Cape Cod 208 Area Water Quality Planning
Herring River Watershed Working Group

Meeting Two
Monday, October 21, 2013
8:30 am- 12:30 pm
Harwich Town Hall, Selectmen's Meeting Room

Meeting 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

Herring River Group

Technologies and Approaches

What is the stakeholder process?

Public Meetings | Watershed Working Groups

Goals, Work Plan & Roles — July

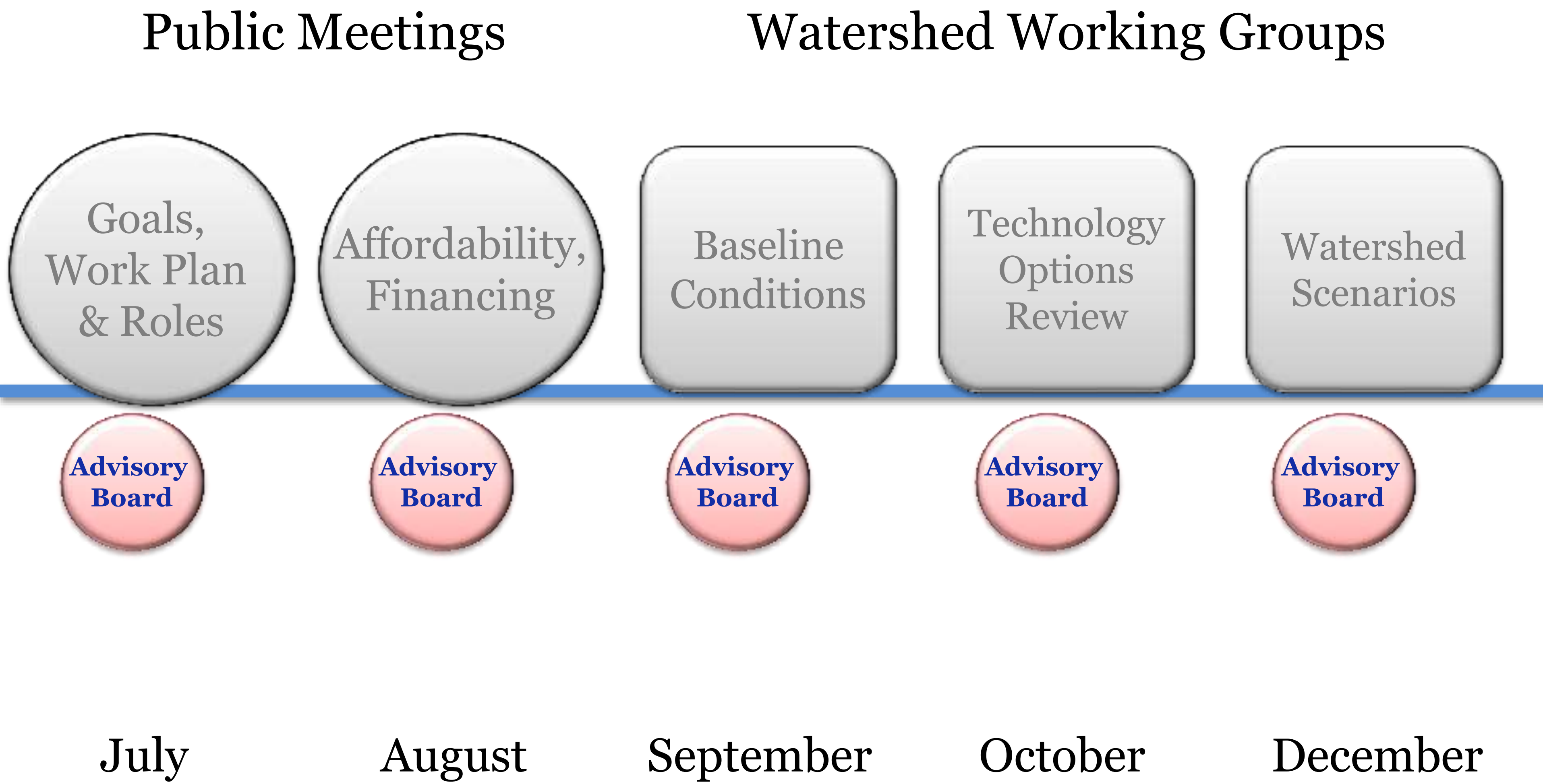
Affordability, Financing — August

Baseline Conditions — September

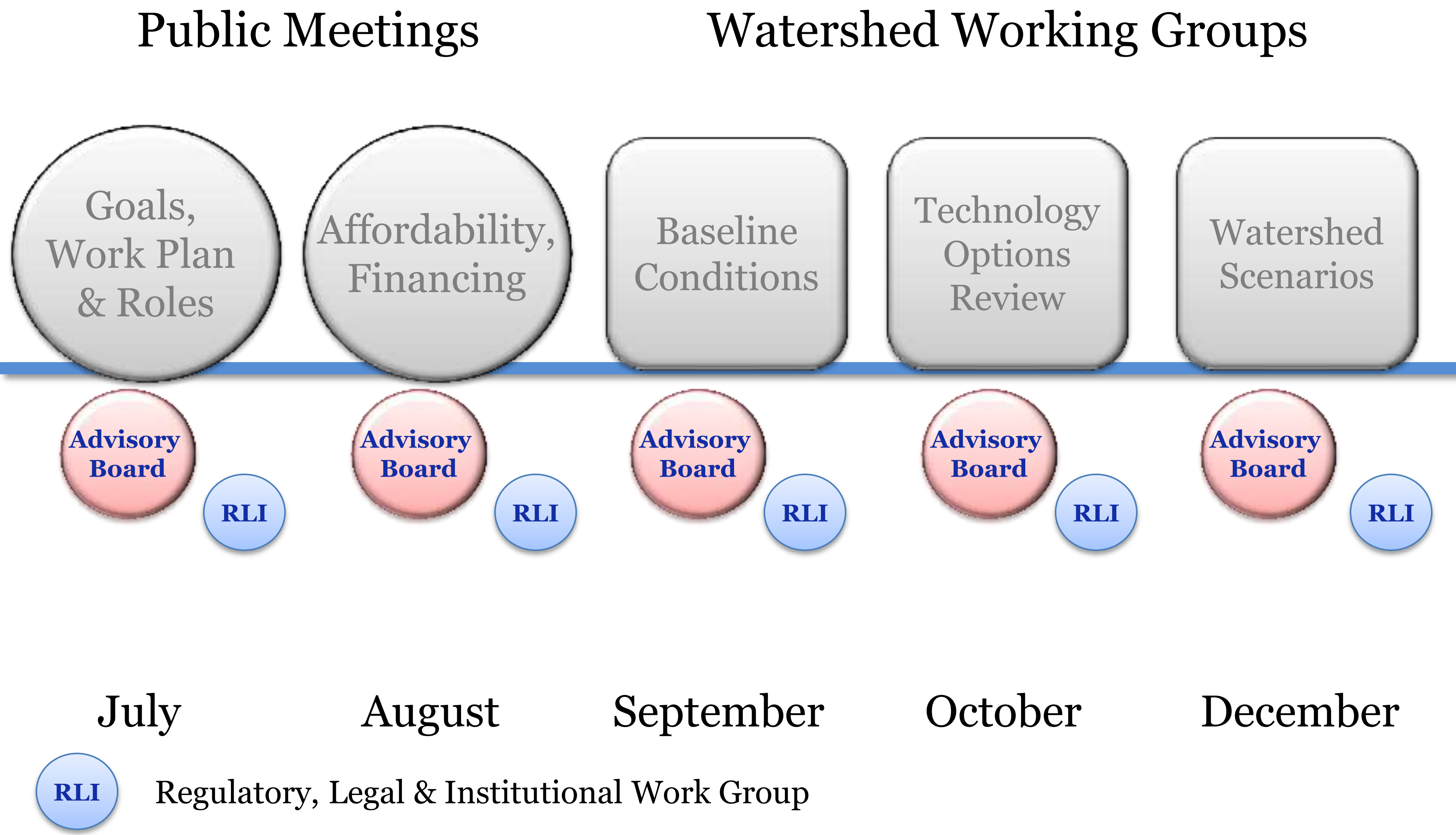
Technology Options Review — October

Watershed Scenarios — December

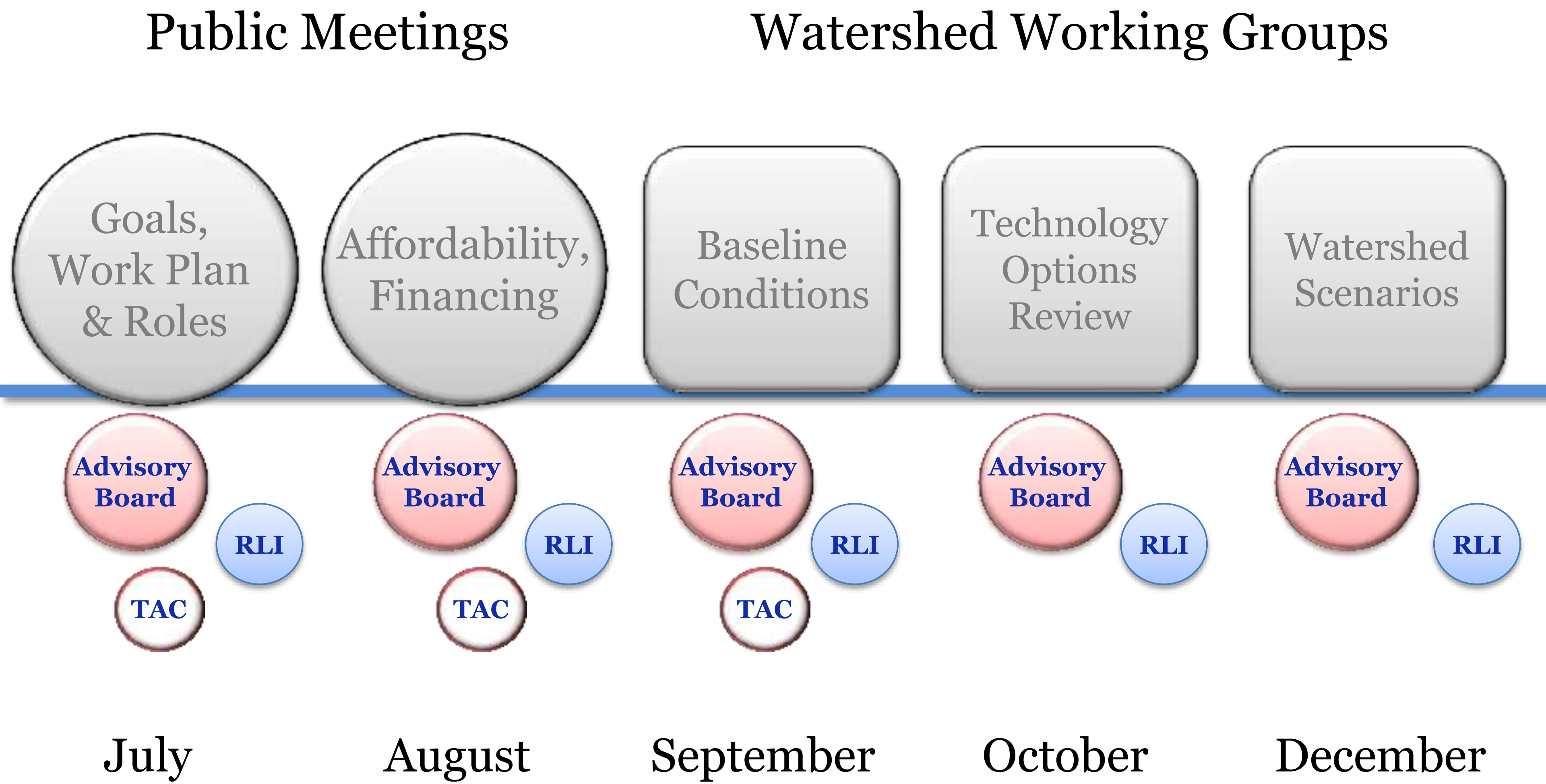
208 Planning Process



208 Planning Process



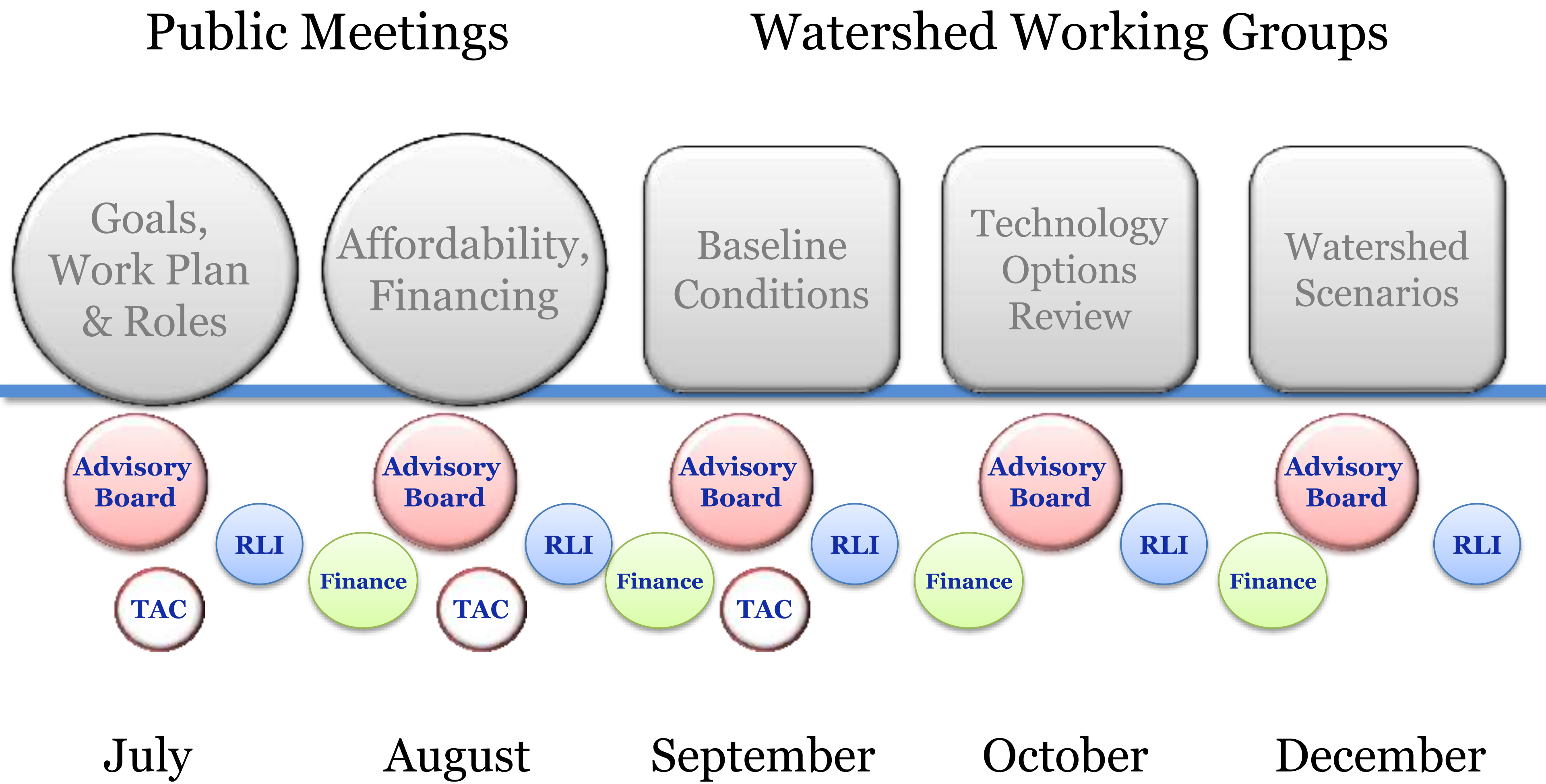
208 Planning Process



RLI — Regulatory, Legal & Institutional Work Group

TAC — Technical Advisory Committee of Cape Cod Water Protection Collaborative

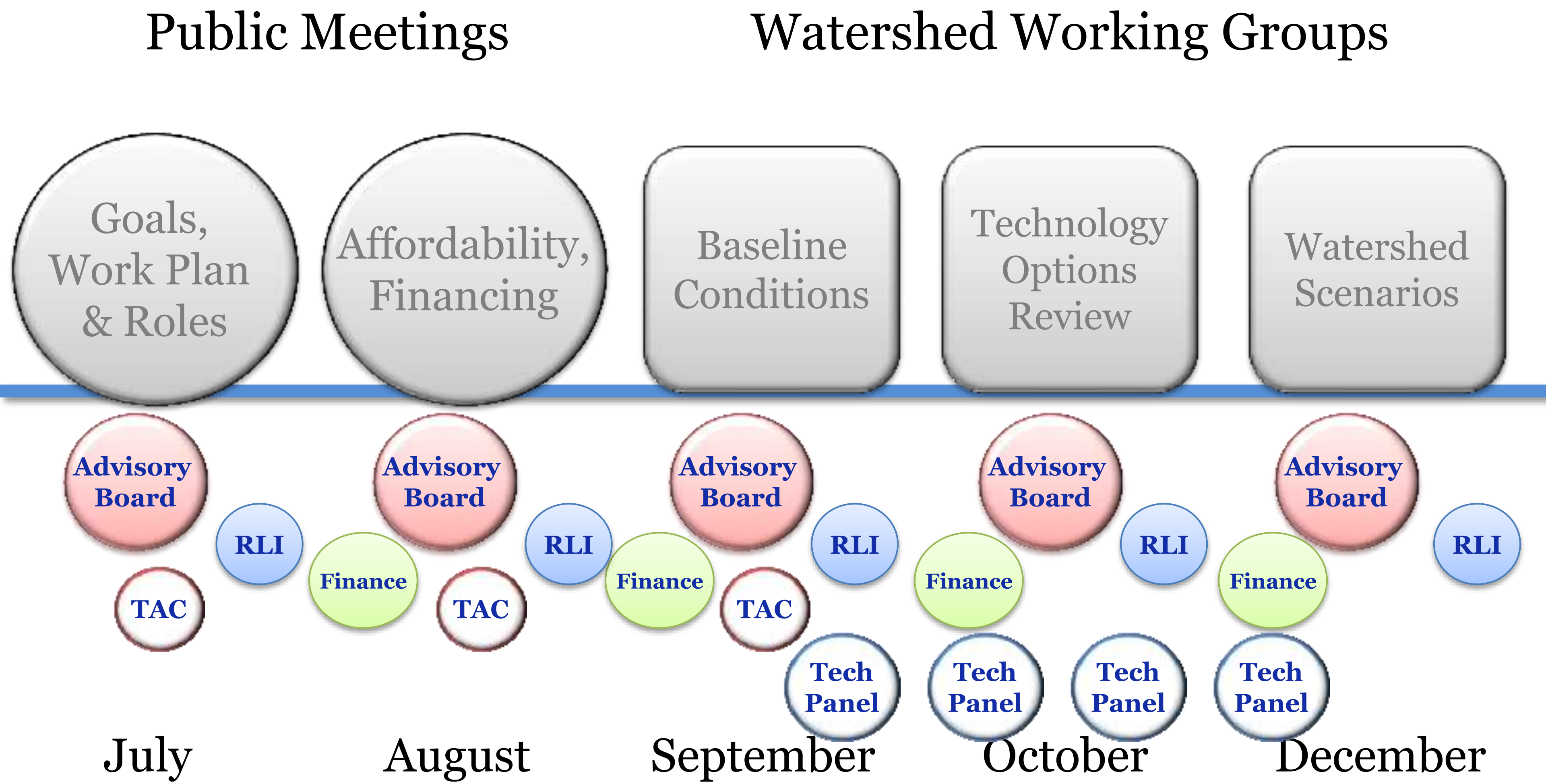
208 Planning Process



RLI Regulatory, Legal & Institutional Work Group

TAC Technical Advisory Committee of Cape Cod Water Protection Collaborative

208 Planning Process



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

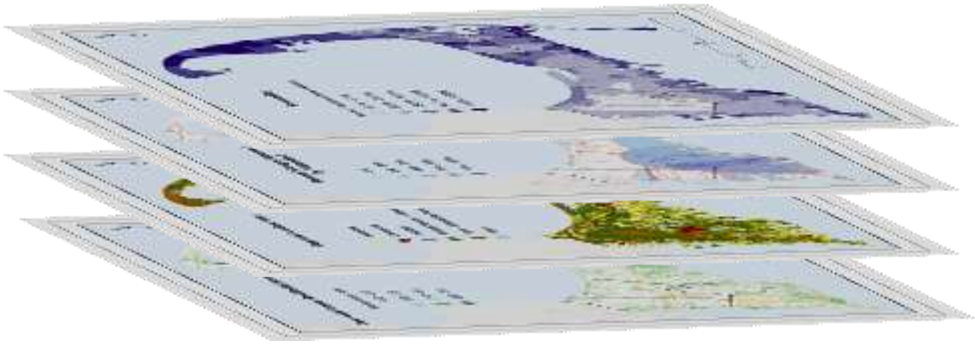
11 Working Group Meetings: Sept 18-27

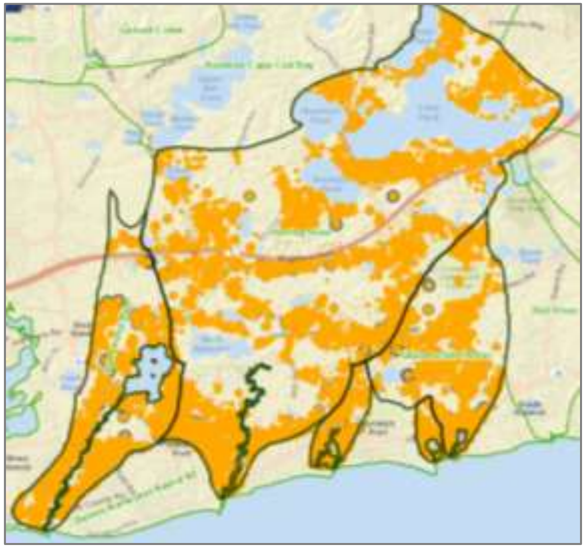
Technology Options Review

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.

Technologies and Approaches for Improving Water Quality

- ❑ Comprehensive analysis of nutrient control technologies and approaches.
- ❑ Not all of the technologies and approaches will be applicable to Cape Cod.

Technologies and Approaches for Improving Water Quality

- Comprehensive analysis of nutrient control technologies 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.

