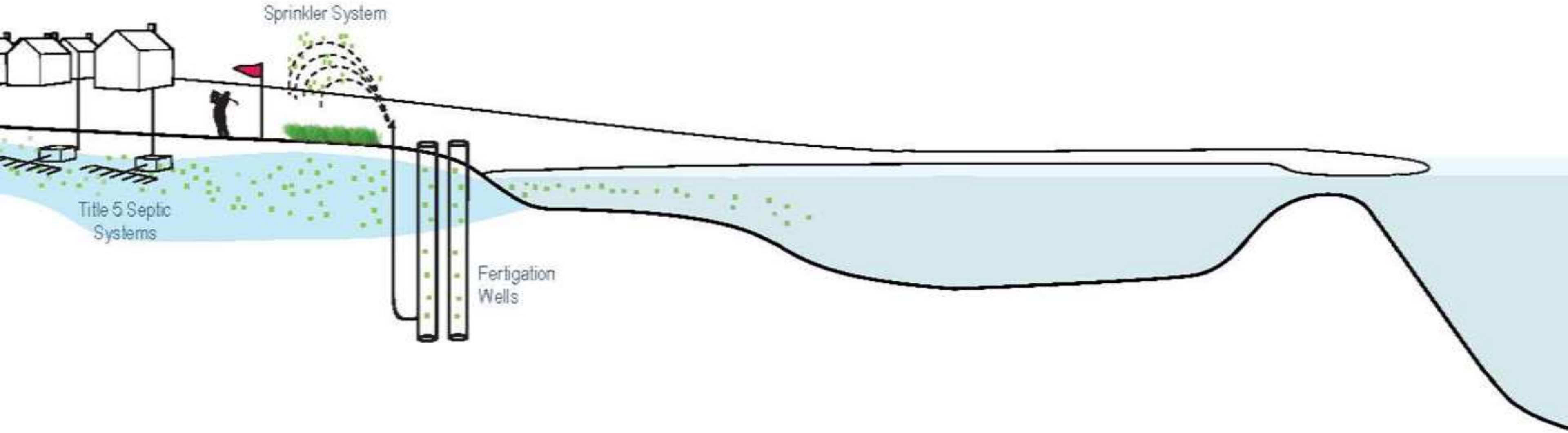


Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Phytobuffers

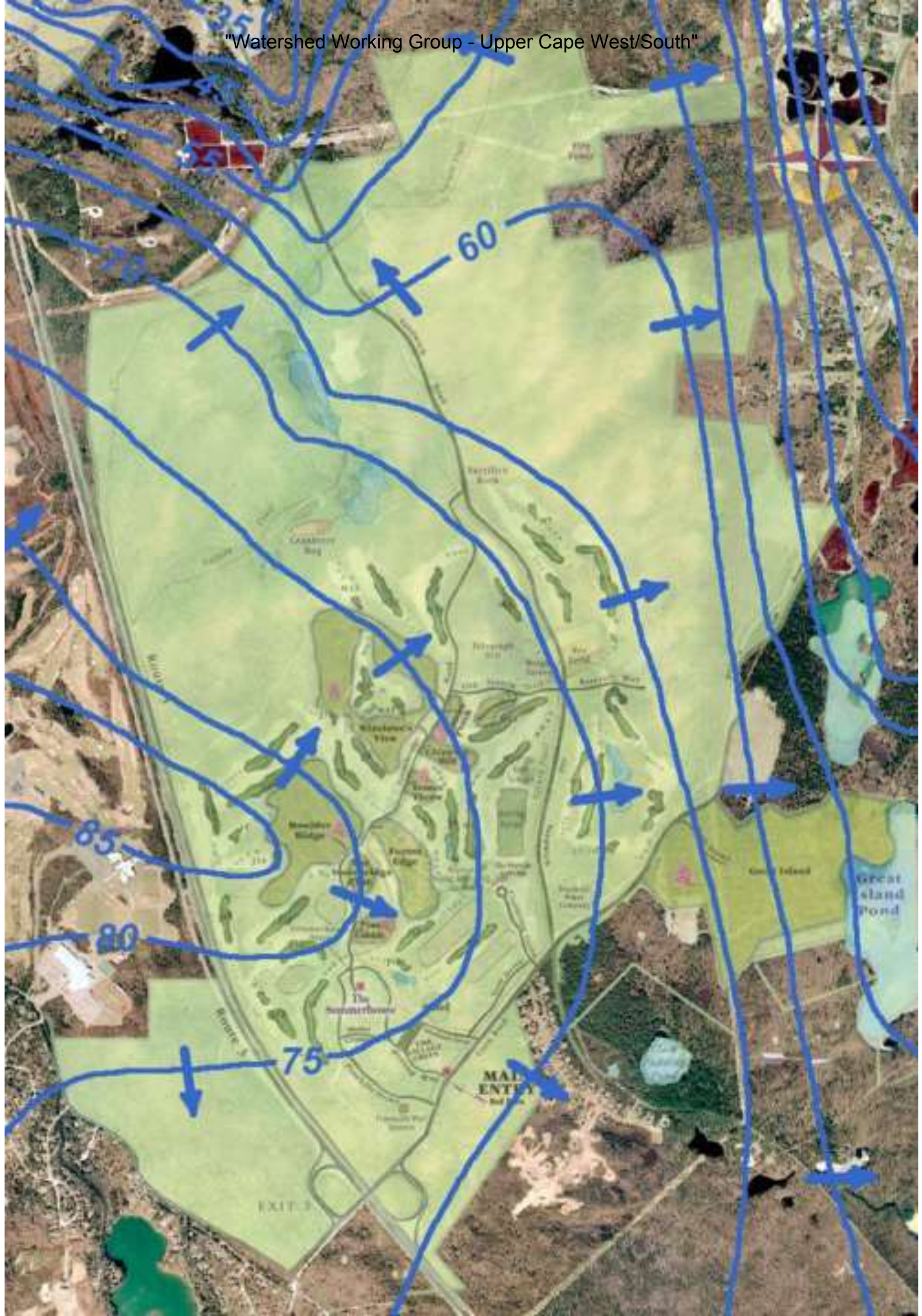
Precedent: Phytobuffer - Kavcee, WY
Source: Sand Creek Consultants

Phytobuffers



Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Fertigation Wells



Precedent:
Pine Hills
Plymouth, MA

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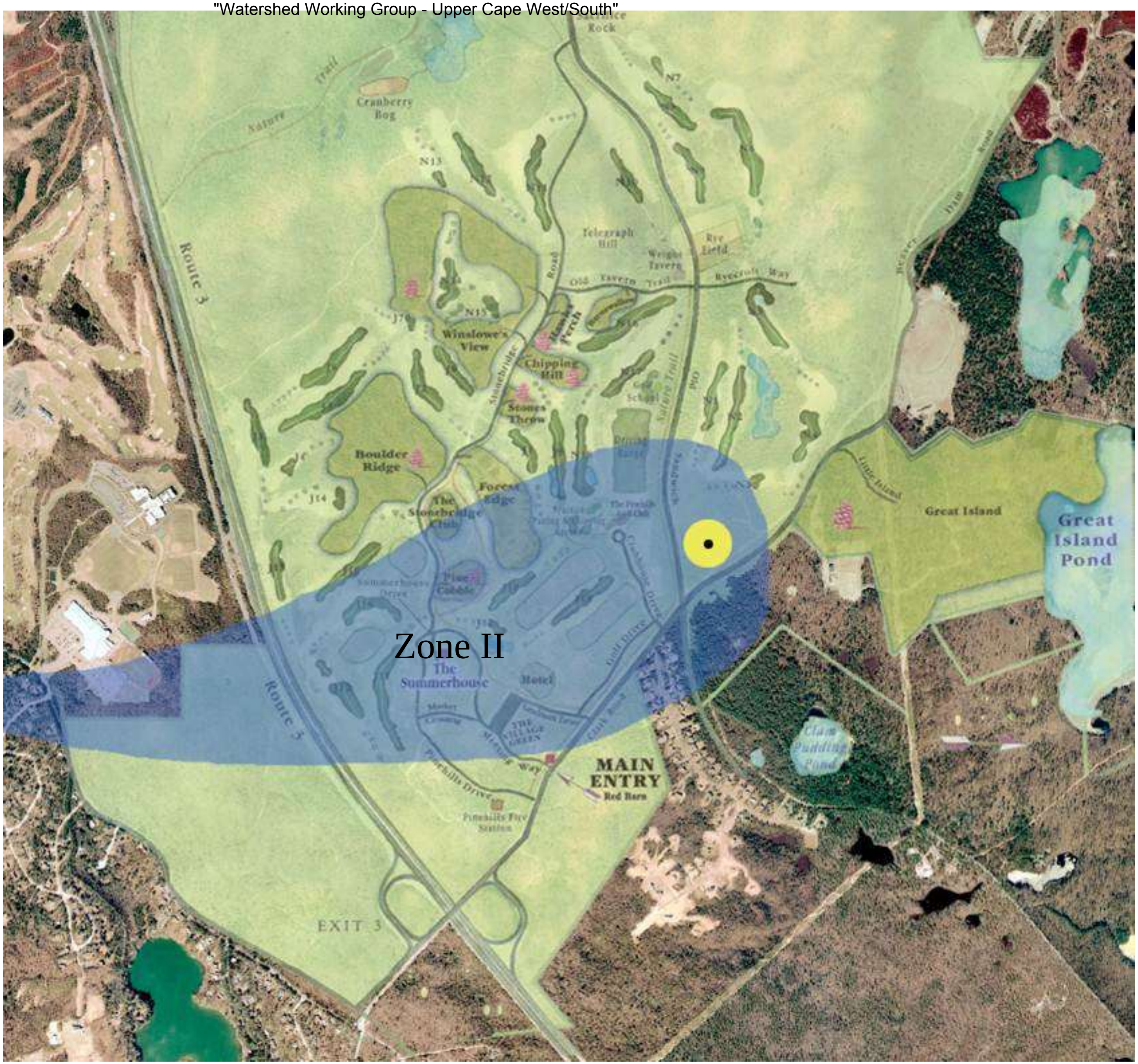

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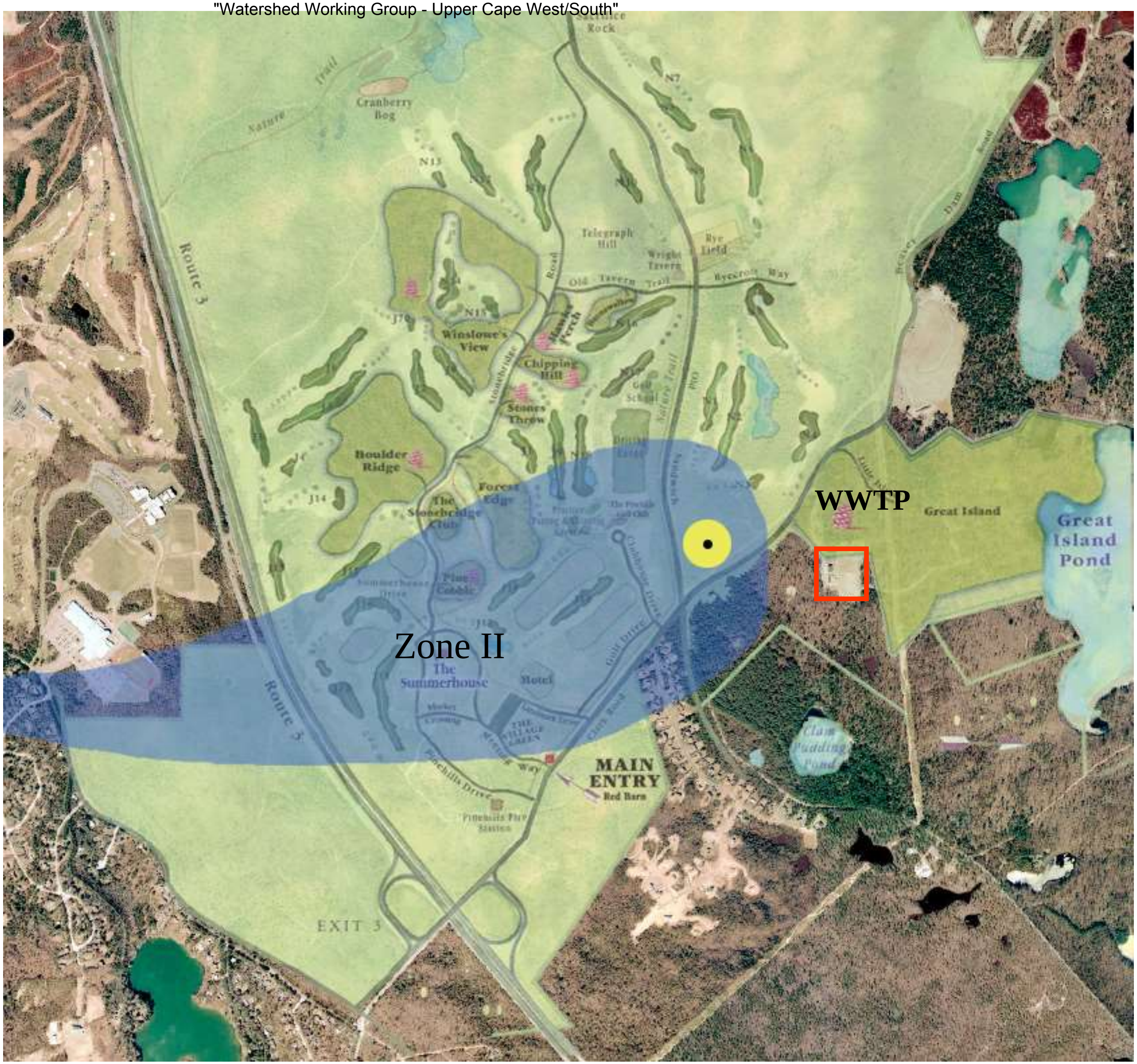

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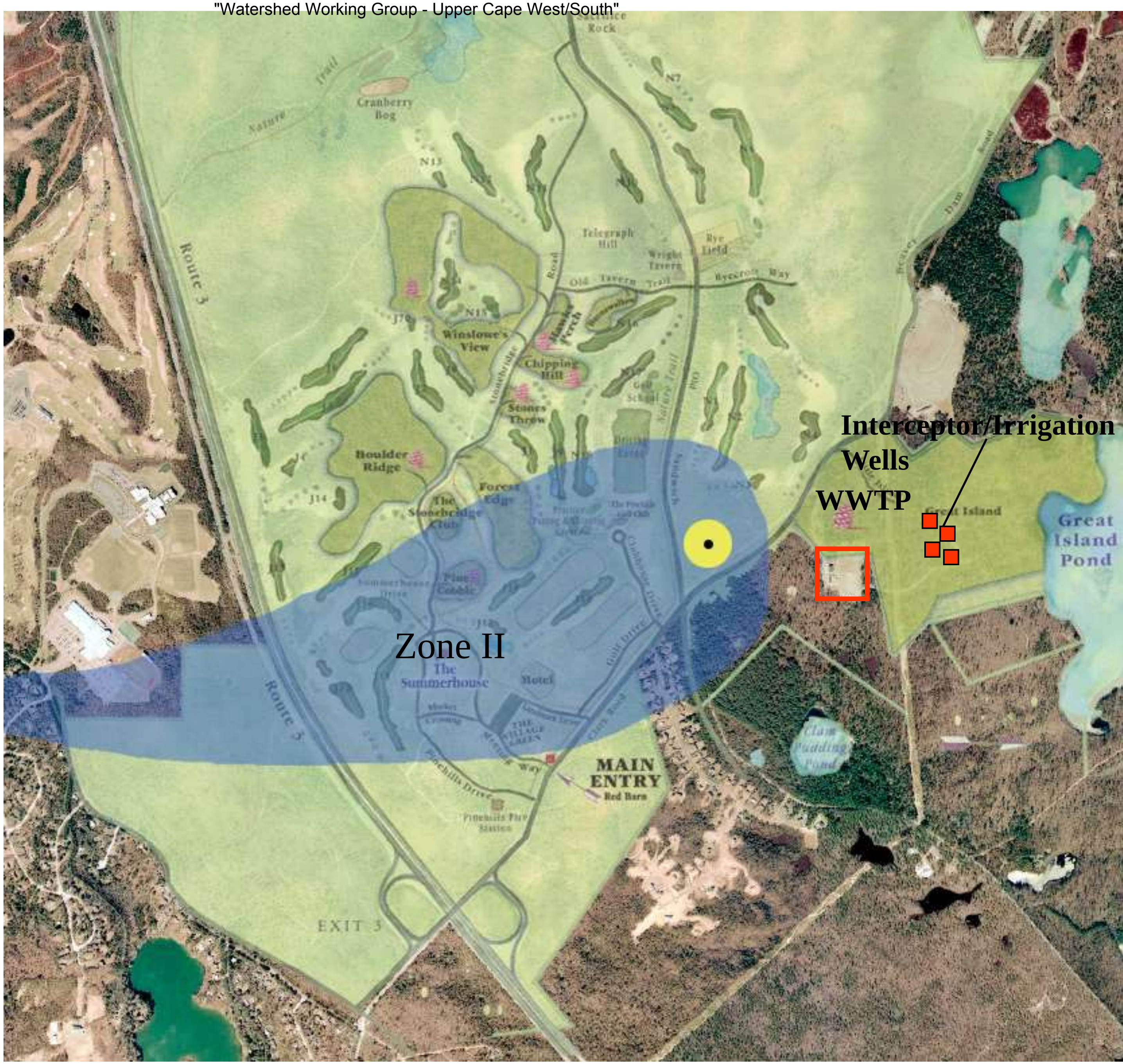
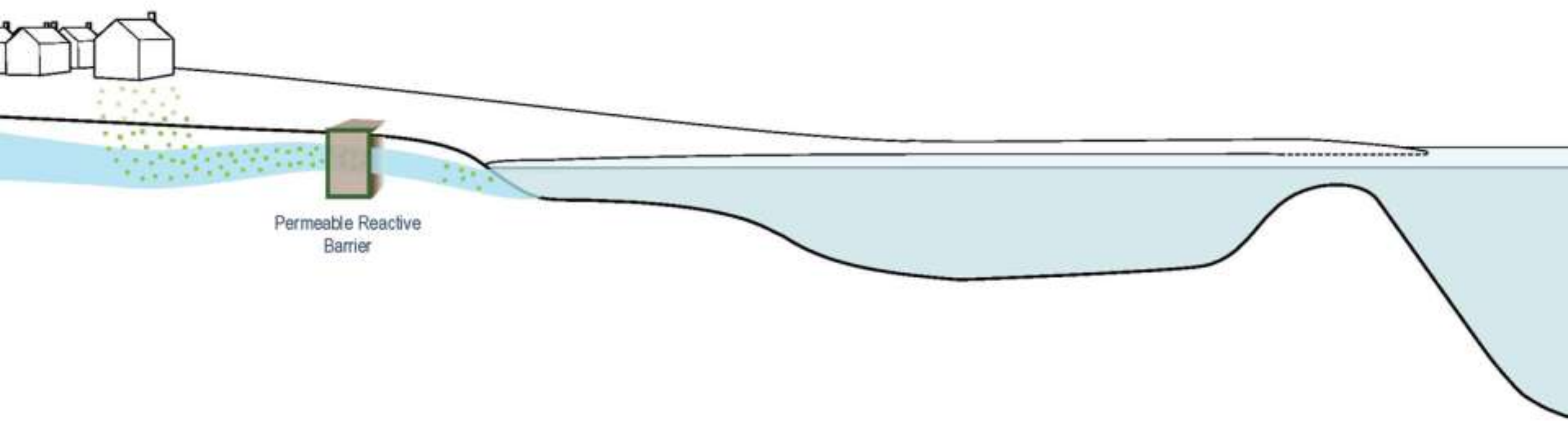


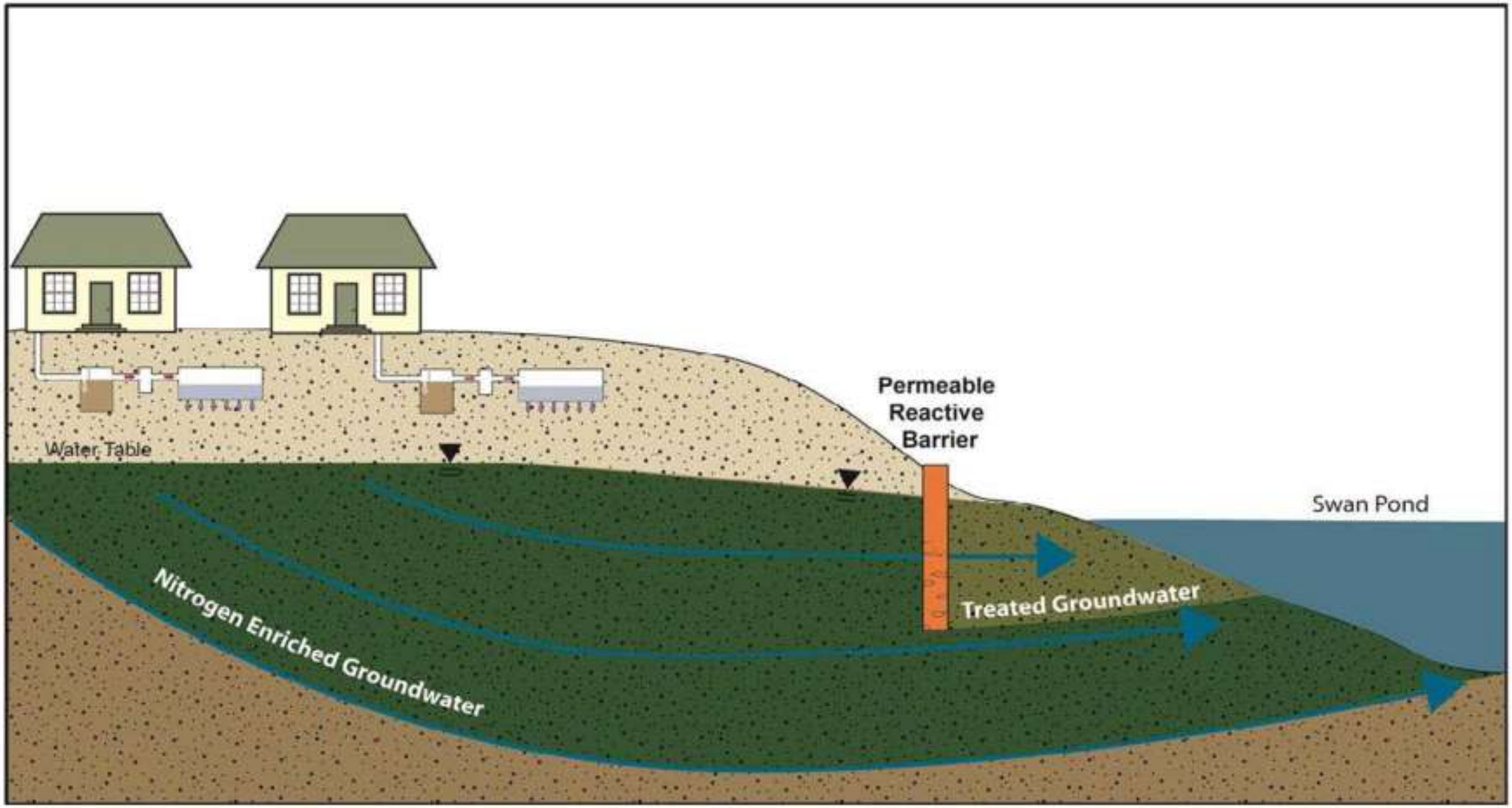
Precedent:
Pine Hills
Plymouth, MA



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

Permeable Reactive Barrier

PRB



Precedent: PRB
Source: Horsley Witten Group Inc.