Technologies and Approaches for Improving Water Quality

- Comprehensive analysis of nutrient control technologies 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 3 will embark on hands on problem solving in each watershed to meet target load reductions.

Technologies and Approaches for Improving Water Quality

- Comprehensive analysis of nutrient control technologies 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 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.

Technologies and Approaches for Improving Water Quality

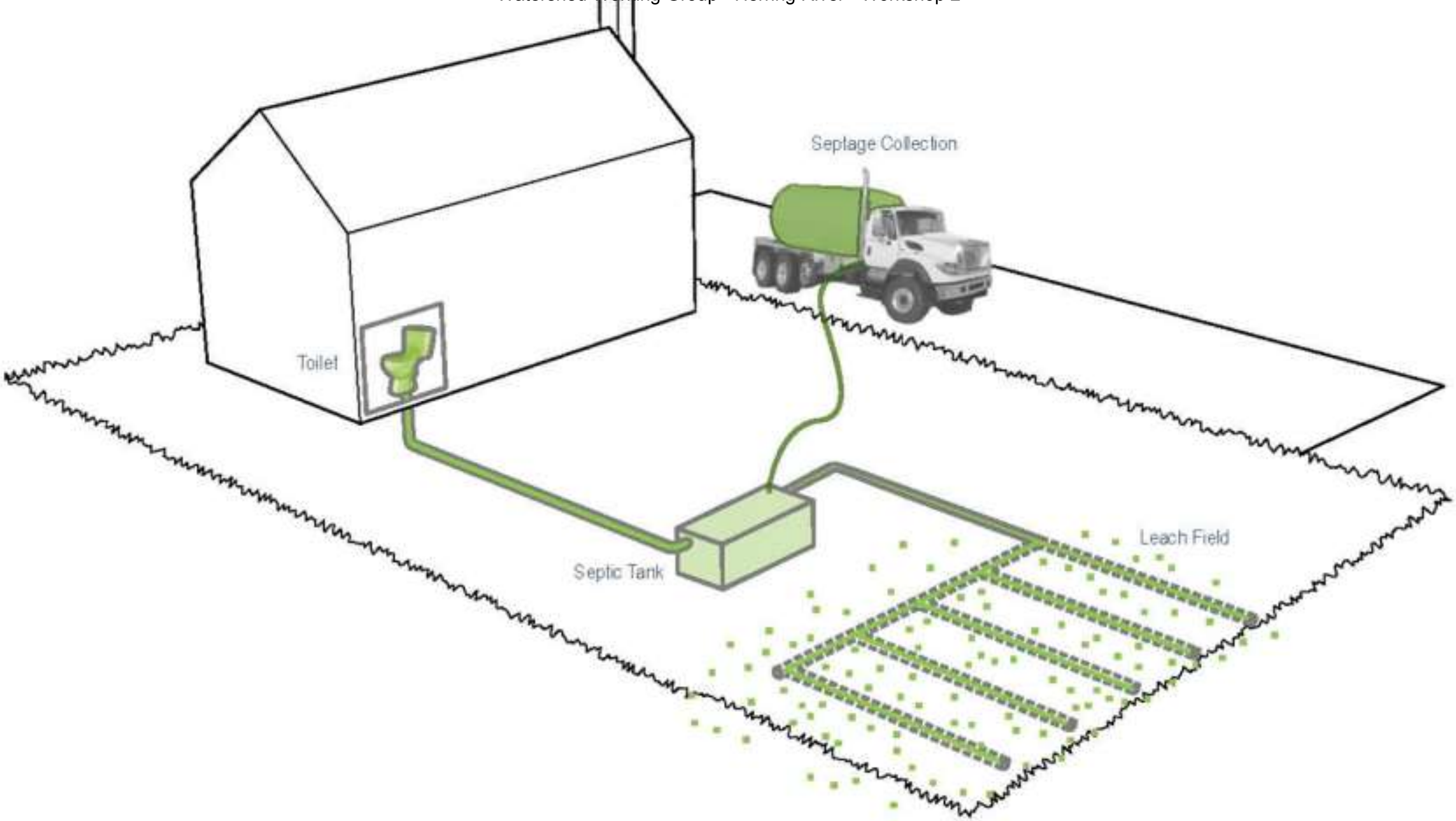
- Comprehensive analysis of nutrient control technologies and approaches.
- Not all of the technologies and approaches will be applicable to Cape Cod.
- Some technologies are so promising that we should identify them for demonstration and pilot projects.
- Workshop 3 will embark on hands on problem solving 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.


Site Scale | Neighborhood | Watershed | Cape-Wide
Compact Development
Remediation of Existing Development
Fertilizer Management
TDR
Transfer of Development Rights
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
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

Solutions: Site

Site Scale | Neighborhood | Watershed | Cape-Wide

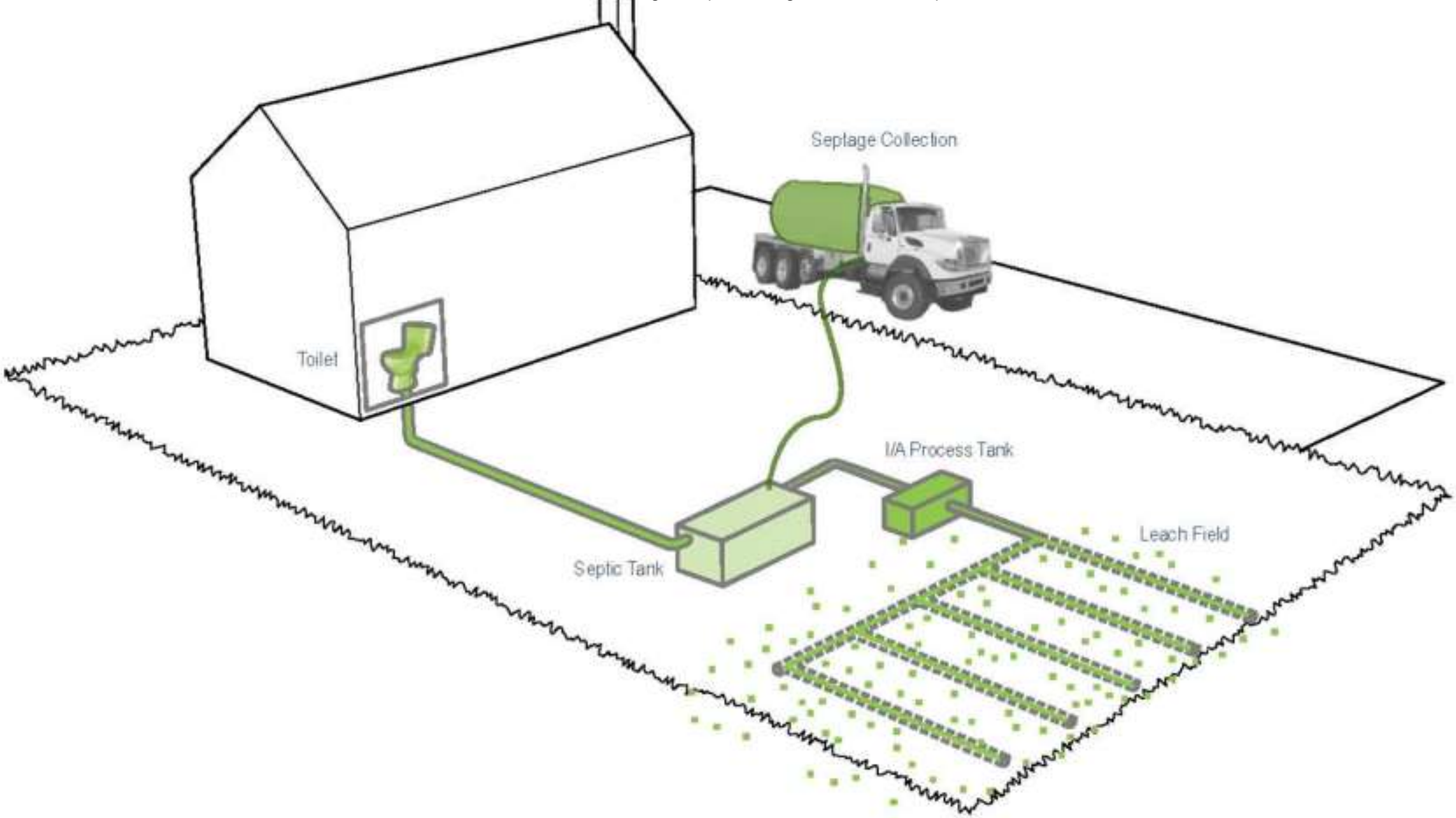
- Compact Development
- Remediation of Existing Development
- Fertilizer Management
- Transfer of Development Rights
- Stormwater BMPs
- Standard Title 5 Systems
- Cluster & Satellite Treatment Systems
- Conventional Treatment
- I/A Title 5 Systems
- STEP/STEG Collection
- Advanced Treatment
- I/A Enhanced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