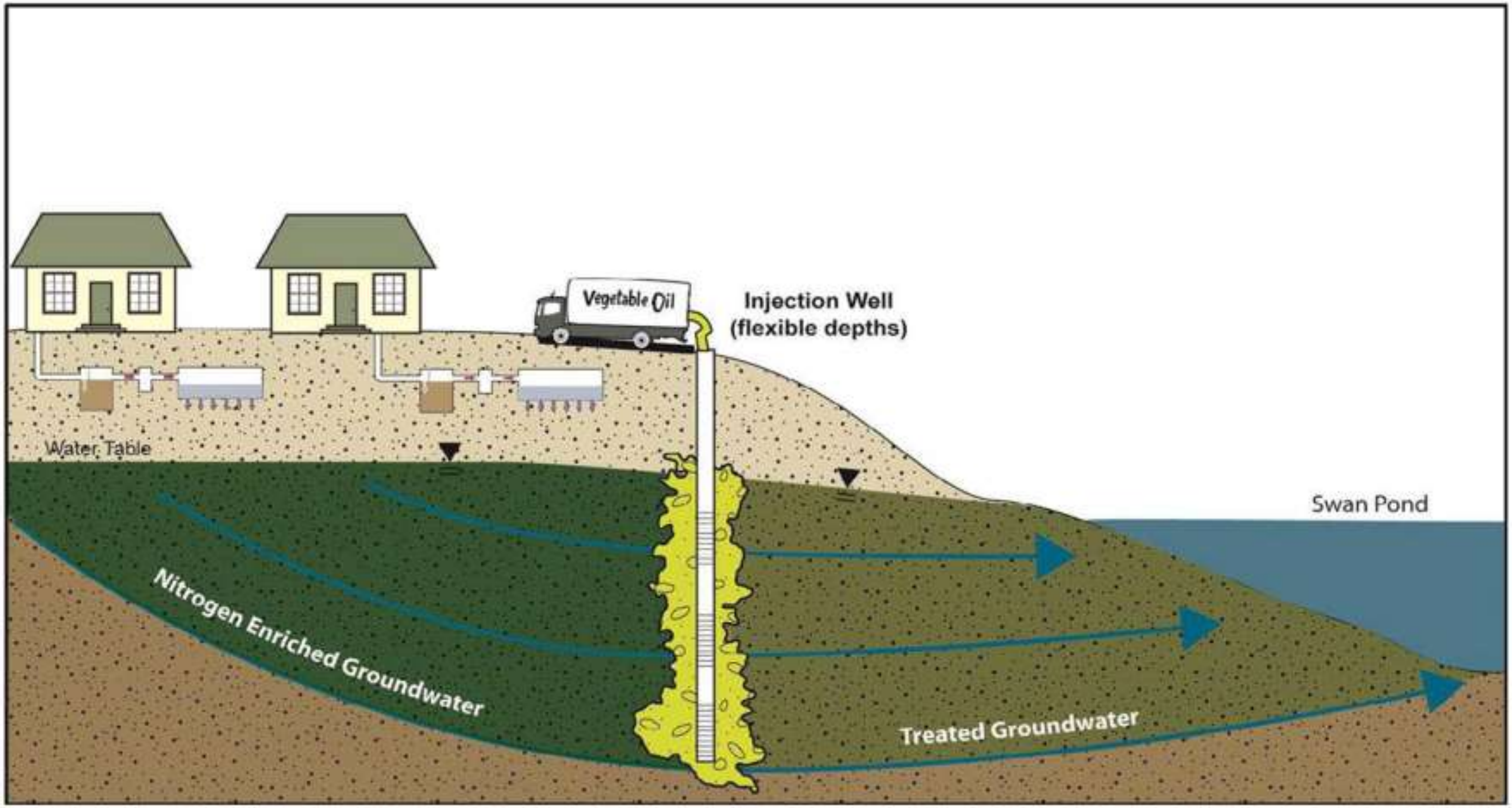
Permeable Reactive Barrier

PRB

Precedent: Falmouth PRB
Source: Mike Domenica

Permeable Reactive Barrier

PRB



Precedent: PRB
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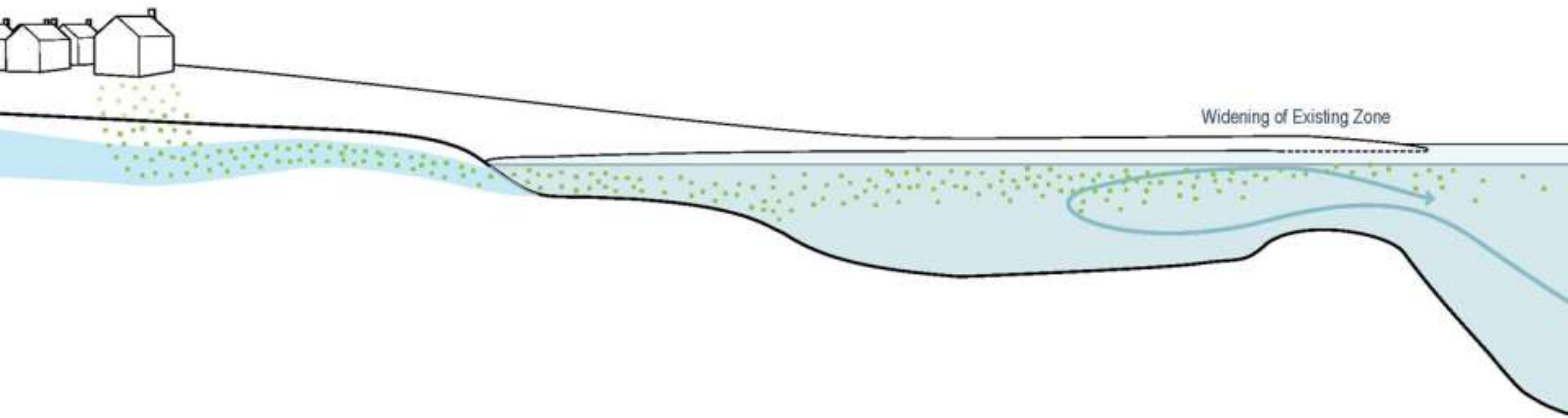
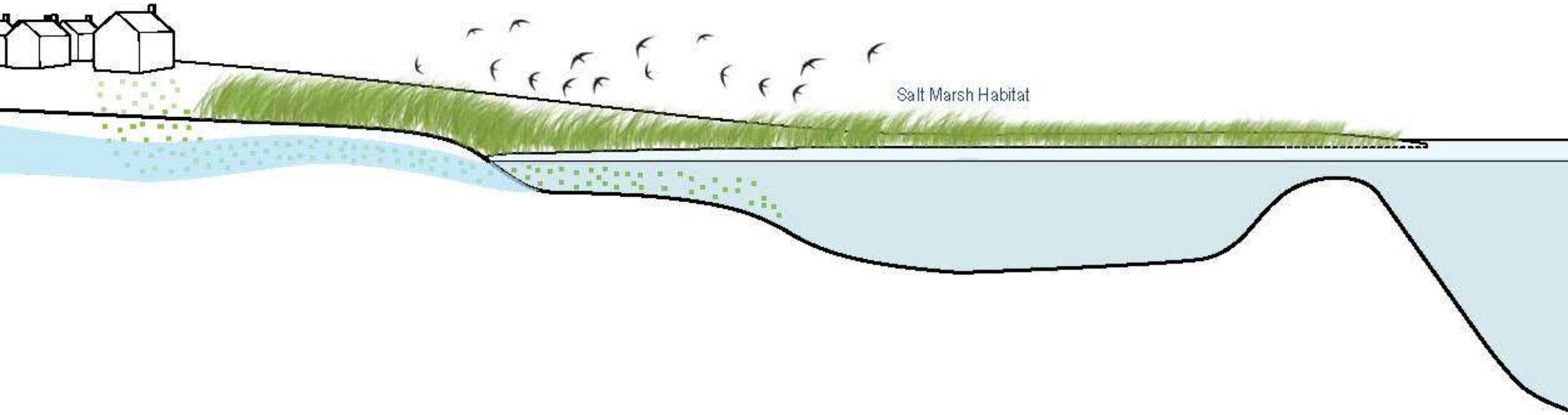
Permeable Reactive Barrier

PRB



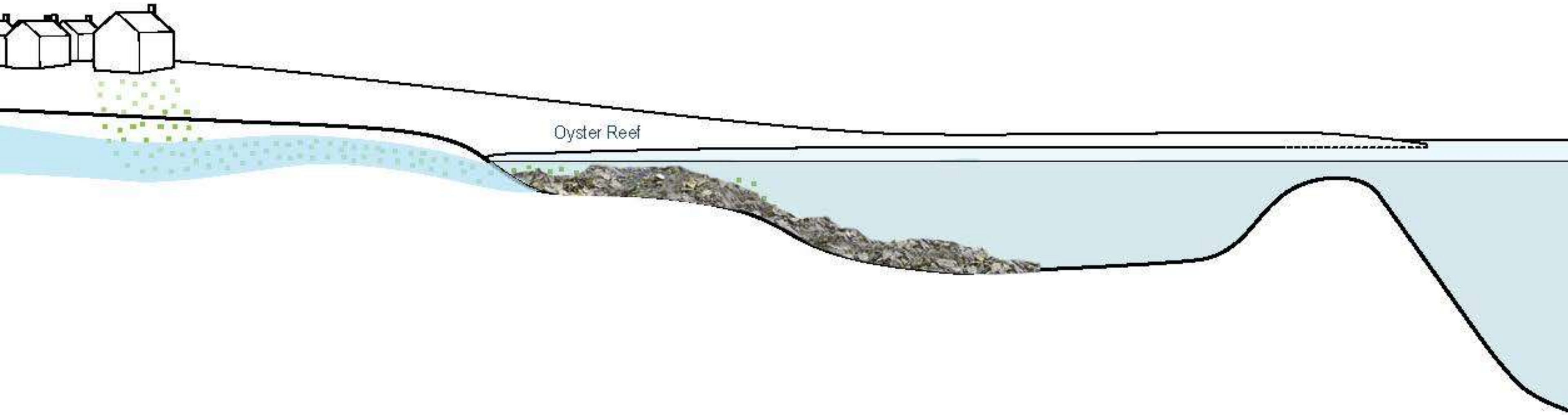
Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Inlet and Culvert Widening



Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Salt Marsh Habitat Restoration



Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

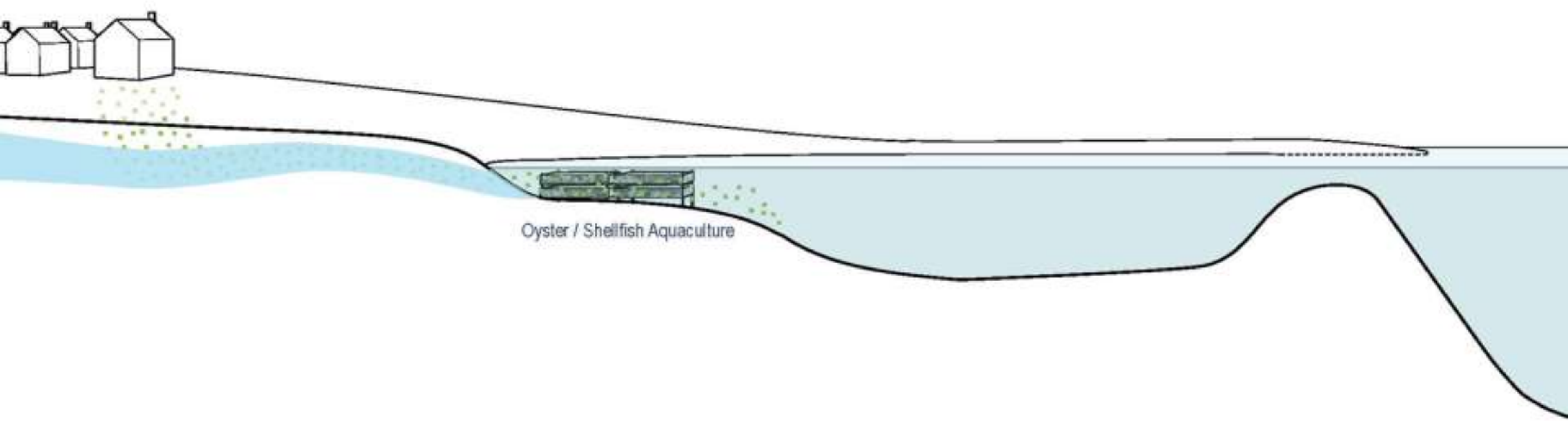
Shellfish Habitat Restoration

Precedent: Wellfleet Oyster Restoration Project
Source: Anamarija Francik

Shellfish Habitat Restoration

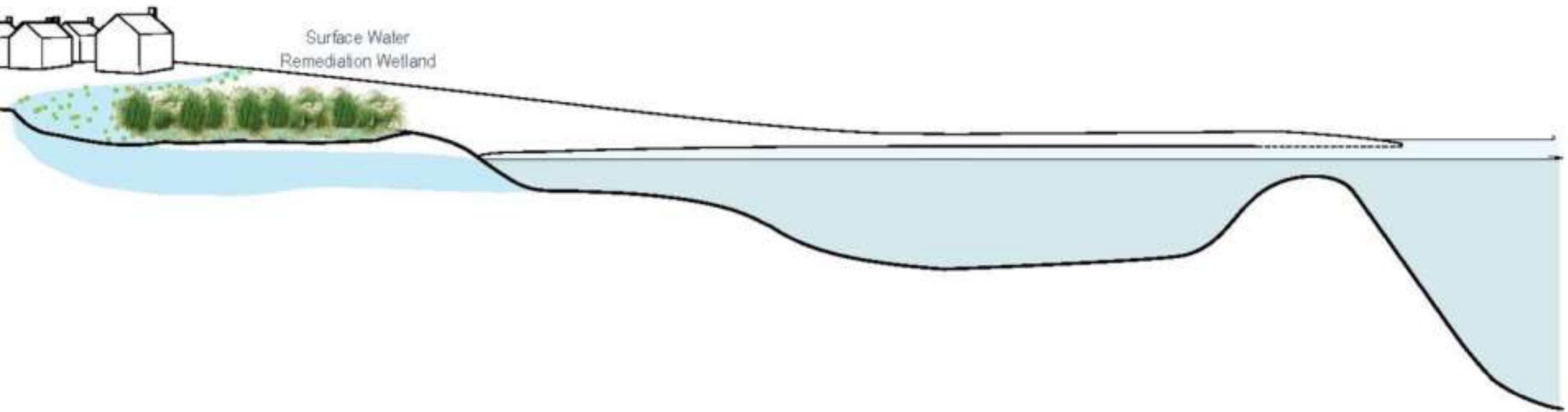
Precedent: Wellfleet Oyster Restoration Project
Source: Anamarija Francik

Shellfish Habitat Restoration



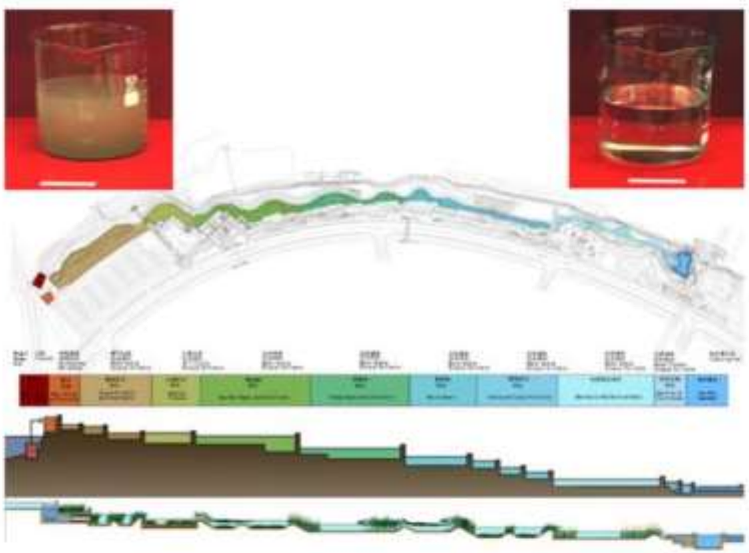
Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Aquaculture / Shellfish Farming



Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

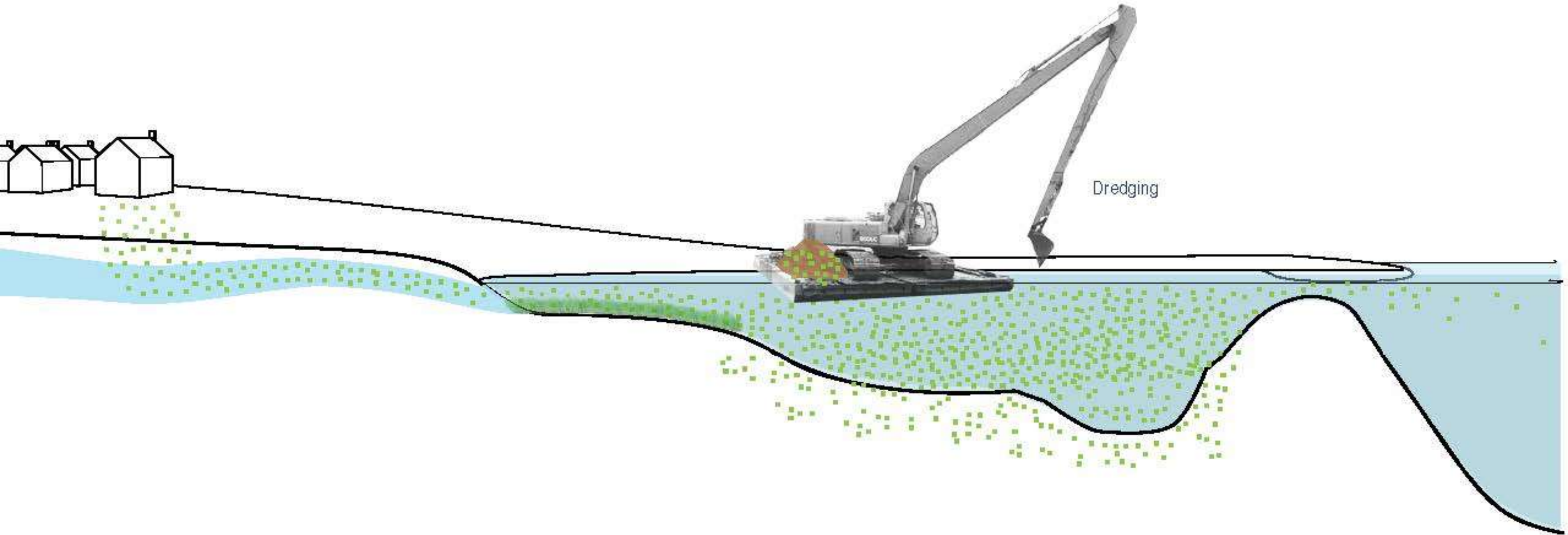
Surface Water
Remediation Wetlands



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

- 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: CAPE-WIDE
Target: REGULATORY

Compact Development

Scale: CAPE-WIDE
Target: REGULATORY

Fertilizer Management

N+P+K MGMT

"Watershed Working Group - Upper Cape West/South"