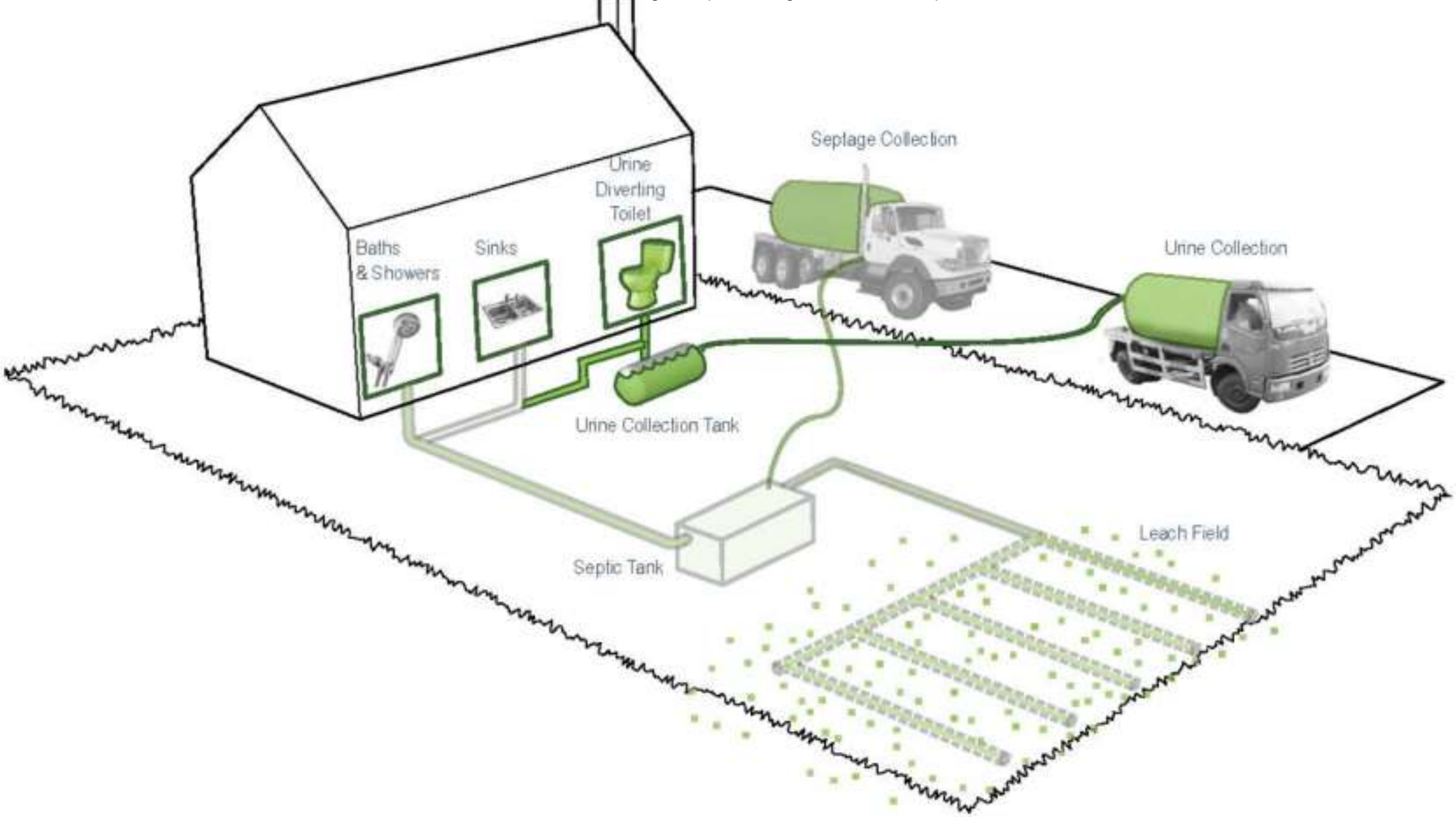
Standard Title 5 Systems

Title 5



Scale: SITE
Target: WASTEWATER

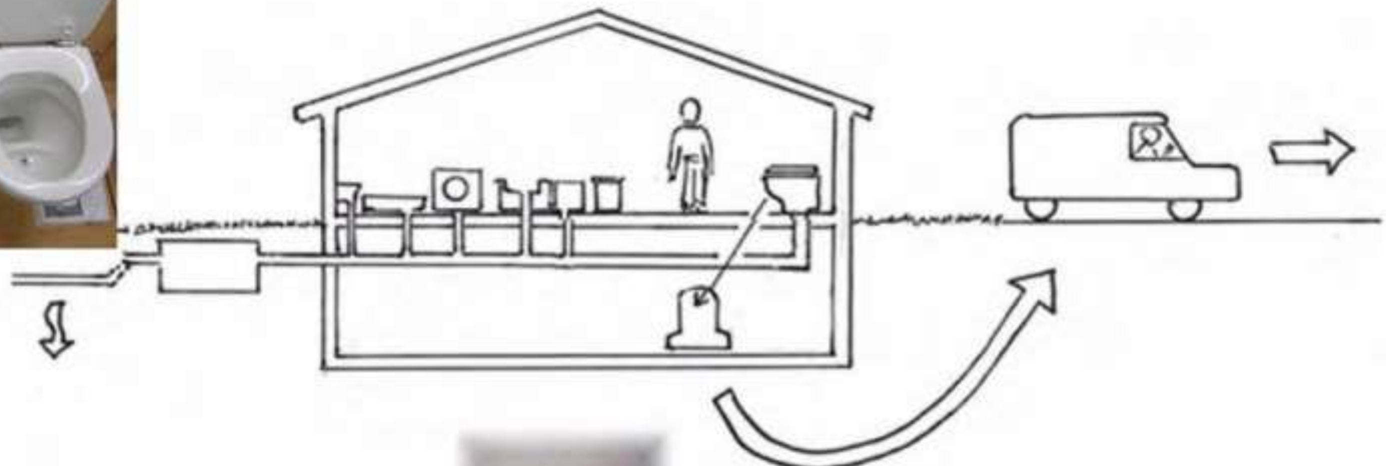
I/A Title 5 Systems



Scale: SITE
Target: WASTEWATER

Toilets: Urine Diverting

Waterless
Urinal

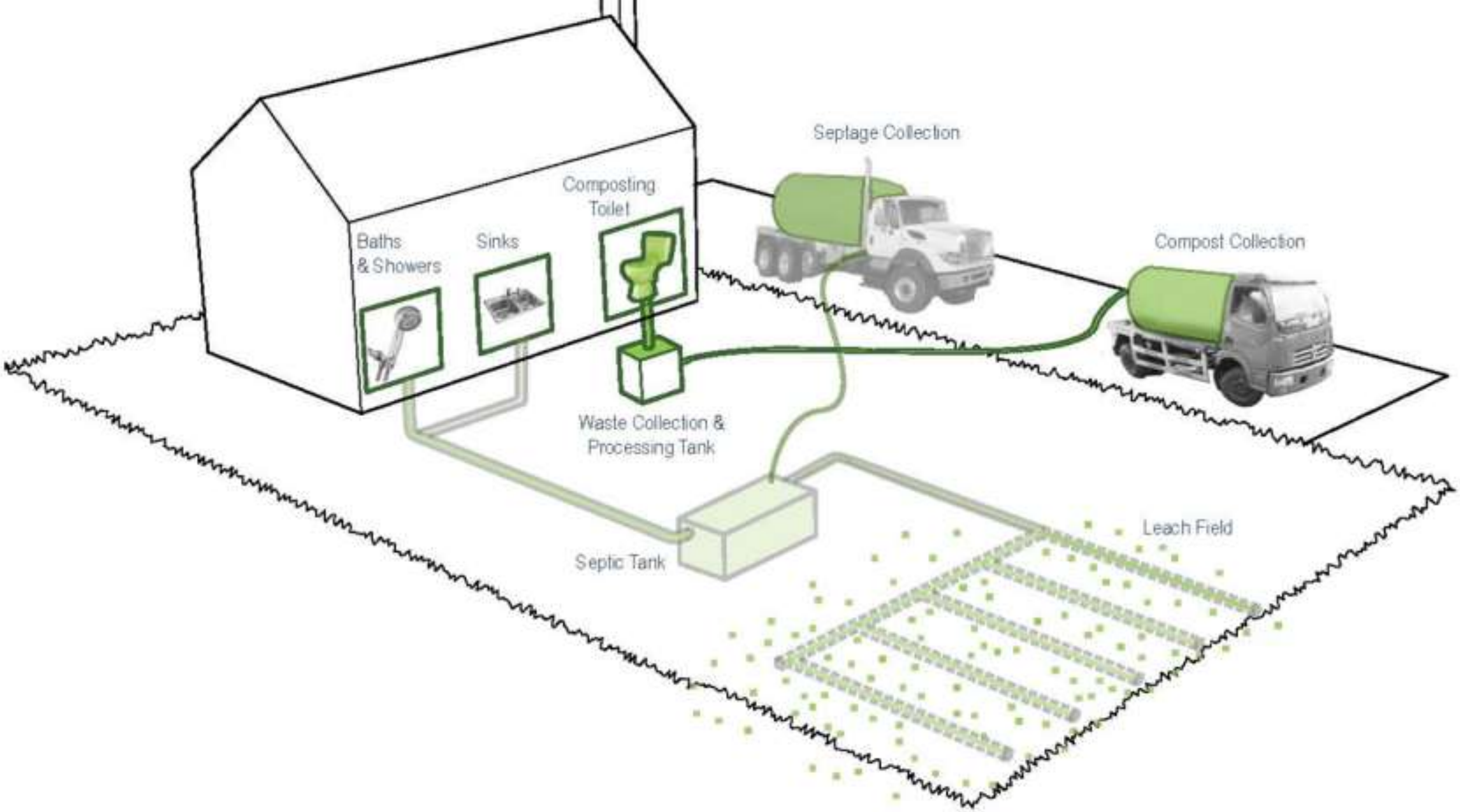


IBC container
(220 gallons)

40" x 40" x48"

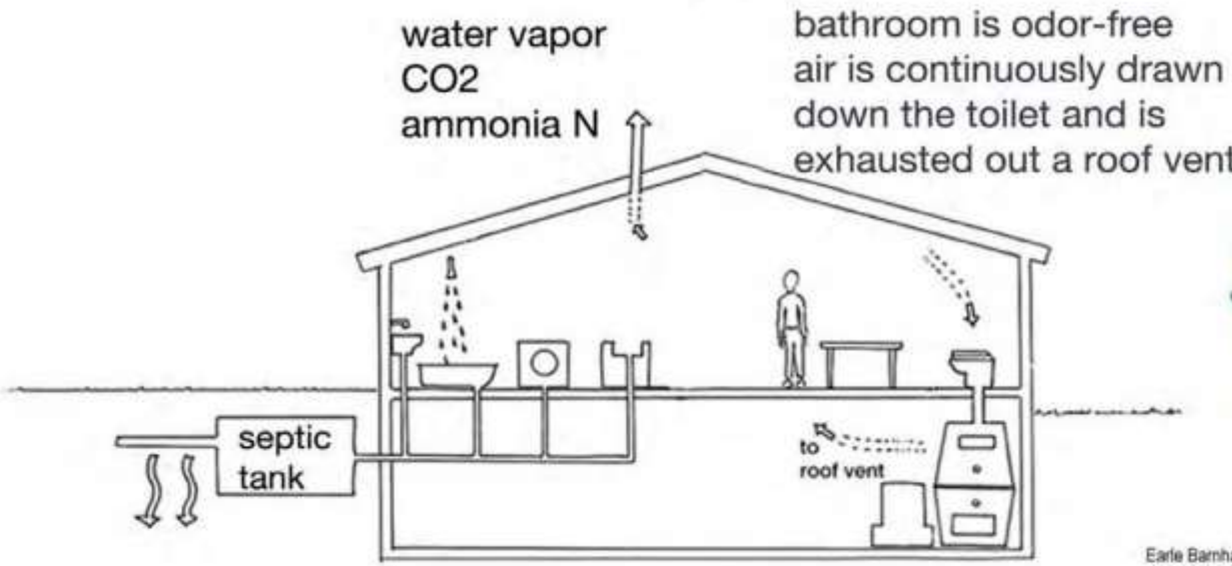
Source: Earle Barnhart, The Green Center Inc. and Horsley-Witten Group Inc.

Toilets: Urine Diverting



Scale: SITE
Target: WASTEWATER

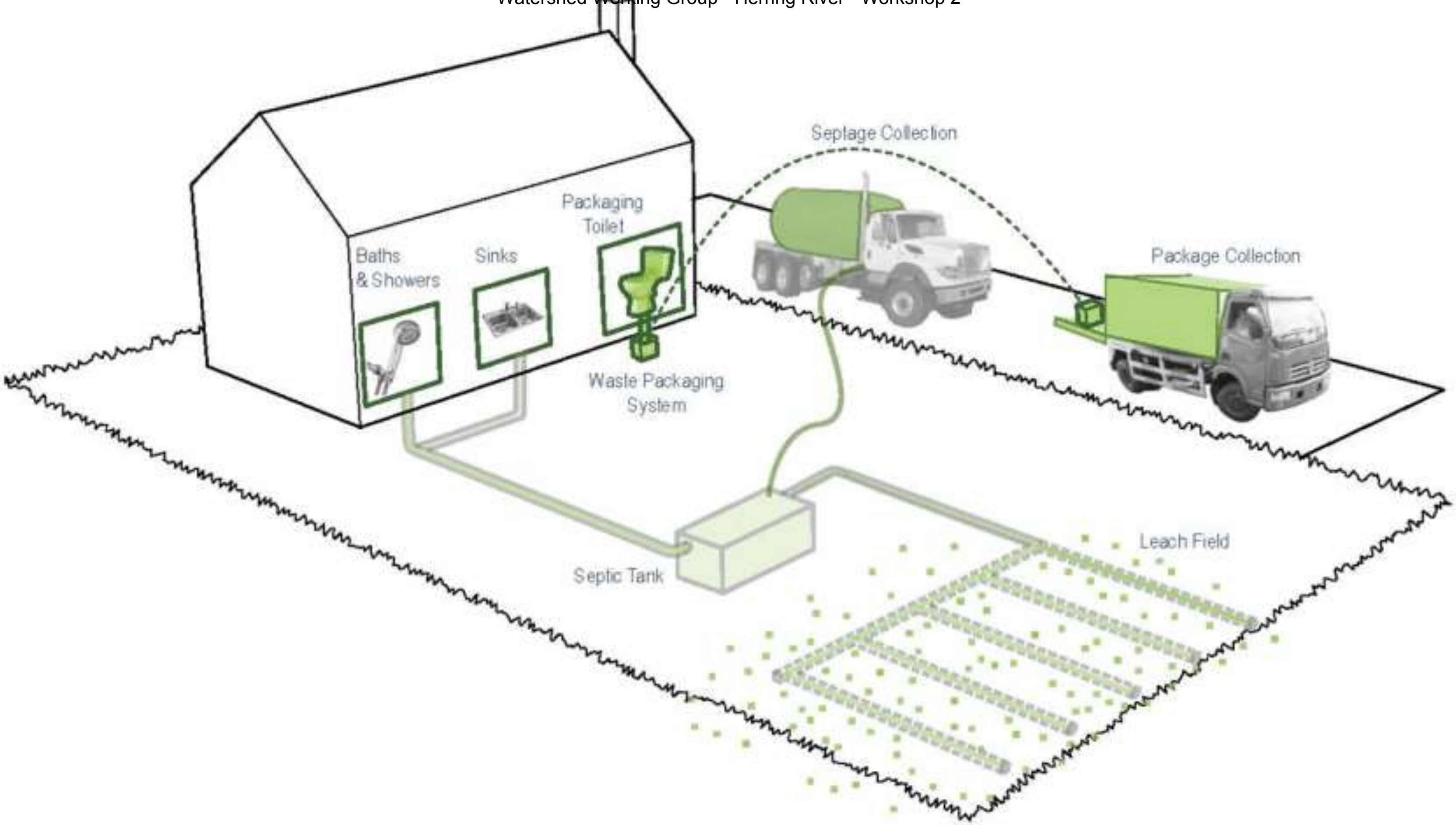
Toilets: Composting



Earle Barnhart
The Green Center, Inc

Source: Earle Barnhart, The Green Center Inc.