Scale: CAPE-WIDE
Target: REGULATORY

Remediation of Existing Development

Scale: CAPE-WIDE
Target: REGULATORY

Transfer of Development Rights

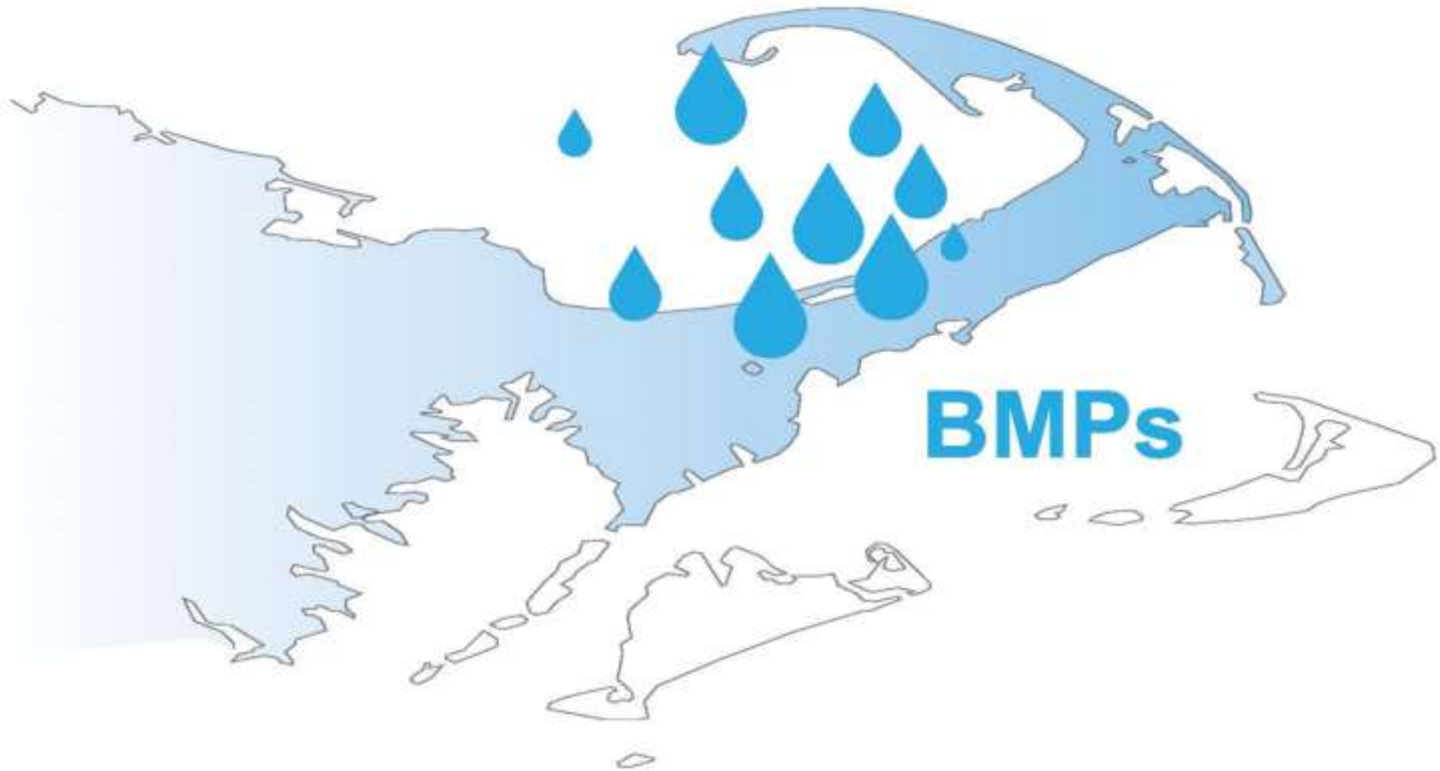
TDR

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

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


Site Scale | Neighborhood | Watershed | Cape-Wide
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
IA
I/A Enhanced Systems
Wastewater Collection Systems
U
Toilets: Urine Diverting
Effluent Disposal Systems
C
Toilets: Composting
Constructed Wetlands: Surface Flow
P
Toilets: Packaging
Constructed Wetlands: Subsurface Flow
Stormwater: Bioretention / Soil Media Filters
Effluent Disposal: Out of Watershed/Ocean Outfall
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Phytoirrigation
EM
Eco-Machines & Living Machines
Phytobuffers
N+P
Fertigation Wells
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Permeable Reactive Barrier
Shellfish and Salt Marsh Habitat Restoration
Aquaculture/Shellfish Farming
Inlet / Culvert Widening
Pond and Estuary Dredging
R
Surface Water Remediation Wetlands
Solutions

Wastewater | Existing Water Bodies | Regulatory

Problem Solving Approach

1 Targets/Reduction 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
C. Growth Management

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

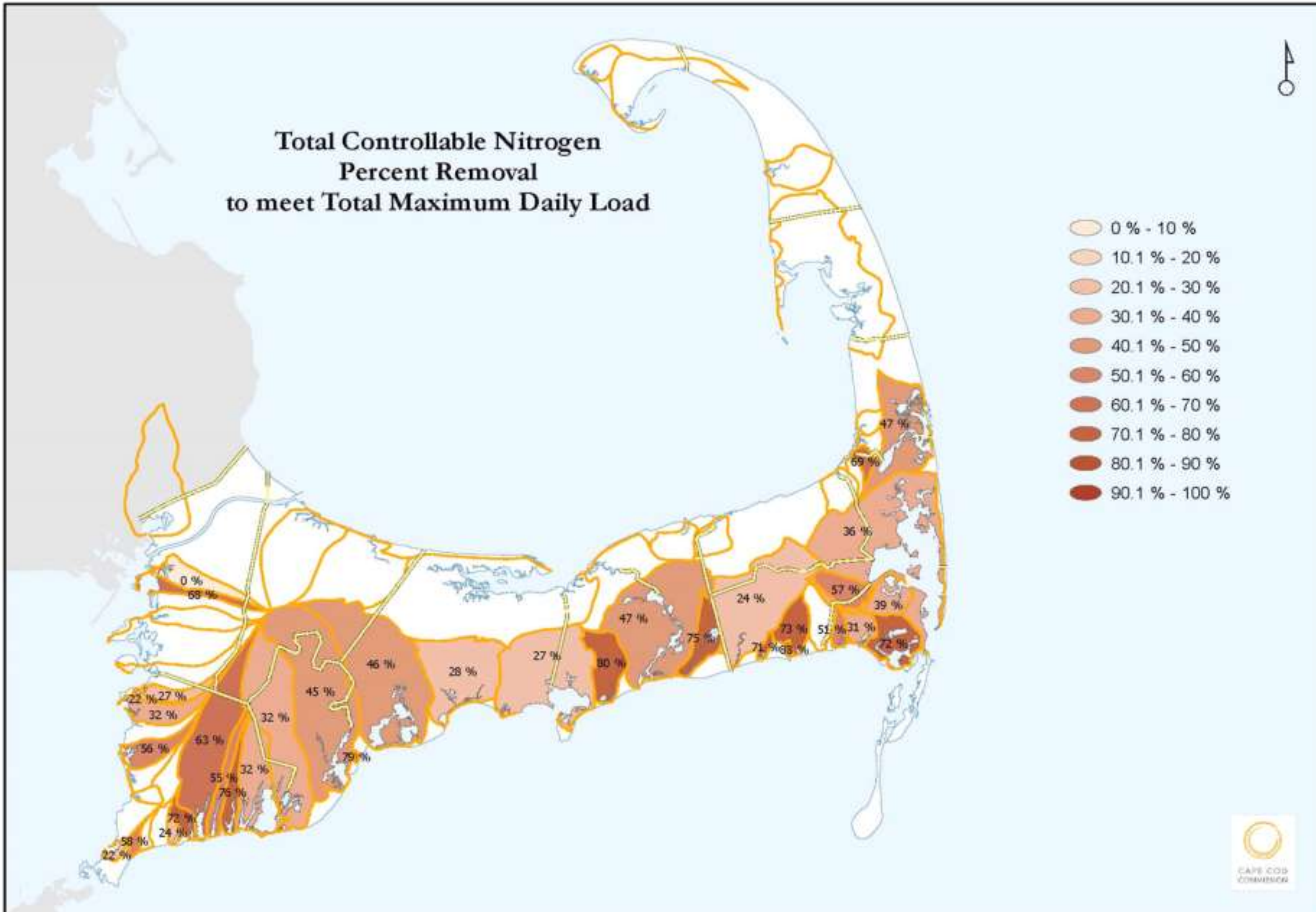
5 Alternative On-Site Options

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

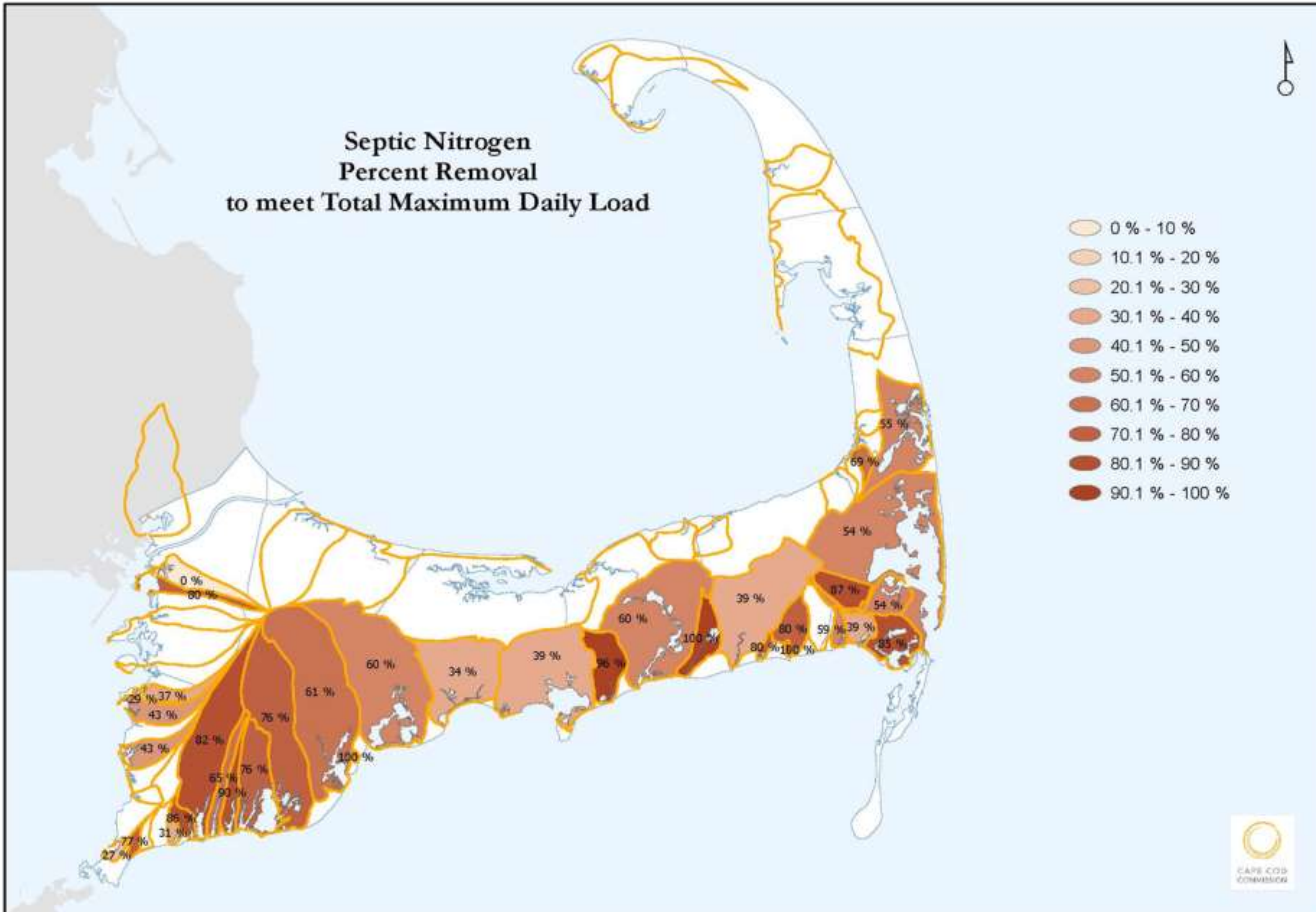
6 Priority Collection/High-Density Areas