Toilets: Composting

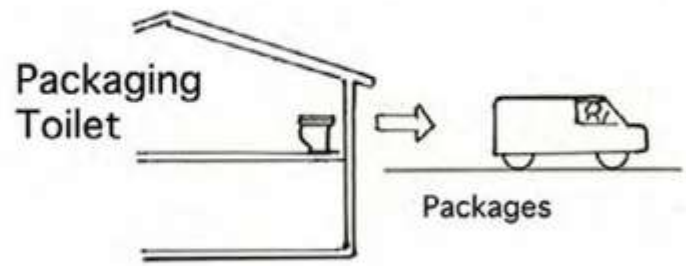


Scale: SITE
Target: WASTEWATER

Toilets: Packaging

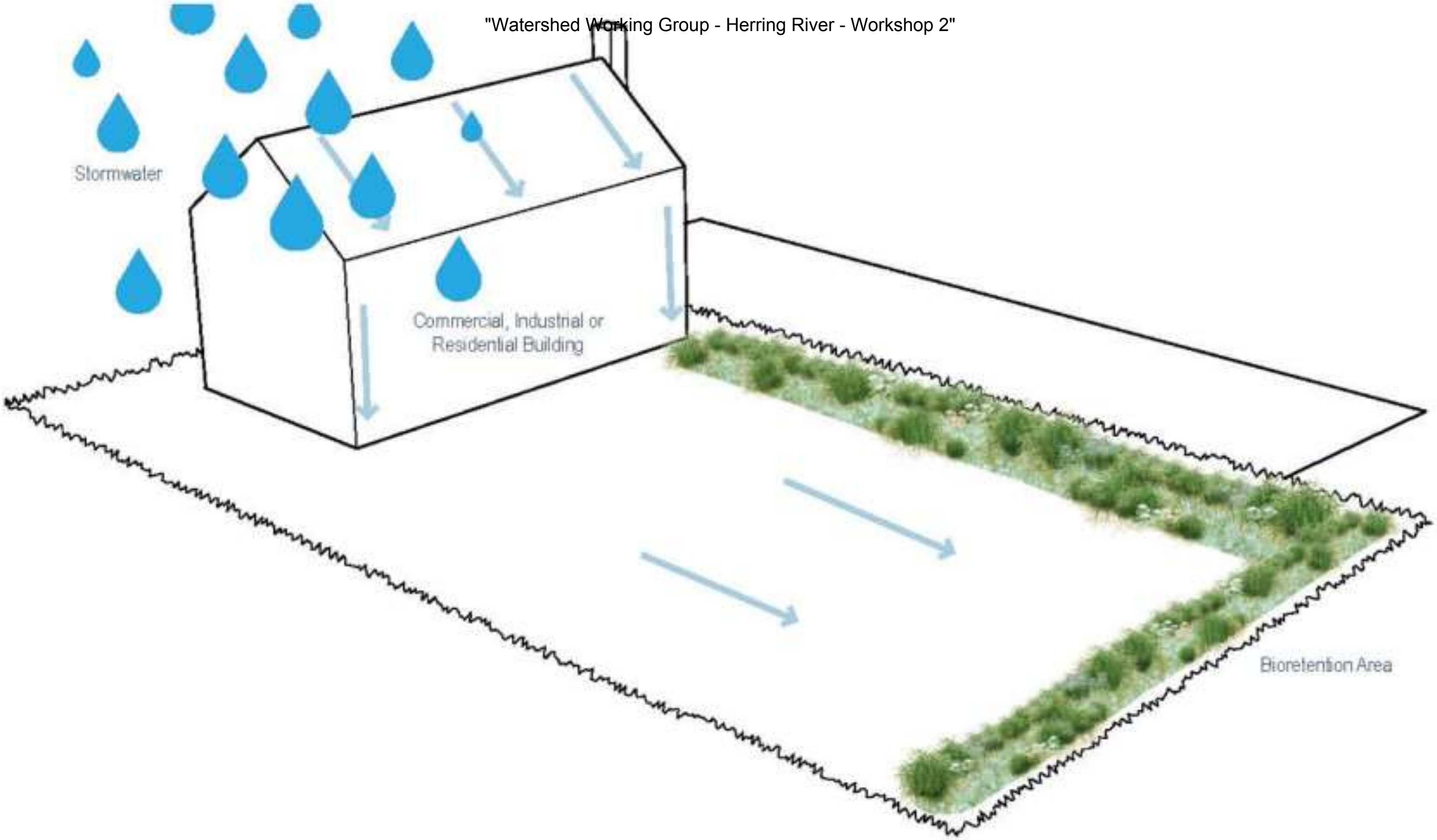
PACTO®

LOOWATT



Source: Earle Barnhart, The Green Center Inc.

Toilets: Packaging



Scale: SITE
Target: STORMWATER

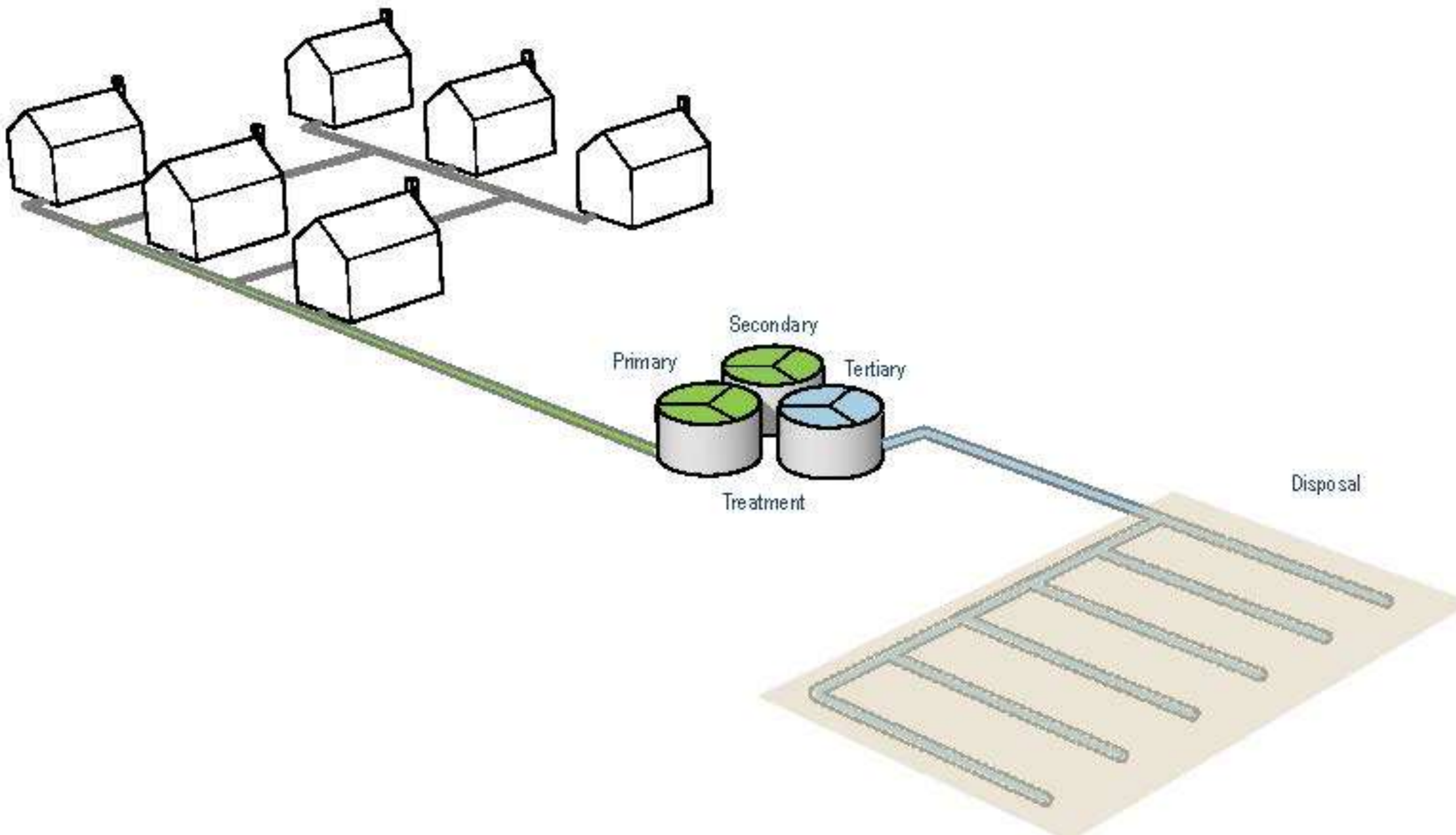
Stormwater: Bioretention /
Soil Media Filters

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

Stormwater: Bioretention / Soil Media Filters

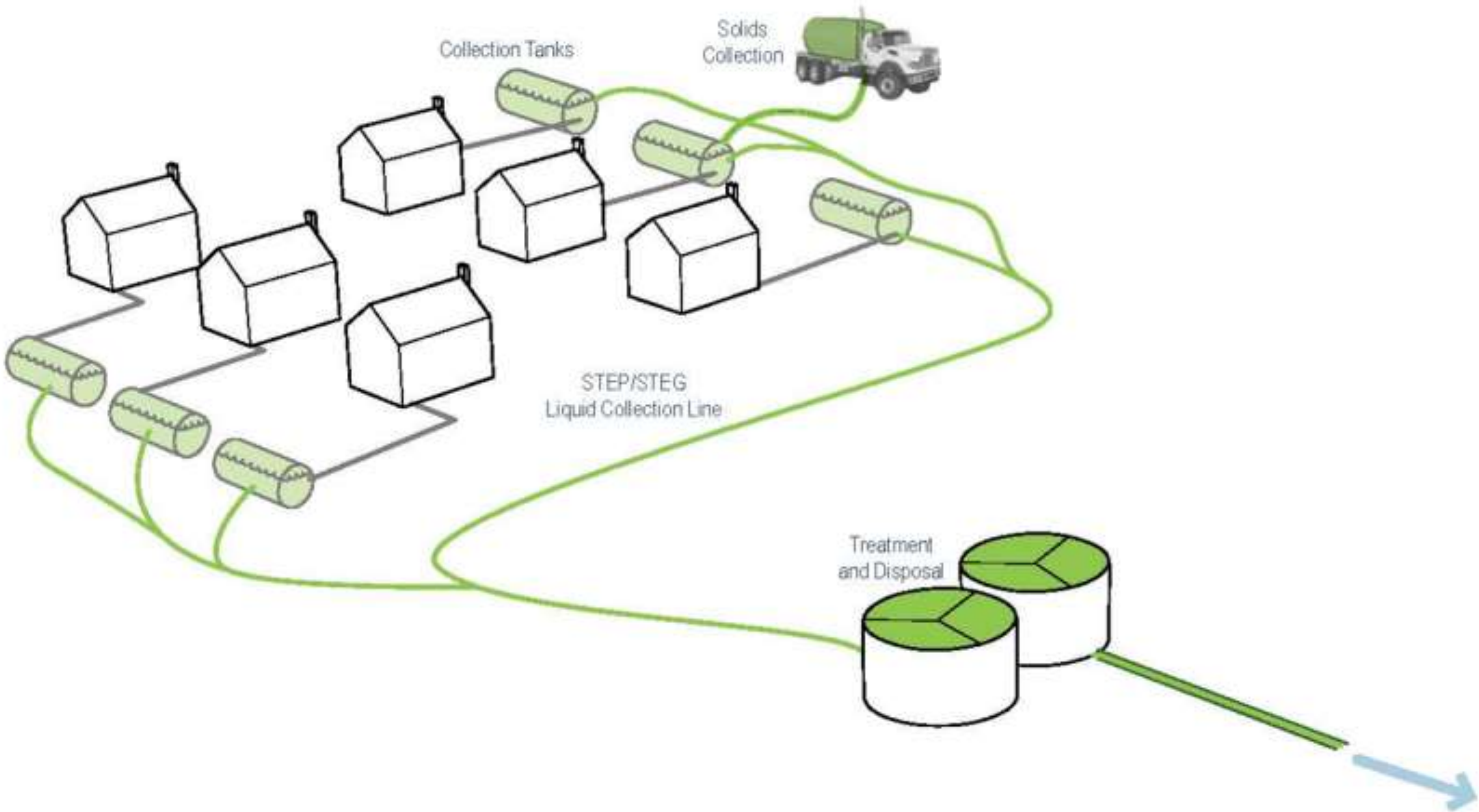
Rain Gardens


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



Scale: NEIGHBORHOOD
Target: WASTEWATER

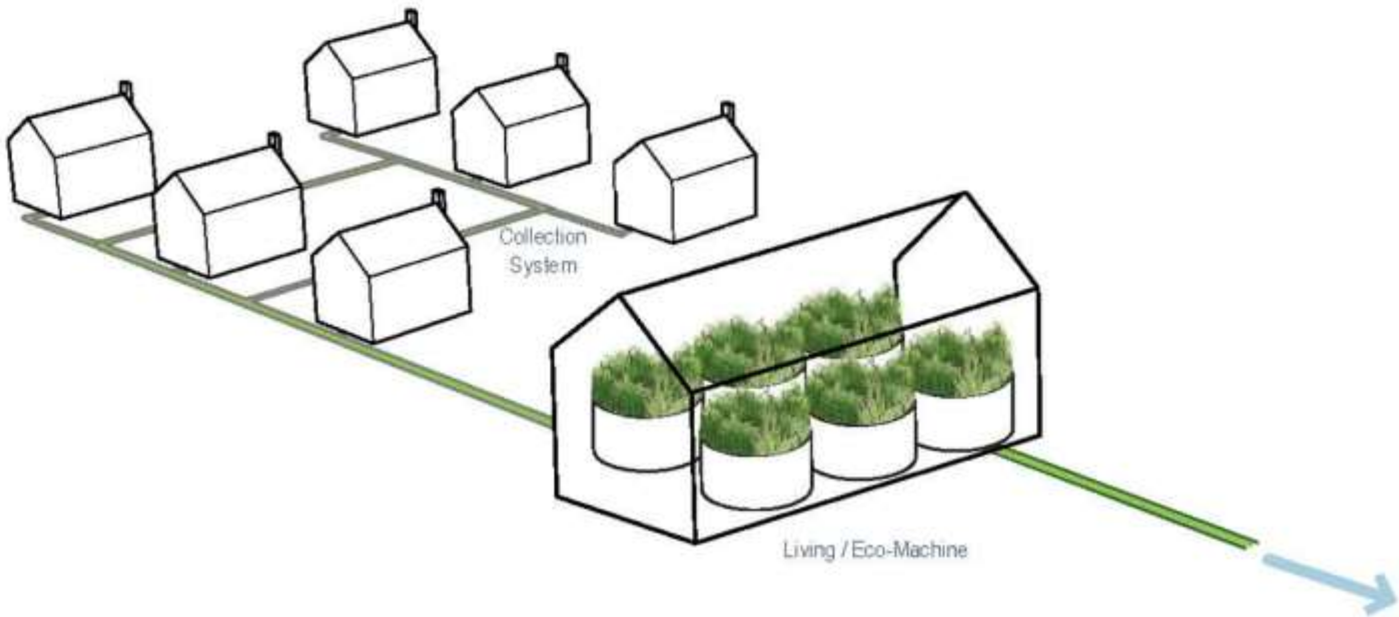
Cluster & Satellite Treatment Systems



Scale: NEIGHBORHOOD
Target: WASTEWATER

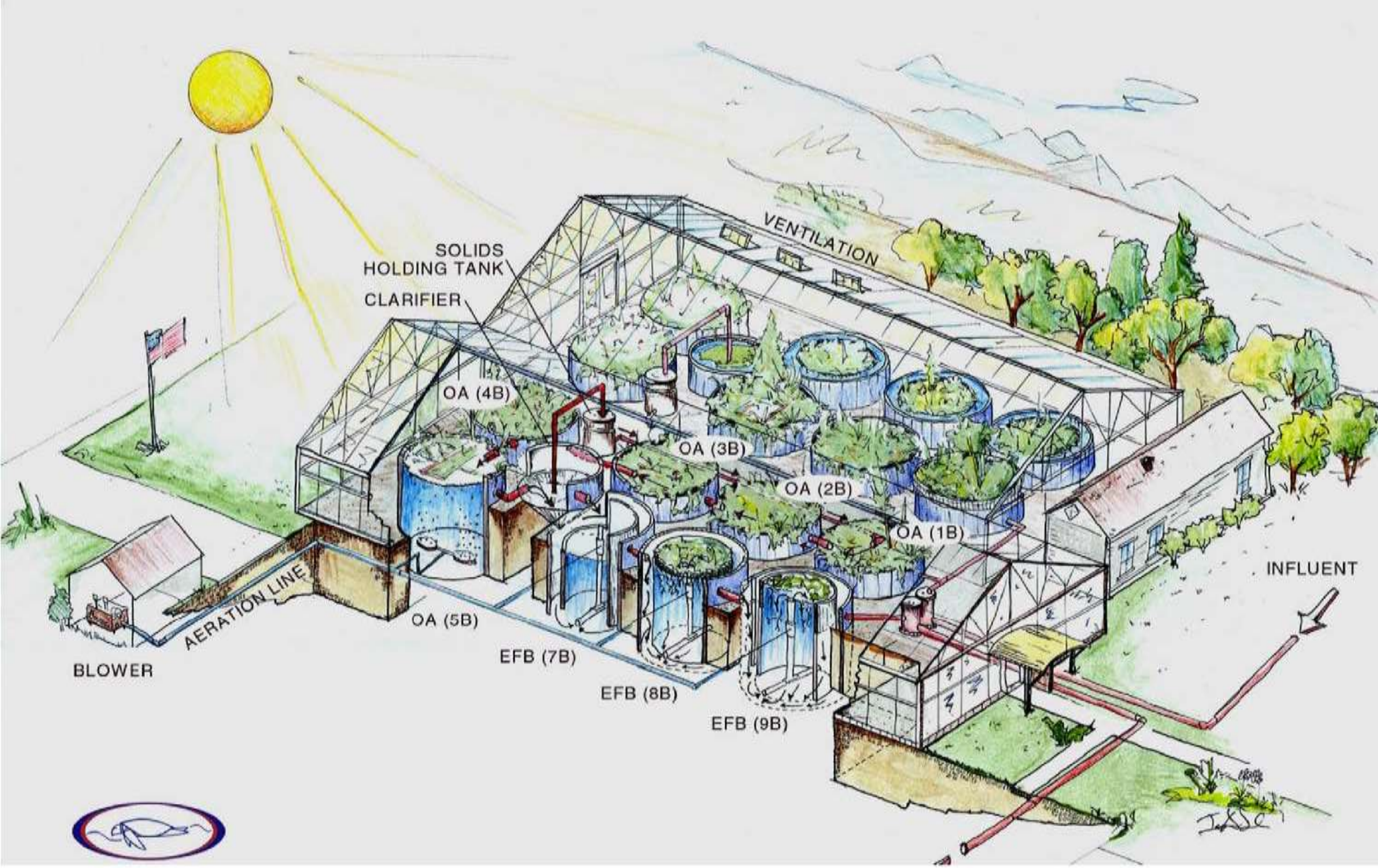
STEP / STEG Collection

STEP/
STEG



Scale: NEIGHBORHOOD
Target: WASTEWATER

Eco-Machines and
Living Machines

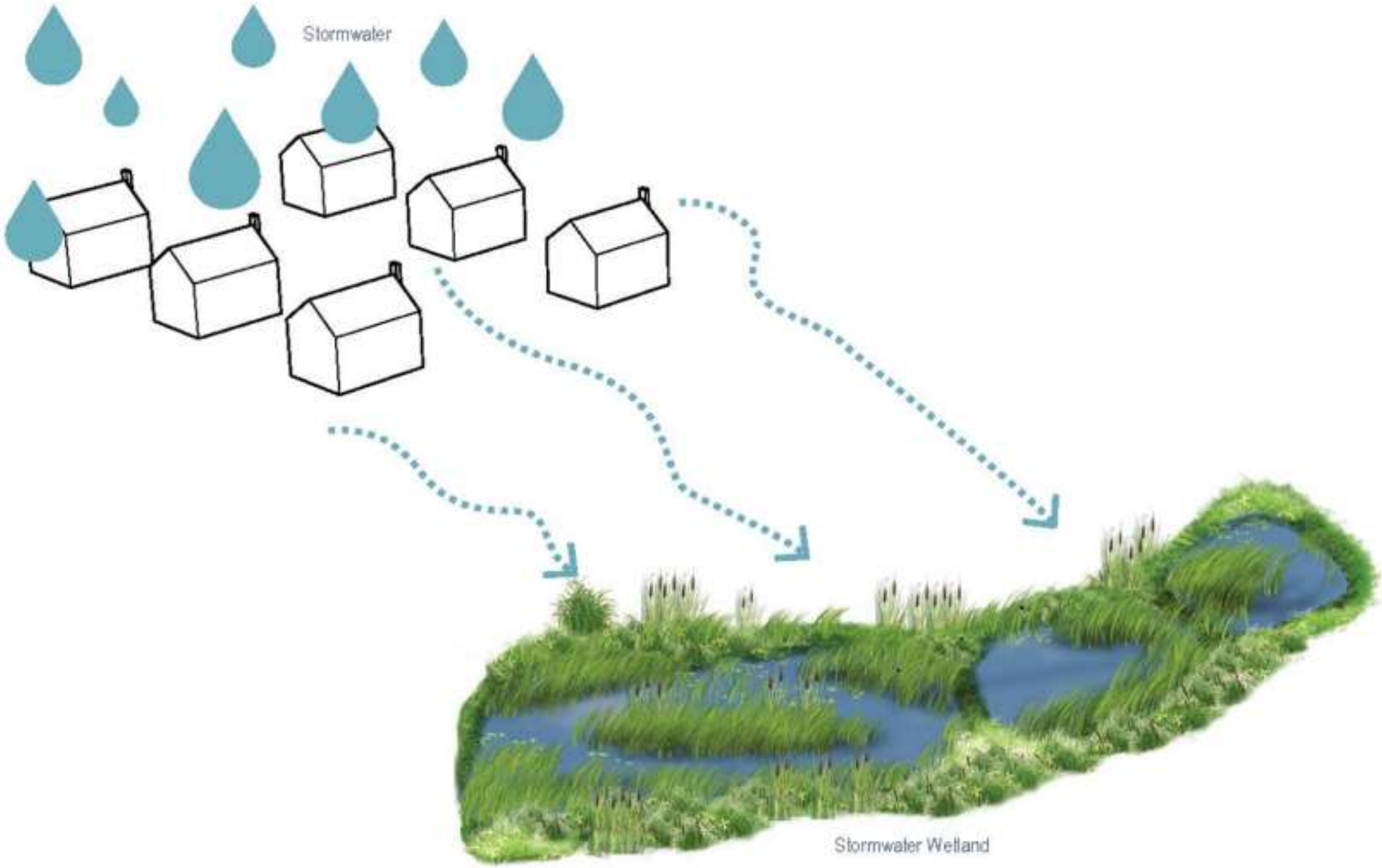


Precedent: Living Machine, South Burlington, VT
Source: Todd Ecological

Eco-Machines and Living Machines

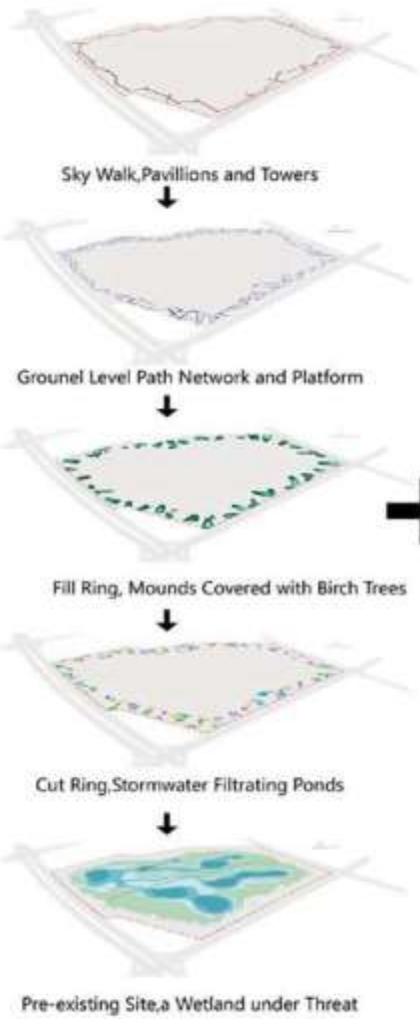
Precedent: Living Machine - South Burlington, VT + Photobioreactors - Falmouth, MA
Source: Todd Ecological and Tom Cambareri

Eco-Machines and
Living Machines



Scale: NEIGHBORHOOD
Target: STORMWATER

Stormwater Wetlands



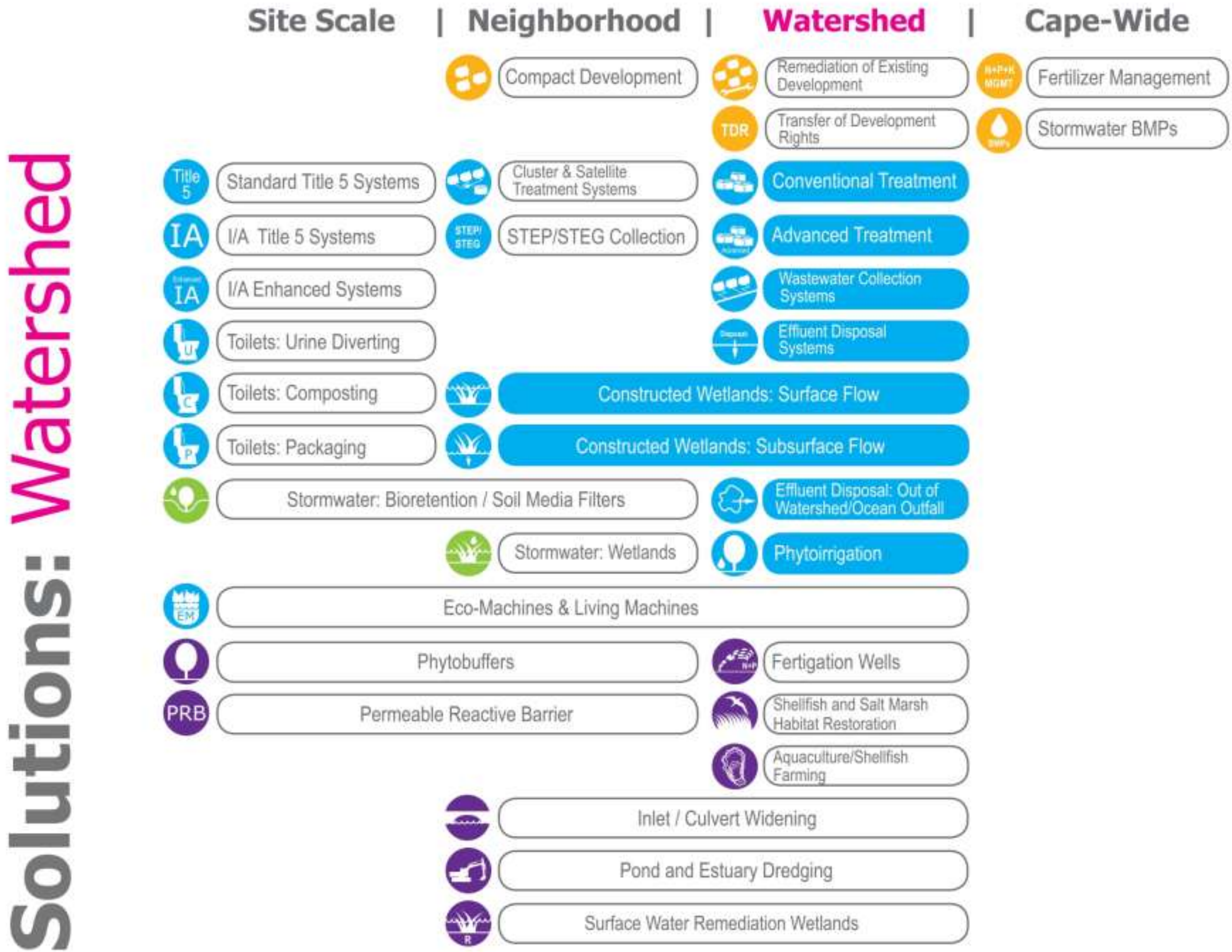
Precedent: Quinli Stormwater Park, China