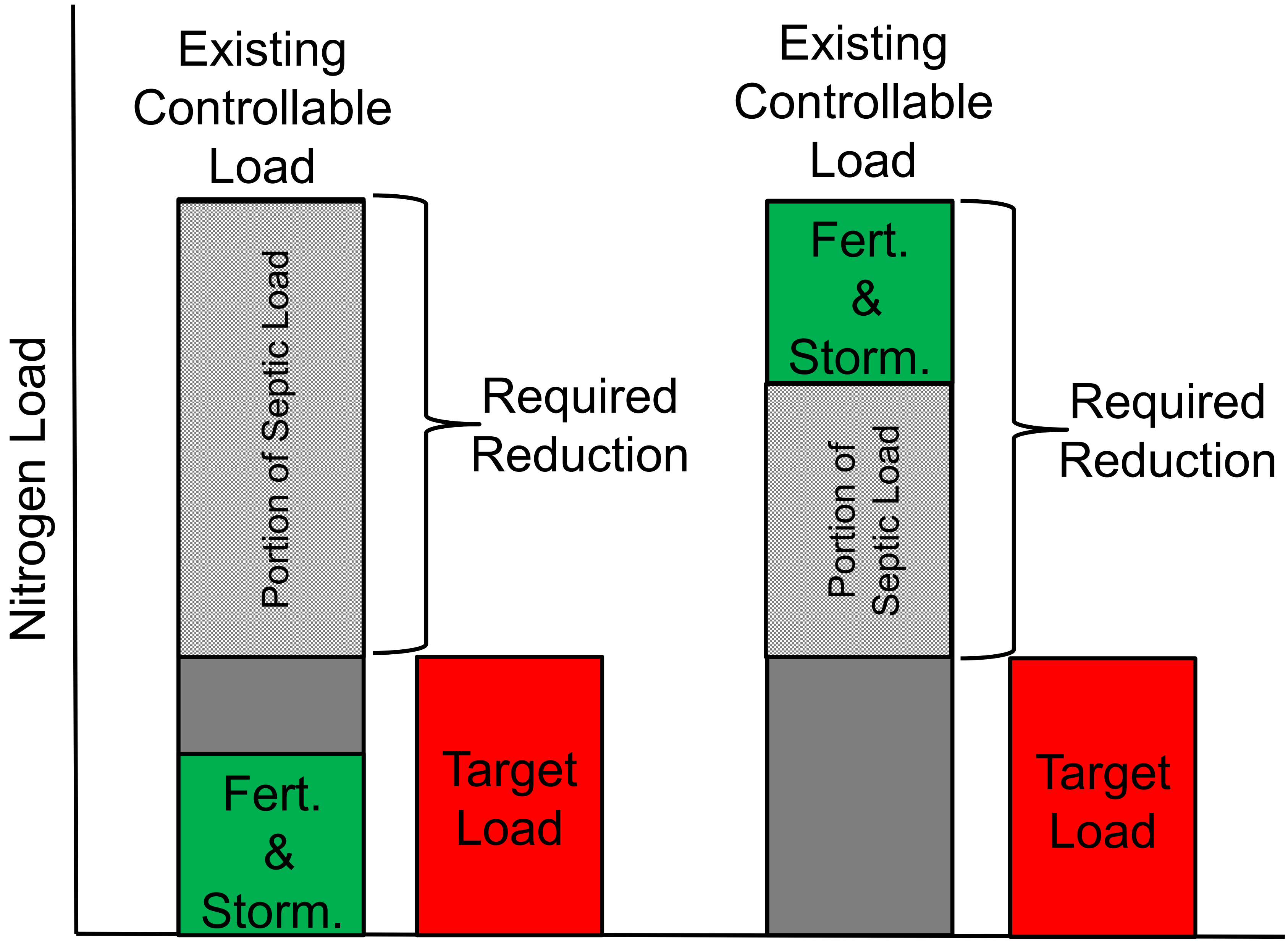
A. Greater Than 1 Dwelling Unit/acre
B. Village Centers
C. Economic Centers
D. Growth Incentive Zones

7 Supplemental Sewering



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 %


Septic 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 %


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

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7 Supplemental Sewering

Triple Bottom Line

Impacts of Technologies and Approaches

Environmental

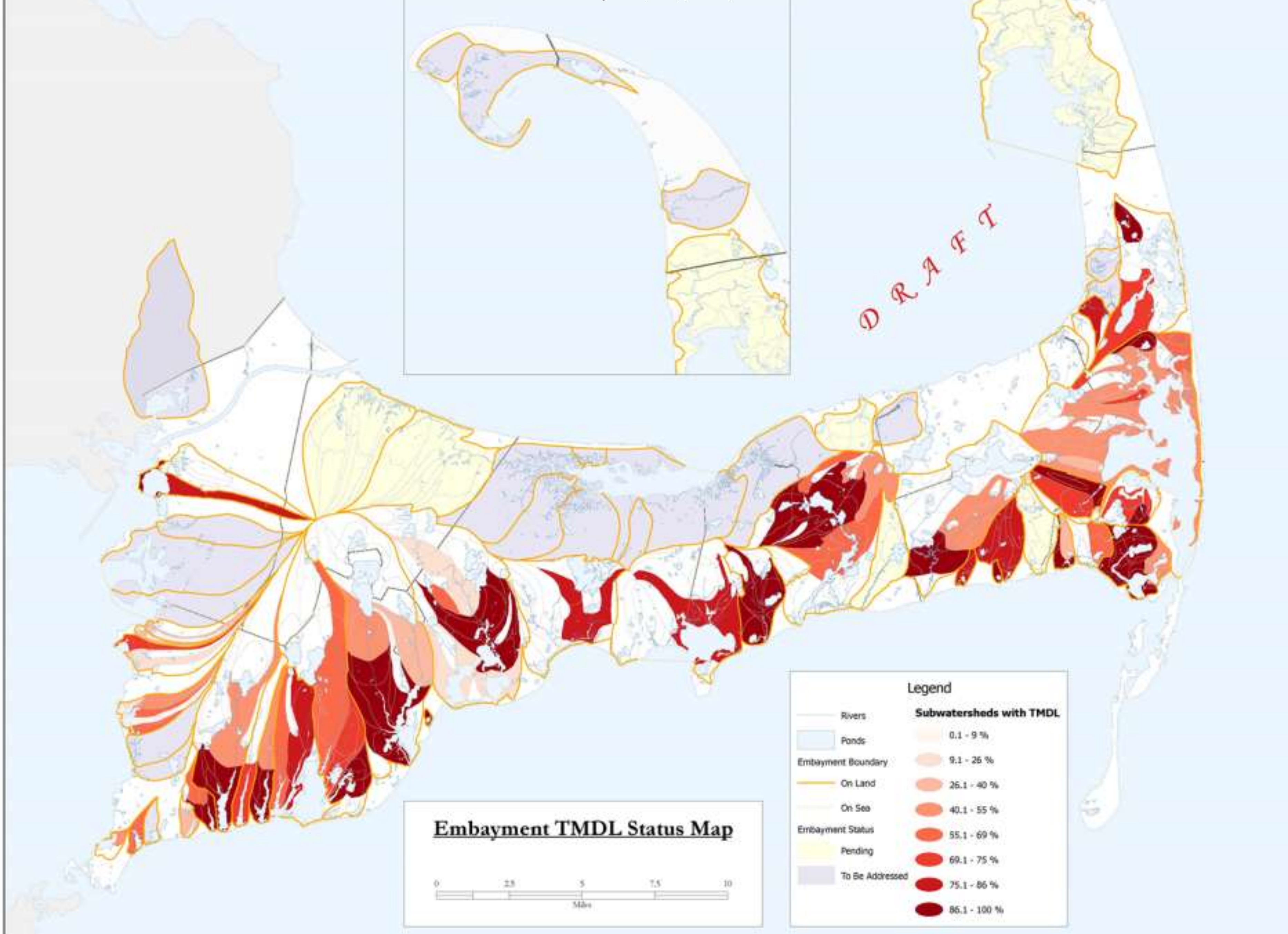
Economic

Social

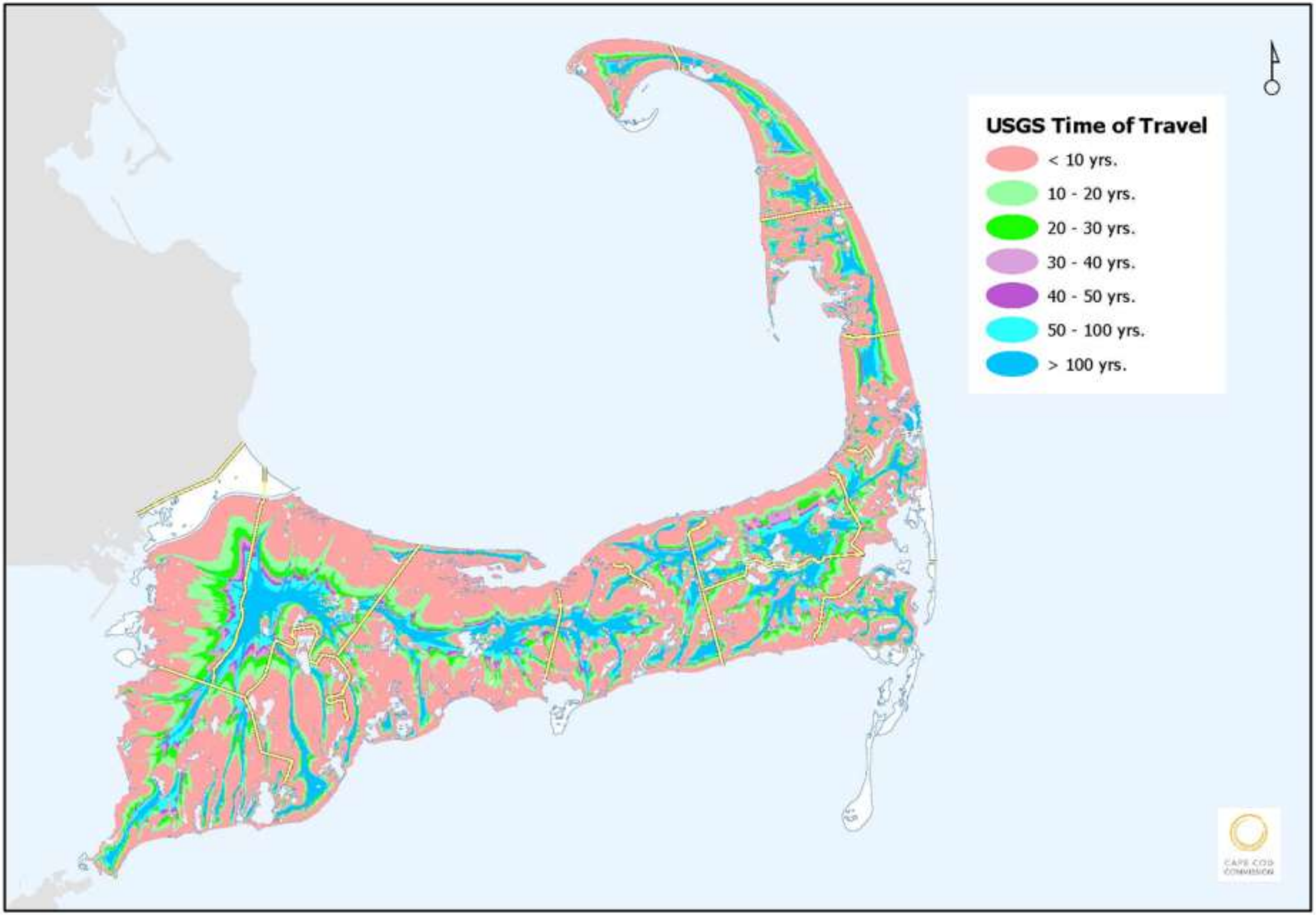
Technology Selection: Process and Principles

- 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

"Watershed Working Group - Upper Cape West/South"



"Watershed Working Group - Upper Cape West/South"



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
Upper Cape West and South Watershed Working Group

Meeting Two
Friday October 25, 2013
8:30 am- 12:30 pm
Falmouth Town Hall, 59 Town Hall Square, Falmouth, MA 02540

I. ACTION ITEMS

Working Group

- Next meeting: Meeting Three
  Monday, December 2, 2013; 8:30AM -12:30PM
  Falmouth Town Hall, 59 Town Hall Square, Falmouth, MA 02540
- Send CBI any additional comments on meeting one draft summary by November 1
- Review the Technology Matrix and continue to prepare thoughts about which technologies/approaches of interest for application in the watersheds of the Upper Cape West and South. Different scenarios and options will be discussed during Meeting Three.

Consensus Building Institute

- Finalize meeting one summary and distribute to the working group.
- Draft and solicit feedback from the working group on meeting two draft summary.

Cape Cod Commission

- Share the technology matrix and updated chronologies with the working group.
- Add incinerating toilets to the matrix of technologies.
- Verify whether or not the eco machine example from South Burlington, Vermont was abandoned.
- Add tertiary treatment to ocean outfall slide
- Add to the technology matrix biomass accumulation data and maintenance information for phytobuffers.

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

Mr. Doug Thompson, the facilitator from the Consensus Building Institute, and Ms. Erin Perry, Special Projects Coordinator at the Cape Cod Commission, welcomed participants. Ms. Perry offered an overview of the 208 Update stakeholder process.[1] In July, public meetings were held

[1] The PowerPoint Presentation made at this meeting is available at: http://watersheds.capecodcommission.org/index.php/watersheds/upper-cape/upper-cape-west-south

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 updated comprehensive 208 Plan. 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 meeting of each Watershed Working Groups will be held in October and early November and are focused on exploring technology options and approaches. The third meeting of each 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 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 Cape$_2$O game launched on October 22. She noted that over 400 people registered for the first round of the Cape$_2$O game and encouraged Working Group members to participate in the interactive, online game, which provides valuable education and input to the Cape Cod Commission.

Ms. Perry announced 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 Cape$_2$O: ur in charge; a summary of planning process to date; and discussion of the stakeholder role in the second six months of the 208 planning process

Ms. Perry reviewed the goal of the 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;

[2] Technology Fact Sheets are available at: http://watersheds.capecodcommission.org/index.php/groupjive/pluginclass?plugin=cbgroupjive&action=plugin&func=file_download&cat=1&grp=19&id=30

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

Ms. Patty Daley, Deputy Director at the Cape Cod Commission and Area Manager for the Upper Cape West and South Watershed Working Group, commented 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 the Commission will convene meetings in November to further discuss the buildout with the town representatives.

The facilitator reviewed the agenda and led introductions. A participant list is found in Appendix A. Mr. Dan Milz, a doctoral student from University of Illinois at Chicago, introduced himself and announced he would be filming the meetings as part of his dissertation research on regional environmental planning and stakeholder decision making on issues that cross jurisdictional boundaries. He said he will not publish the film or identify anyone by name in any of the documents he will produce. He will attend many meetings and is available to answer group member questions about his research.

The facilitator reviewed the meeting guidelines and spoke briefly about communication protocols. Noting that group members should not be dissuaded from communicating between themselves, he requested group members send communications about group processes to him rather than sending them to the entire group. He will then forward germane emails to the group as a whole. Questions about substantive issues should be sent to both Ms. Daley and him.

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 has engaged in a comprehensive analysis of nutrient control technologies and approaches. This analysis is distilled into: the Technology Fact Sheets, which present various information on the technologies being considered; the Technology Matrix, which includes additional information on site requirements, construction, project and operation and maintenance costs, 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.
- Some technologies are so promising that we should identify them for demonstration and pilot projects.
- Workshop three 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.

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

Ms. Daley offered a brief overview of the technologies and approaches. The following section briefly describes each technology. Participants' questions and comments about the technologies are also discussed below (in *italics)*:

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. 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 will post George Huefelder's (Barnstable County Department of Health and Environment) baseline data soon.

- *We should note that there is an ever widening range of I/A systems, some of which may be Title V compliant and others that may not be compliant. We are fortunate to have access to Huefelder's research, but given the wide range of I/A systems that are encompassed in the slide describing I/A's, there may be use in applying a weighting scheme to different I/A system alternatives*.

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 recycling such as conversion to a fertilizer. Through these means, the nitrogen 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 that separates human waste from shower, sink and other household water uses. The composting toilets use no or minimal water. The human waste 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 uses (sink and shower uses) continue to flow to the septic system. (Case example: Falmouth, MA).

- *It was mentioned the residuals go to a disposal site, but some eco-toilets recycle and recover nutrients.*

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 nutrients can be recycled by the servicing company that picks up the packages.

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).

The group made the following general comments and questions about site based technologies:

- The group discussed the need for an enforceable monitoring system of site-based technologies: One member said *the optimal functioning of several of the onsite technologies is heavily user dependent and questioned how the state could enforce proper operation and maintenance*. Another member said *this project should to try to drive industry to create systems that enable remote monitoring and ensure proper use*. A third member commented that *the project could help develop a standardized adaptive monitoring program for site based technologies that is driven by optimization of a system's performance rather than regulatory requirements.*
- Participants made the following comments about affordability of site based systems: *The delineation of floodplains in the new FEMA flood maps will add additional insurance costs for some, which will influence the affordability of the site-based systems. The cost of insurance could compromise a homeowner's ability to install a site-based system.*
- The group discussed adaptability of systems given changing social and environmental conditions: one member commented that *any options the group proposes should consider the potential impacts caused by climate change. Nitrogen removal, while important in the near term, is not the long-term problem.* A second member said *systems should be resilient to fluctuating populations as well as changes in climate.*
- *We will need to develop a methodology that enables us to standardize the characteristics of each system, then compare and contrast the systems based on this standardized information.*
- *It would be useful to provide contractors looking for building permits and homeowners with a field card of each technology that details information on cost, maintenance and operation and vendor locations. Educating them on the technologies will be important.*

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 treat septic tank effluent or primarily treated wastewater. In these systems, aeration and clarification chambers combine 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).

- *It might make sense to not use trademarked names.*
- *Yarmouth constructed a microalgae system.*
- *The South Burlington system was abandoned. It was originally constructed as an EPA pilot project but was decommissioned after pilot phase concluded. There is a system in Weston that is still operating.*

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

The group made the following general comments and questions about the neighborhood scale technologies:

- *These technologies all look residential based. If someone develops a small hotel or a mid-sized building, are these technologies economically efficient? How do growth zones or economic development areas fit into the consideration?* Ms. Daley responded that the size and location would inform whether or not a collection and disposal system might be required. Dense development areas could be sewered, but it would still depend upon nutrient removal requirements. *Another member said that such development could be served by new toilet technologies.*
- The group briefly discussed the ultimate goal of the project and nitrogen reduction credits. Some group members said the ultimate goal of addressing the nutrients was to restore the ecosystem. Another member said the ultimate goal is to reduce nitrogen in accordance with the regulation and that ecosystem restoration is a secondary goal. A third person noted the TMDL requires nitrogen reduction but said the ultimate goal is to restore estuaries and freshwater quality. This person questioned whether Towns would only consider those systems for which nitrogen reduction credits can be received or if the Towns would consider systems that have yet to be assigned nitrogen reduction credits. The member also asked how it might be possible to assign nitrogen reduction

credits to new technologies.

- Referring to a previous statement, a member said *the group might need to understand how close some of the systems are to becoming mainstream in terms of commercial development. Ecotoilets are feasible in a dense area, but the group may need to help the technology and industry by providing contractors with information about where to buy these technologies, how to install them properly, who will maintain them and how, etc. to make the technologies commercially available.*
- *Could there be state endorsed financial incentives to adopt new technologies similar to alternative energy development incentives?*

Watershed level technologies/approaches

Conventional treatment: A conventional wastewater treatment facility 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).

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).

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 and may require less land area for disposal than the traditional collection and treatment facility. 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.

- *The infiltration basin and the soil absorption systems discharge the effluent above the water table and the wick well and injection well discharge the effluent into the water* *table. The distinction is important because the location of the discharge impacts soils differently.*

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 a high level of regulatory oversight. The solution is considered due to limited land availability for disposal on Cape Cod.

- *Ocean outfalls will face significant regulatory hurdles because both the DEP and EPA would be involved.*
- *Ocean outfalls require tertiary treatment too—this could be added to the slide. An estimate should also be added into the technology matrix for the length of pipe required to dispose into the ocean.* Ms. Daley said this would be site specific.

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).

- *A more regionally applicable example was started at Penn State forty years ago.* Another commenter said *this project was spraying effluent on trees and other vegetation but it was stopped due to unexpected consequences.*

The group made the following general comments and questions about the watershed level technologies and approaches:

- *Conventional treatment is misleading title since septic systems are the conventional treatment option on the Cape.* Ms. Daley said conventional treatment was selected because this is the term most engineers use to refer to that type of system.
- *Depending on the scale, we might also consider whether or not energy generation from waste, similar to the Deer Island Biogas generation station, could be applicable to our systems. Is this possible with modular systems and at what scale does this make financial sense?* Ms. Daley said Littleton was looking at building a modular central treatment center that could expand with increasing population. Another group member said *according to the Federal Energy Management Program, approximately a million gallons of waste per day are needed to make it reasonable to install.*
- *We are testing sites for subsurface disposal in Bourne. The sites were selected outside the floodplain, but now one of the sites is included in the floodplain due to the new FEMA floodplain delineations. To what extent is the Cape Cod Commission considering floodplains in the analysis?* Ms. Daley said the Cape Cod Commission has GIS maps of the flood plains and will include this in the analysis.
- *The University of Pennsylvania example—they were spraying treated effluent on trees and woods. This was stopped due to unexpected consequences. But this is a good example to look at.*
- *Other contaminants in the system too need to be considered.*

Neighborhood or Watershed level technologies/approaches

Phytobuffers: Using trees with a deep root system to capture nutrients in the soil, particularly willows and poplars. Green plants with deep tap roots are planted as a buffer to intercept existing groundwater. The plants and 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).

- *Any idea how much biomass you get from these systems? Can we include this information as well as information about maintenance such as trimming and harvesting?* Ms. Daley said they could include biomass data and maintenance information in the technology matrix.
- *We could consider using bamboo.* Another member responded *bamboo is invasive.*

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 curtailing fertilizer costs to the irrigated areas. (Case example: Plymouth, MA).

- *Since this is recovering nutrients from the groundwater, the particulars differ from other approaches. The regulatory climate for extracting this water from the ground is very different than if you were to dispose of effluent into a wetland.*
- *Nitrogen is now calculated in the groundwater in the Midwest and included as a resource for irrigation.*

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).

- *PRBs can be used to remove phosphorous too. One foot of freshwater can hold back about 40 feet of salt water.*
- *Brewster is considering a PRB injection well.*

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 three feet of tidal range).

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 have 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 that removed by their biological cycling which puts nitrogen directly back into the atmosphere. Aquaculture can be done in man-made structures (e.g. cages, floating bags) or natural reefs.

- *The bags are viewable now in Little Pond on Narragansett Street*
- *There is no odor, the water is clear, and birdlife is coming back.*
- Ms. Daley said shellfish and aquaculture projects show a lot of promise but a member of another group who was a shellfish warden pointed out that they are living animals, which can present some hazards if relied upon too heavily. In response, a group member said *activated treatment sludge systems, which sometimes fail, are also comprised of living organisms.*

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 operation and maintenance 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 released 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).