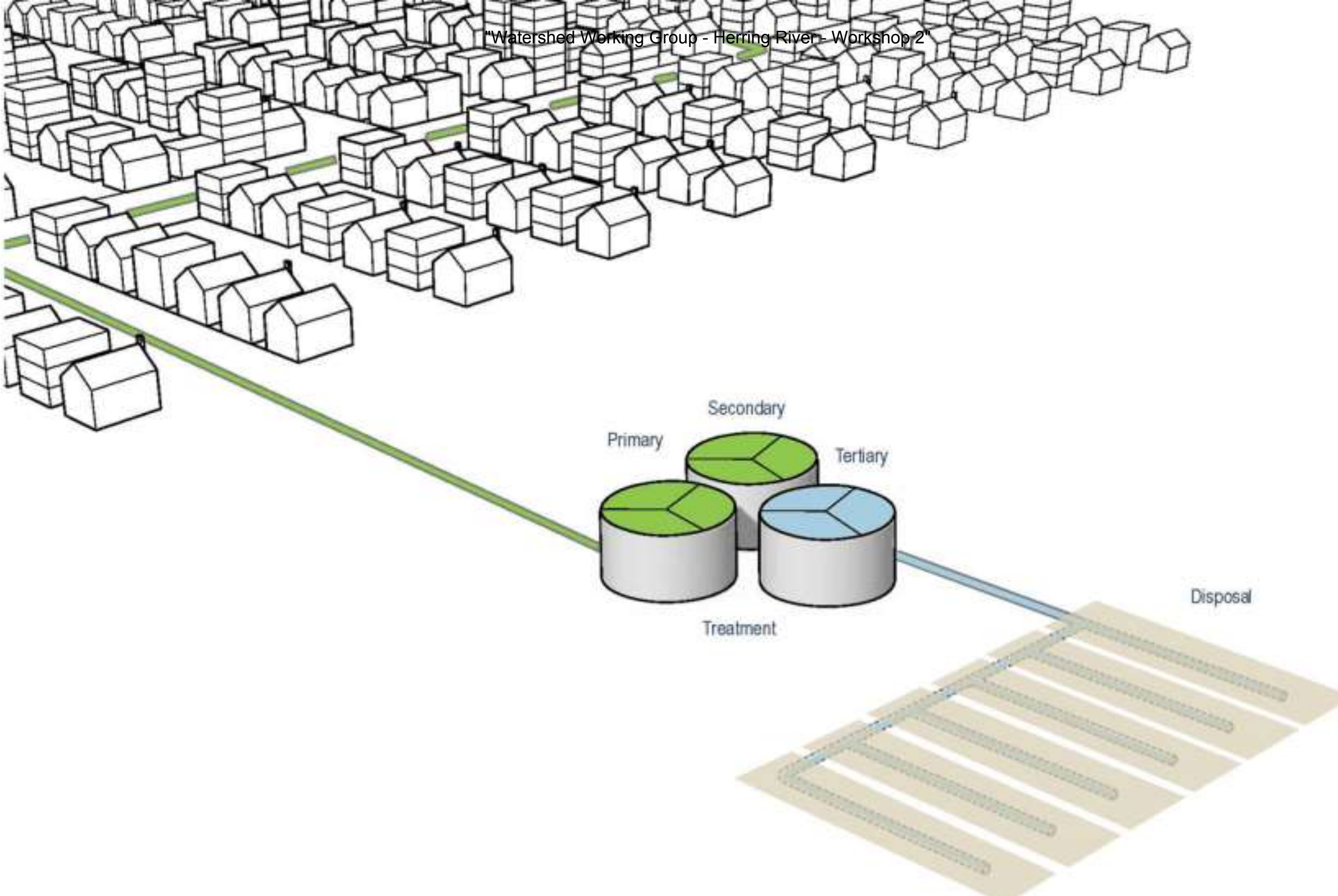
Source: Turenscape

Stormwater Wetlands

Stormwater Wetlands

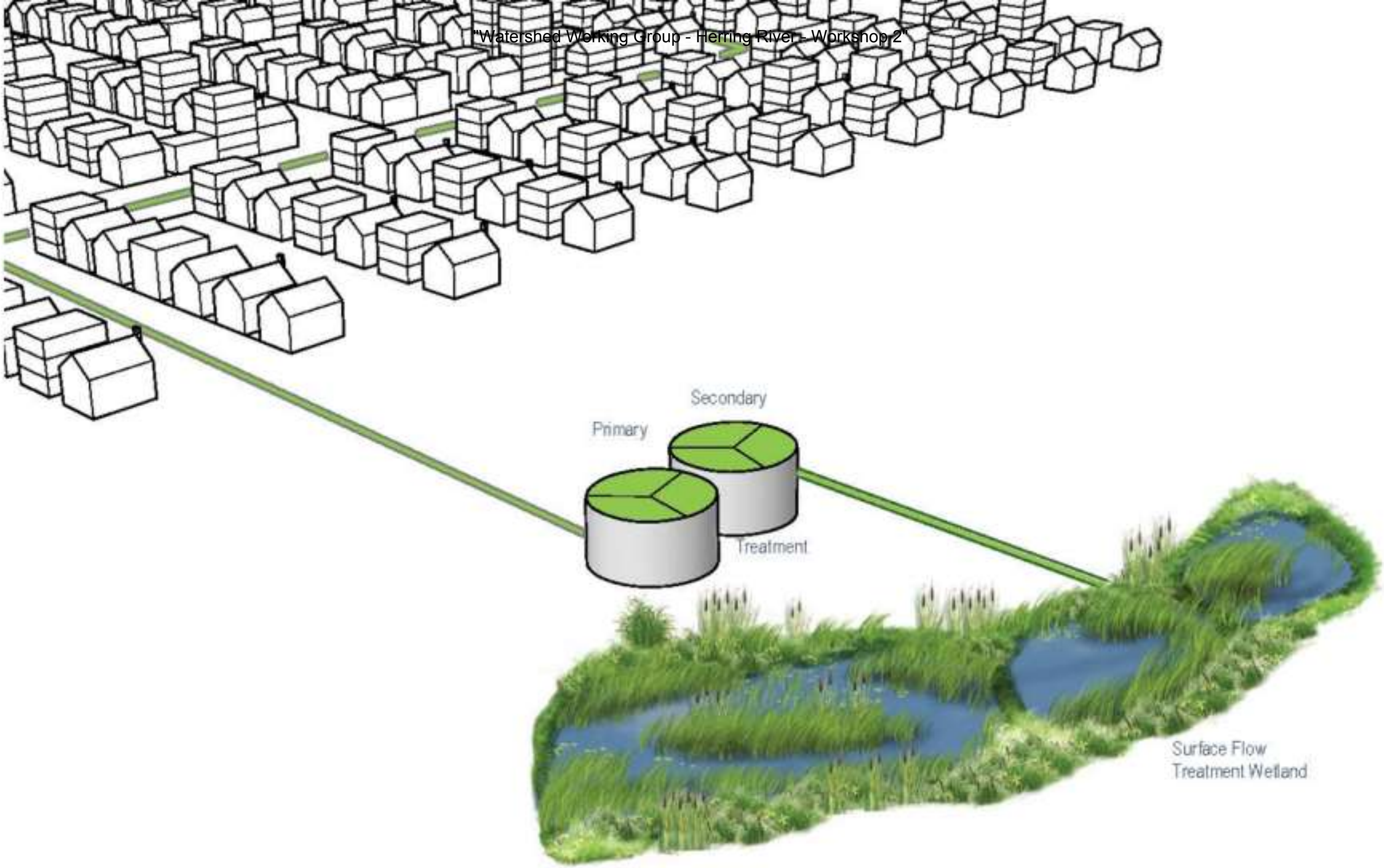
"Watershed Working Group - Herring River - Workshop 2"





Scale: WATERSHED
Target: WASTEWATER

Conventional Treatment

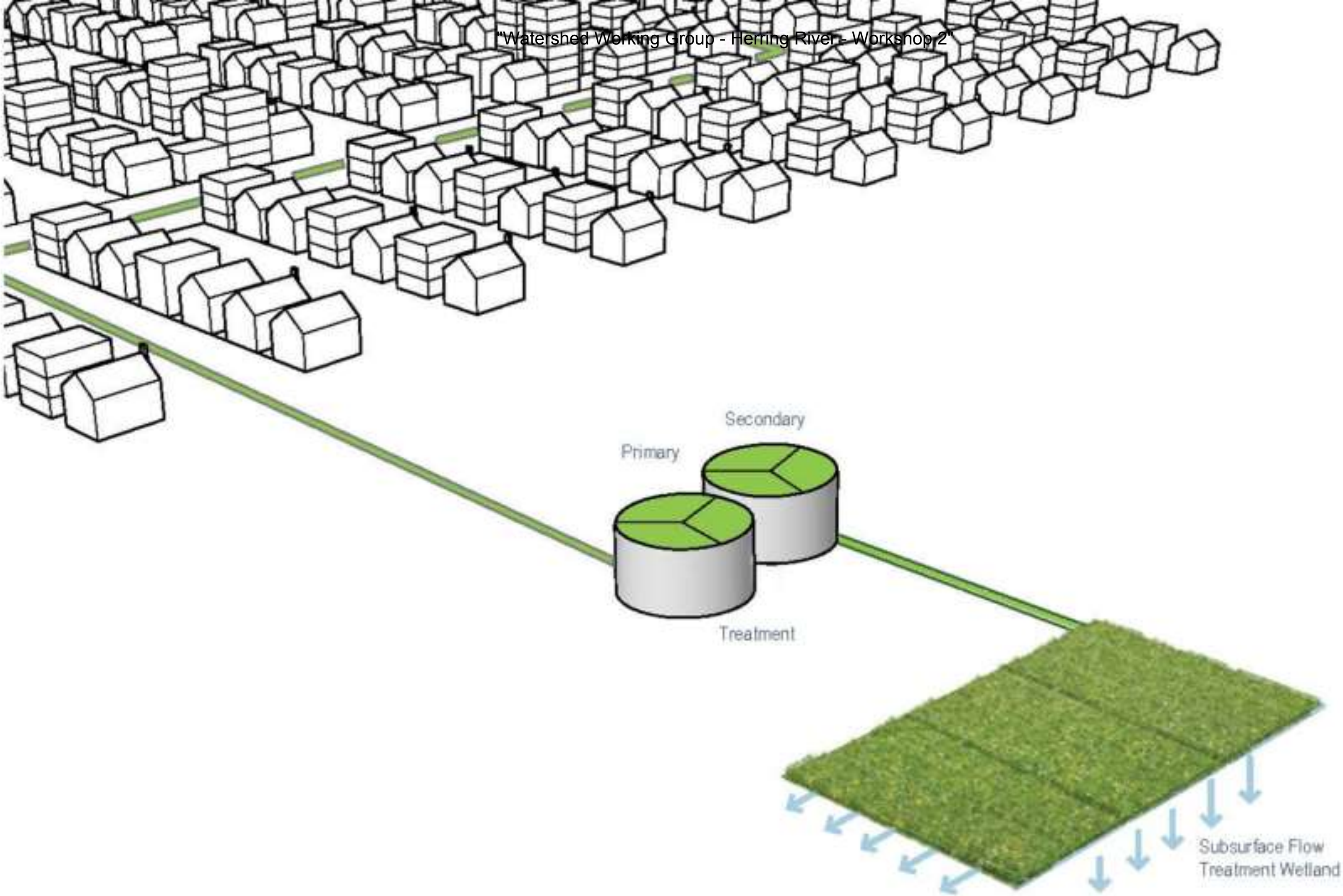


Scale: WATERSHED
Target: WASTEWATER

Constructed Wetlands:
Surface Flow

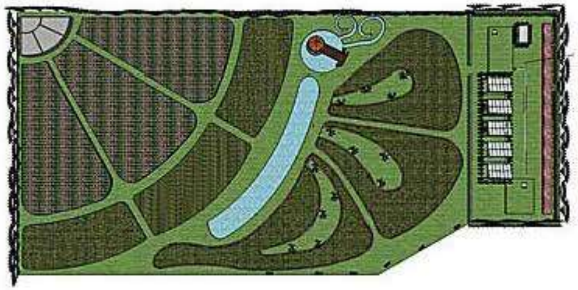
Precedent: Talking Waters Garden - Albany, OR
Source: Kate Kennen

Constructed Wetlands: Surface Flow



Scale: WATERSHED
Target: WASTEWATER

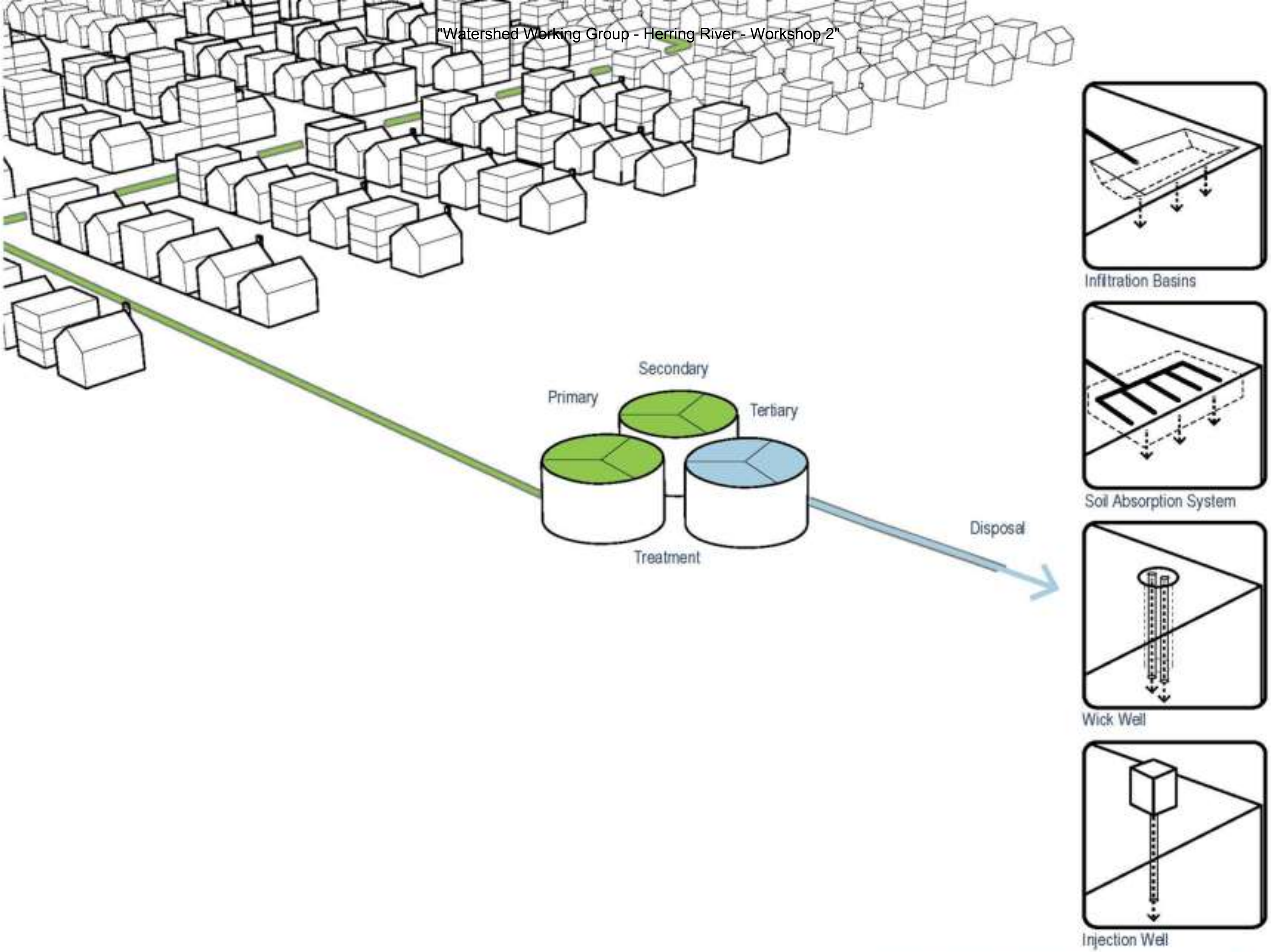
Constructed Wetlands:
Subsurface Flow



Precedent: Koh Phi Phi Treatment Wetland, Thailand

Source: Hans Brix

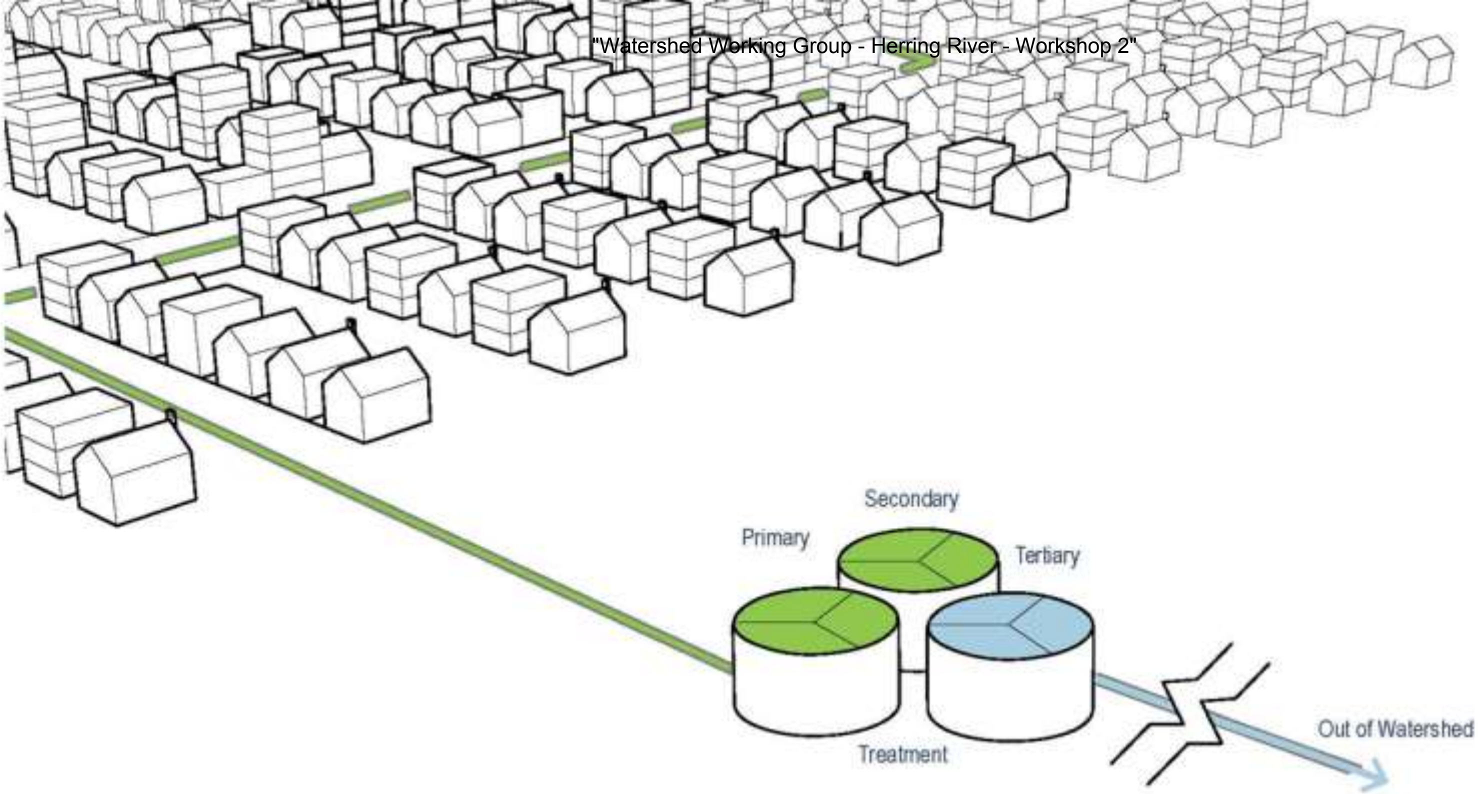
Constructed Wetlands: Subsurface Flow



Scale: WATERSHED
Target: WASTEWATER

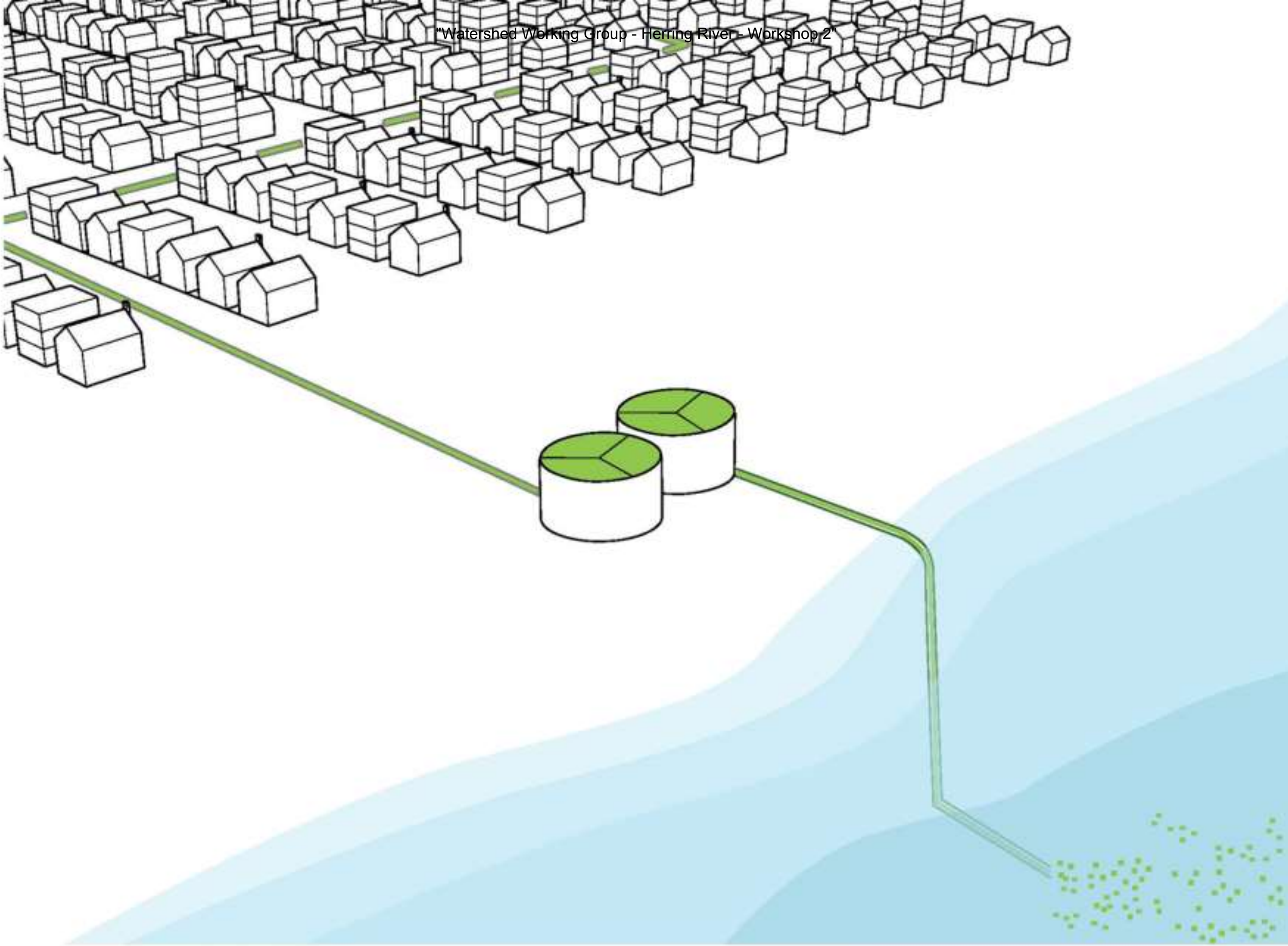
Effluent Disposal Systems

Disposal:



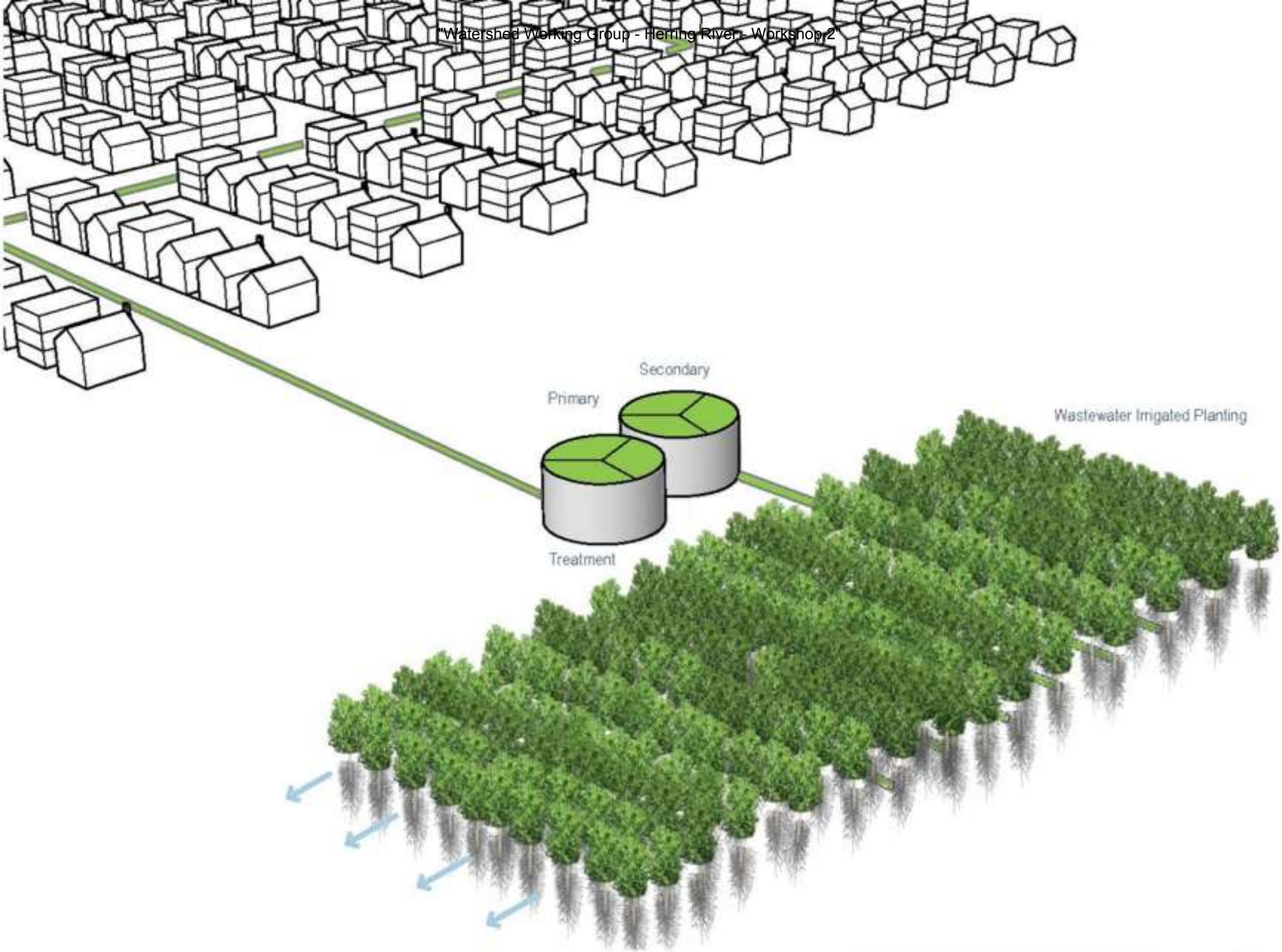
Scale: WATERSHED
Target: WASTEWATER

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

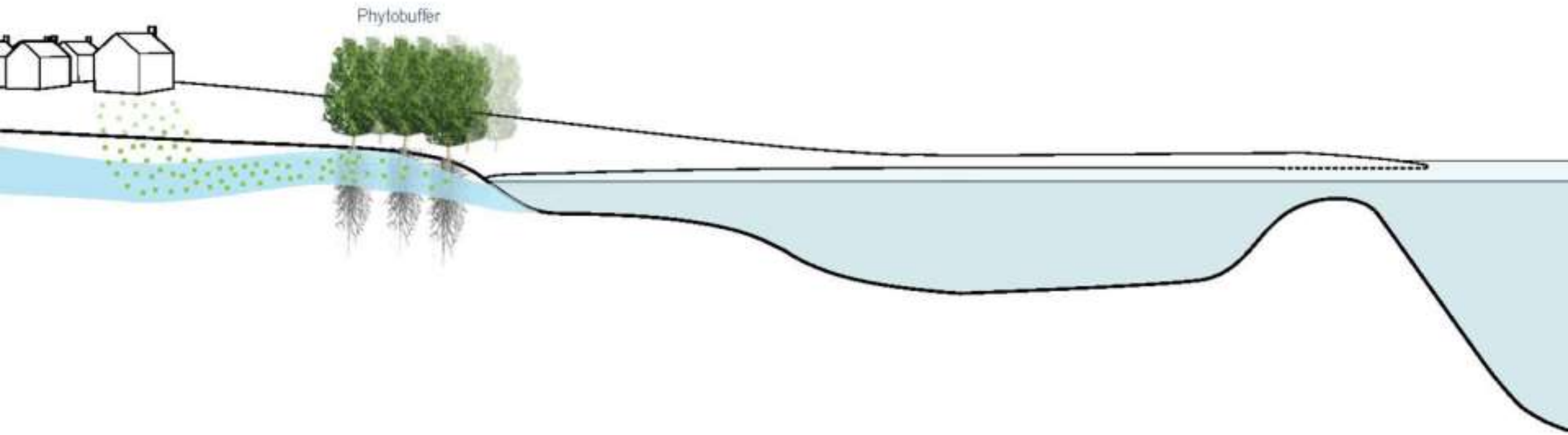
Precedent: Woodburn OR, Wastewater Treatment Facility
Source: CH2MHill

Phytoirrigation

Solutions: Ex. Water

Site Scale | Neighborhood | Watershed | Cape-Wide

- Compact Development
- Remediation of Existing Development
- 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

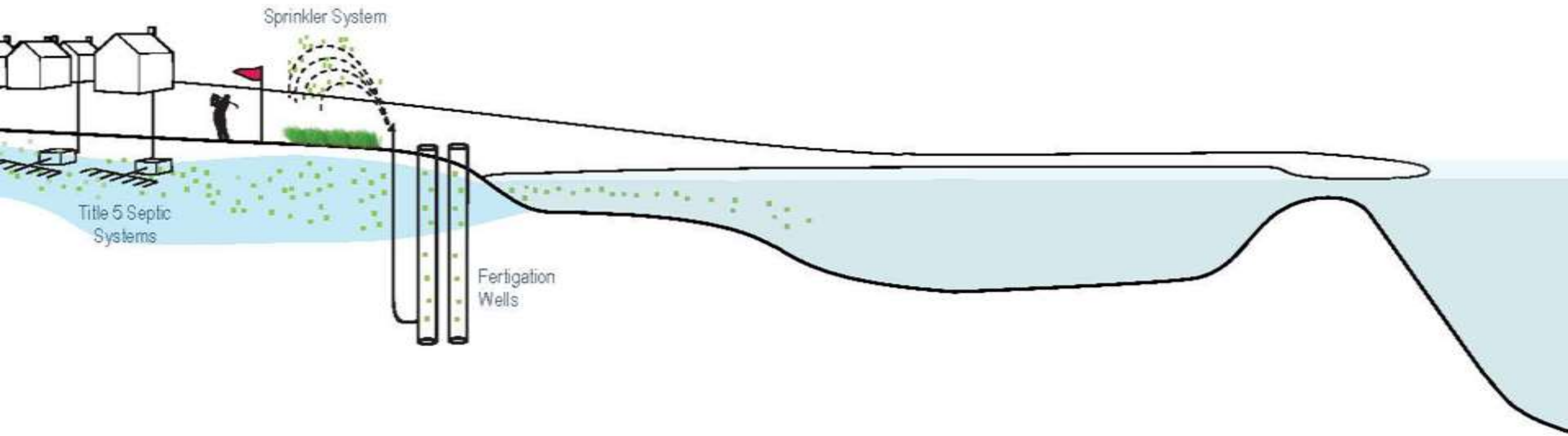


Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Phytobuffers

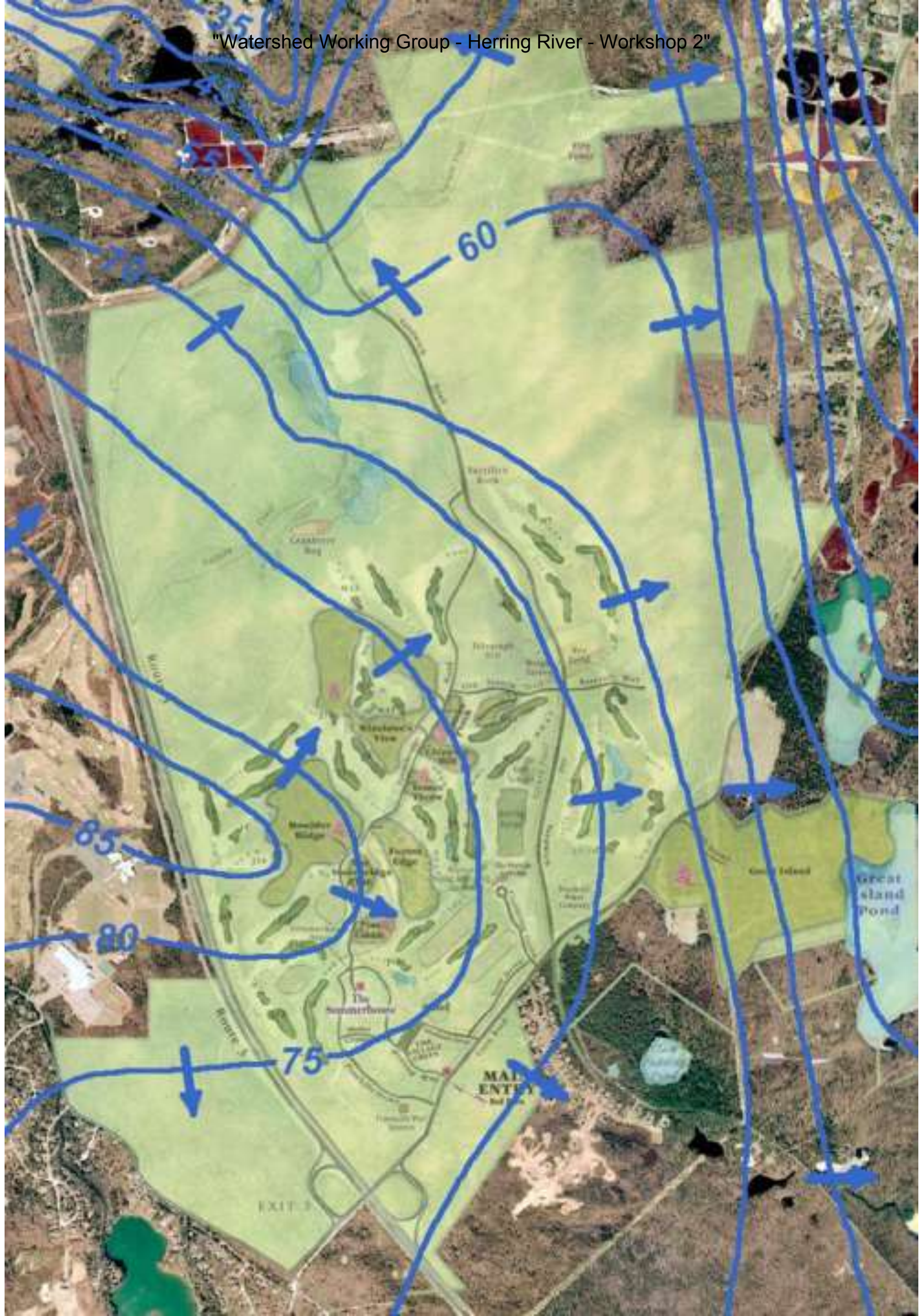
Precedent: Phytobuffer - Kavcee, WY
Source: Sand Creek Consultants