- *Are there any examples of dredging being done to reduce nitrogen?* Mr. Mark Owen, consultant for the Cape Cod Commission, said there is a proposal in Barnstable to dredge Mill Pond with the though that deepening it will increase the freshwater in the system and help to naturally attenuate the nitrogen. But, an endangered species in the pond may preclude this measure.
- *Disposal of the dredged material is costly, too.*

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”.

- *A 120 home dense development with an RUC system was planned in Yarmouth; only sixty homes were built due to the economic decline.*

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 can be reduced using tail water recovery systems. Site-specific assessments are needed to estimate load reductions. Ms. Daley added that the Cape Cod Commission designated a cape-wide Fertilizer Management District of Critical Planning Concern (DCPC) that 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. She said Falmouth already has a bylaw in place. Barnstable County will be conducting a public education process around fertilizer use.

- *Is there a timeframe by when adoption of the regulations must be complete?* Ms. Daley said it must be done by the end of December; but new legislation may extend the adoption period.
- *Most boards of health are looking into this regulation. The enforcement part is not feasible, but it is a step in the right direction for education purposes.* Ms. Daley commented that the Cape Cod Commission released a pesticide and fertilizer study for

public comment. The study includes quantities and types of materials used by utilities, homeowners, and municipalities.

- *Fertilizer regulations should be reasonable and practical for golf courses. They are in a tough position because the greens must look a certain way or their jobs are on the line; yet they do not want to use nitrogen because it is expensive.*
- *The fertilizer regulation in Falmouth is slightly stalled due to a lack of manpower.*

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.

- *Is this a form of nitrogen trading?* Ms. Daley said trading could occur on many different things provided the right market incentives are in place.

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.

Ms. Daley noted that in many instances, one of the solutions may not achieve the TMDL, but pairs of solutions could help to reach 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/Chatham- *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*

General questions and comments:
Comments made throughout the presentation:

- *Can you please add incinerating toilets to the matrix?* Ms. Daley responded that incinerating toilets could be added to the matrix.
- *We need more comparative analysis and a deeper review of the nitrogen removal rates associated with the technologies since there seems to be some inaccuracies and omissions in the data sheets. For example, the 85-90 percent nitrogen removal rate for urine diverting toilets is not correct. Grey water streams should also be noted as sources of nutrients from homes. One data sheet indicates that central sewer systems remove nitrogen, but this is not true.*
- *We should remember that the nitrogen removal rates associated with some of these technologies differ from what the state will give credit for without intense monitoring. If we are looking to acquire nitrogen removal credits, we will likely need to do pilot tests and prove their removal capacity.*
- *Will the issues we raised be added to the Technology Matrix?* Ms. Perry said the Technology Panel had yet to complete their work so some of these issue may be added to or corrected in the matrix. The final matrix will be distributed prior to the December meeting.
- *It would be good to include the dollar per pound of nitrogen removed, the amount of carbon dioxide emissions per pound of nitrogen removed, and the amount of water used per pound of nitrogen removed on the Technology Matrix.* Ms. Daley said the Technology Panel plans to include nutrient recovery, water use, energy use, and cost per pound for nitrogen removed in the Technology Matrix.
- *Aquaculture in Falmouth is only a demonstration site. Nothing has yet to start in Little Pond.*
- *Resource recovery is a very interesting idea at the regional level but incorporated at sub watersheds.*
- *Resource recovery from wastewater bio-solids could be added to the matrix--it could work regionally.* In response, another group member said that *resource recovery from sludge does not require a lot of space. Some systems can allow you to compost the waste if it is dried.* Another member *said dewatering the waste would not be feasible here.*

IV. PROBLEM SOLVING PROCESS AND PRINCIPLES

Ms. Daley explained that the Working Groups will focus on 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 needs to be reduced. For example, the portion of septic load that needs to be reduced could be made smaller if Cape Cod takes on 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.

A group member noted that until 1990 the amount of nitrogen deposited from the atmosphere appeared to be a steady input, but since then it appears the amount in rainfall is decreasing. This decrease is presumably due to emissions control technologies in the Midwest. The group member requested the Cape Cod Commission help communities on the Cape to collect consistent data on nitrogen in rainfall.

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 complex traditional options later (e.g. sewering). 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 sewering or other grey infrastructure management options

Ms. Daley said two scenarios will be presented at the third workshop. The first will look at a more traditional approach with permitted technologies to meet the TMDLs. The second approach will look at the target reduction goals and other wastewater management needs and address them first with technologies presenting low barriers to implementation. The group will discuss these scenarios and develop an approach to meet the goals using both green and grey infrastructure.

Ms. Daley displayed a USGS map of ground water percolation rates on the Cape. She noted that the different percolation rates across the Cape might suggest mixing and matching technologies to achieve impact in a specific timeframe. *A member questioned whether the map was accurate, stating the Woods Hole time of travel didn't look right.*

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 (Triple Bottom Line). The facilitator then asked the group to think about the environmental, social and economic impacts and discuss how the technologies might help or hinder each of these elements. Group members made the following comments. They are grouped by theme where appropriate while recognizing many categories are linked:

Speed/Timing:

- *I like the top down and bottom up reverse logic. Timeframes are very important. We have to meet them and must give adequate chance for things to prove themselves. But at some point in time there will be a regulatory control that spurs us to move on.*
- *Speed of impact is relative to the technology—which technologies take a long time to remediate the problem and which will be more quickly adopted by the population.*
- *Given the difference in percolation rates across the region, we can implement some actions that will improve the waters of the coastal ecosystem while simultaneously taking other actions to remedy the problem up stream. This way we would deal with the immediate problem and the upstream, longer-term problem too.*

Reasonable Growth Assumptions:

- The group discussed buildout after a group member asked if the seven-step approach considers buildout. Ms. Daley said the scenarios to be presented at the third workshop will only consider existing development. *A group member said it seems more practical to consider buildout. Another group member mentioned there are two types of buildout, theoretical and practical; the difference between the two, respectively, is what is possible and what is likely. The member suggested it would be useful to gear the scenarios toward the practical buildout. Several other members agreed.*
- *A flow neutral by-law that would control flow at 110 gallons per bedroom is on Falmouth's Town Warrant. This is a low barrier method to reduce nitrogen and temper growth. The seventh step of the seven-step process are low barrier technologies because they are approved by the state, but it may not show the fastest impact or be affordable. The speed of impact and affordability should be considered when selecting treatment options.*

Performance Ranges:

- *Some technologies labeled as ecotoilets should be categorized separately since performance varies across the systems under this label. Another group member asked how they will determine the effectiveness of each technology and whether or not a margin of error would be applied to account for technologies used incorrectly.* Ms. Daley said the technology matrix will contain information to determine effectiveness and margins of error.

Real Costs:

- *Some of the standard eoctoilets have a footprint of 2x3 feet. It is important to recognize the size limitations of installing some of these systems into homes and to think about what really must take place for them to be adopted.*

Adaptability and Resilience:

- *Preference should be given to systems adaptable to future regulations that may address contaminants of emerging concern.*

Multiple-Benefits:

- *Options or combinations of options that provide multiple benefits should be particularly valued (e.g., those that both reduce controllable nitrogen and provide other ecological benefits or avoid the environmental harm associated with other choices).*

Low-hanging fruit:

- Several group members suggested starting with strategies and approaches that are easily implemented, have systemic benefits and are least expensive.

Regulatory/Permittable:

- *Important to understand the regulatory hurdles each option faces in obtaining "credit" for nitrogen reduction.*

Social Aspects:

- *Community outreach and education will be necessary to build acceptance. Supporting the local contractors and average citizen will be key to gaining public buy-in.*
- *Familiarizing the community with the technologies will be critical to community acceptance. Community members should be involved early so they know what they will face long before it is actually here.*

Incentives/Disincentives

- *Incentives in the form of nitrogen credits or taxes for nitrogen produced could help incentivize people to adopt new technologies. For example, perhaps we could use the money that would otherwise be spent on sewers and develop a grant program for adoption of specific technologies.*

Affordability

- *Government subsidies are sometimes needed to spur adoption. How can we incentivize companies to get involved? Since the Cape is a potentially large market for the companies making these technologies, it would be worthwhile investigating whether or not they would help set up pilot projects at reduced costs.*
- *We tried to get sewering in Buzzards Bay, but the public did not accept it because many of them had already invested money into Title V systems. We will need to consider that some people will be reluctant to implement other technologies because they already spent money on septic systems.*
- *For affordability, we need to look at what is the cheapest option that will achieve regulatory limits.*

Other

- *When selecting technologies, we should think about the scale of waste in comparison to trash. The amount of human waste produced per person per year is much smaller than the amount of trash produced per person per year. Given how small this amount of waste is per year—approximately 5 medium garbage cans per year—packaging toilets are a feasible option.*
- *It might be valuable to do a "thought experiment" with a technology like packaging toilets. This would allow us to determine the reasons for using packaging toilets, the challenges it would face, how to deal with questions of regulatory changes to make it work, etc.*
- *There is no guarantee the ecosystem will recover if we achieve the TMDL targets. Therefore, perhaps we should first focus on those areas in decline and attempt to restore dead ecosystems second. We are likely to see greater impact in systems that are still somewhat functioning. A group member responded we* should take care *to be careful about how we characterize ecosystems—calling a system dead may not be accurate.*
- *Please use a different symbol for the composting toilets since they do not have water tanks. It would also be good to distinguish between permittable and non-permittable technologies on the fact sheets.*

Technology Selection: Process and Principles

Ms. Daley noted that the Working Group had identified many of the principles that the Cape Cod Commission hoped would 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.
- *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 surface or groundwater). There are pros/cons to each approach 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:
Monday, December 2, 2013
8:30AM -12:30PM
Falmouth Town Hall, 59 Town Hall Square, Falmouth, MA 02540

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.). During the meeting, the Cape Cod Commission will use tools to calculate ideas/options and their impacts. Working Group participants should come prepared to offer 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

- A group member asked how the watersheds on the military base will be addressed. Ms. Daley said this topic is being addressed internally.
- Dan Milz, University of Illinois at Chicago, asked the group members if anyone had tried to use the GIS layers on the Cape Cod Commission's website. One member said he had tried but had some difficulties working with it. Ms. Daley said she was aware others were having issues too and requested people to contact her if they also encounter difficulties accessing the data.

APPENDIX ONE: MEETING PARTICIPANTS

Upper Cape West & South Workshop 2
October 25, 2013
Attendance

1. Earle Barnhardt	-	
2. Michael Ciaranca	-	Sate of MA, Joint Base Cape Cod
3. Cynthia Coffin	-	Bourne BOH
4. Wesley Ewell	-	Bourne Wastewater Coordinator
5. Cheryl Holdren	-	FACES
6. Nate Jones	-	Health Agent, Town of Sandwich
7. Sia Karplus	-	CWMP, Falmouth
8. Hilde Maingay	-	
9. Dan Milz	-	University of Illinois, Inst. of Envir. Science and Policy
10. Ed Nash	-	Golf Course Supt. Assoc.
11. Mark Owen	-	AECOM
12. Korrin Petersen	-	Senior Attorney, Buzzards Bay Coalition
13. Jerry Potamis	-	Wastewater Superintendent, Falmouth
14. Sallie Riggs	-	Wastewater Advisory Committee, Bourne
15. Julian Suso (from 10:30am)	-	Town Manager, Town of Falmouth
16. Virginia Valiela	-	CWMP, Falmouth