Phytobuffers

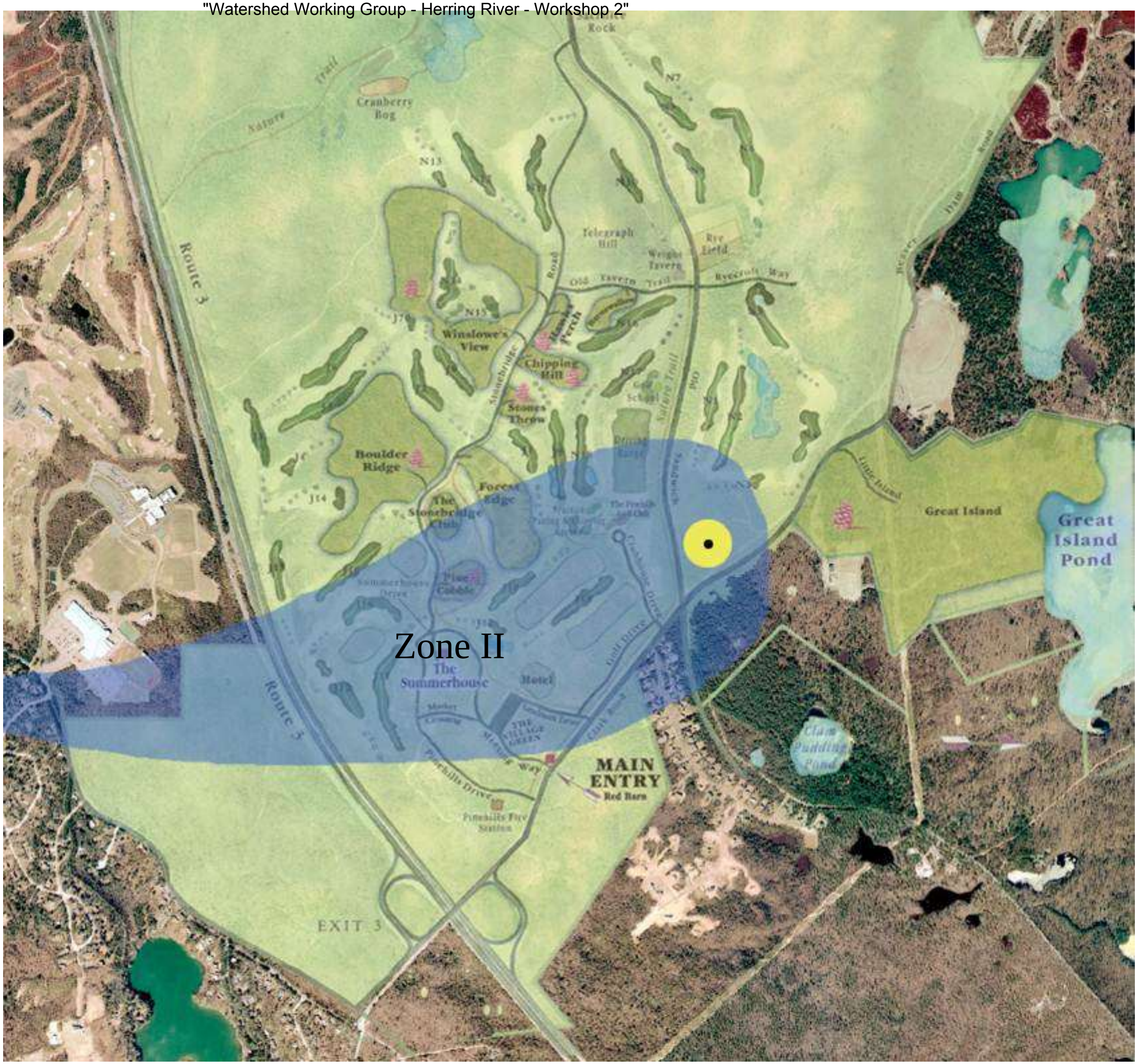


Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

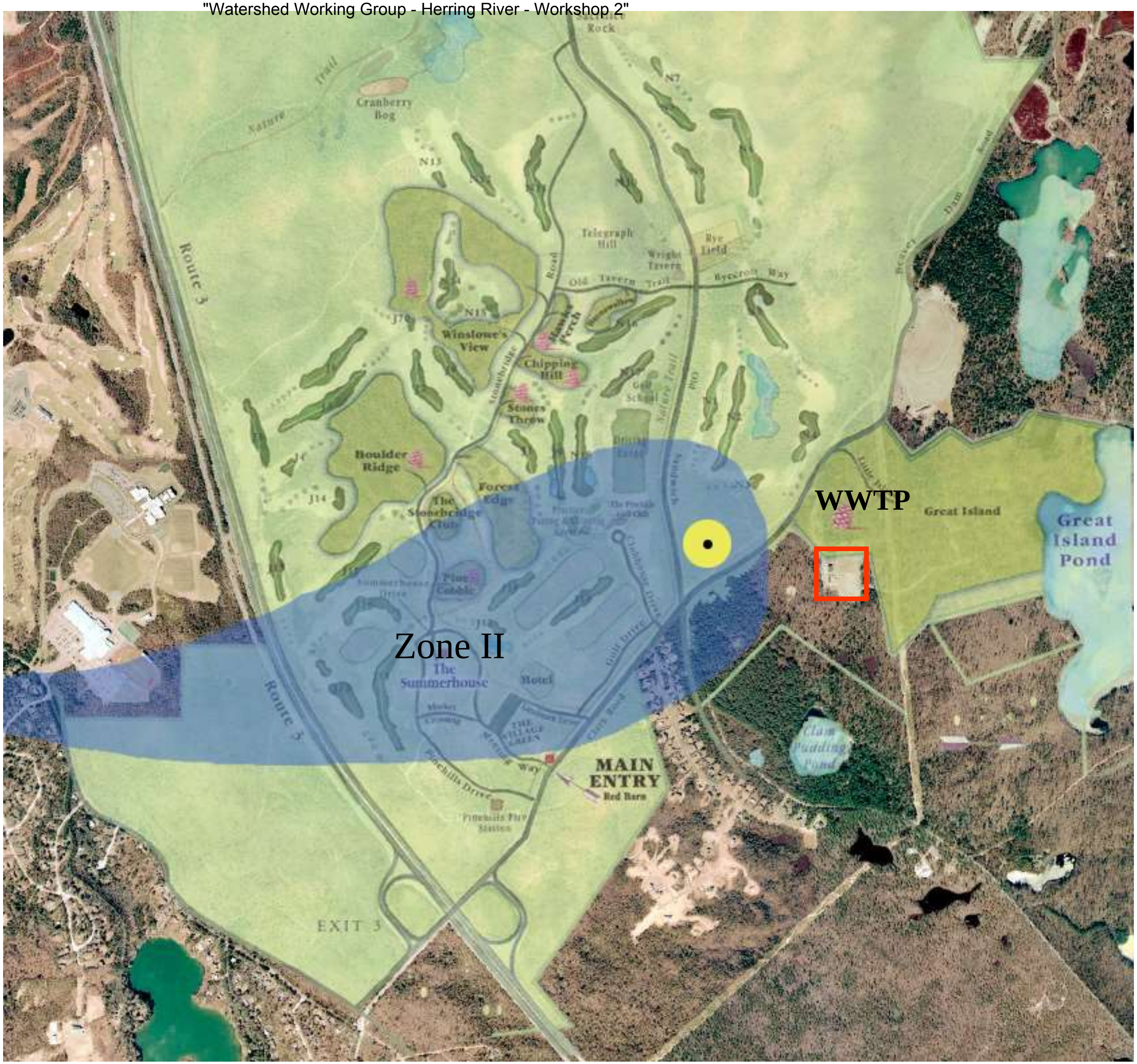
Fertigation Wells



Precedent:
Pine Hills
Plymouth, MA

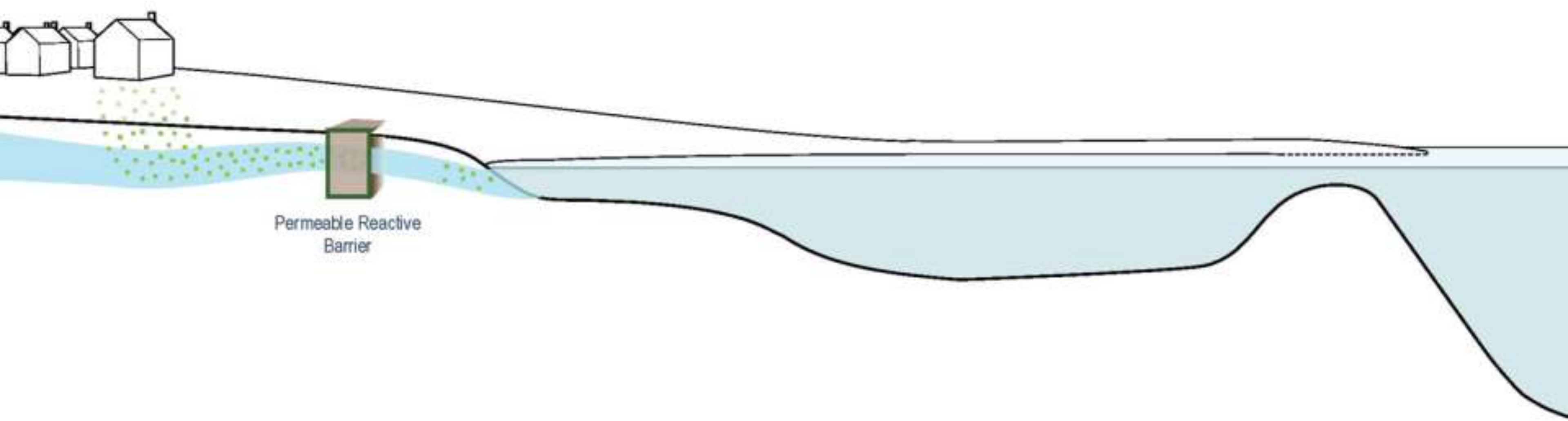


Precedent:
Pine Hills
Plymouth, MA



Precedent:
Pine Hills
Plymouth, MA

Precedent:
Pine Hills
Plymouth, MA



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

Permeable Reactive Barrier

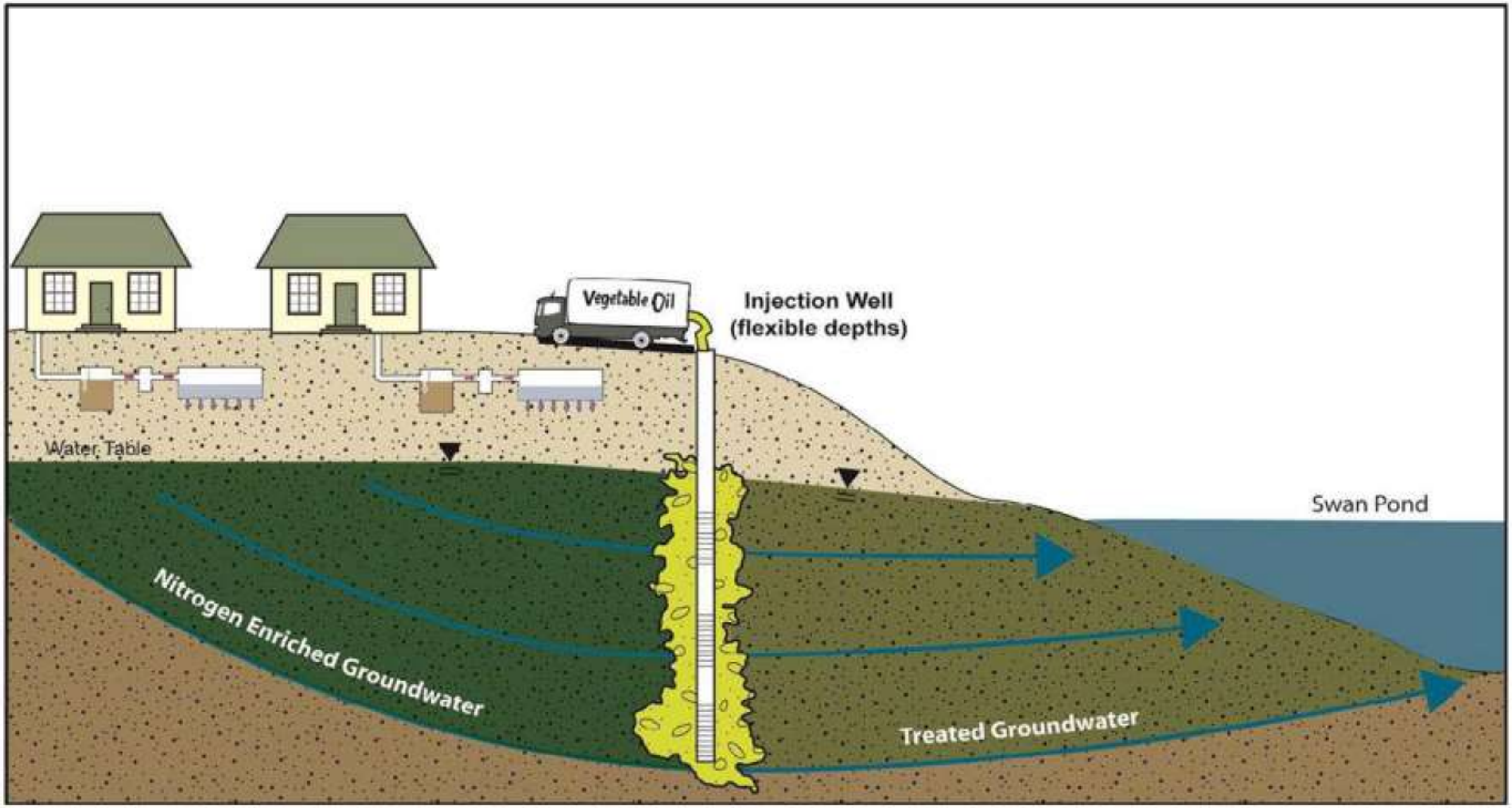
PRB

Precedent: Falmouth PRB

Source: Mike Domenica

Permeable Reactive Barrier

PRB

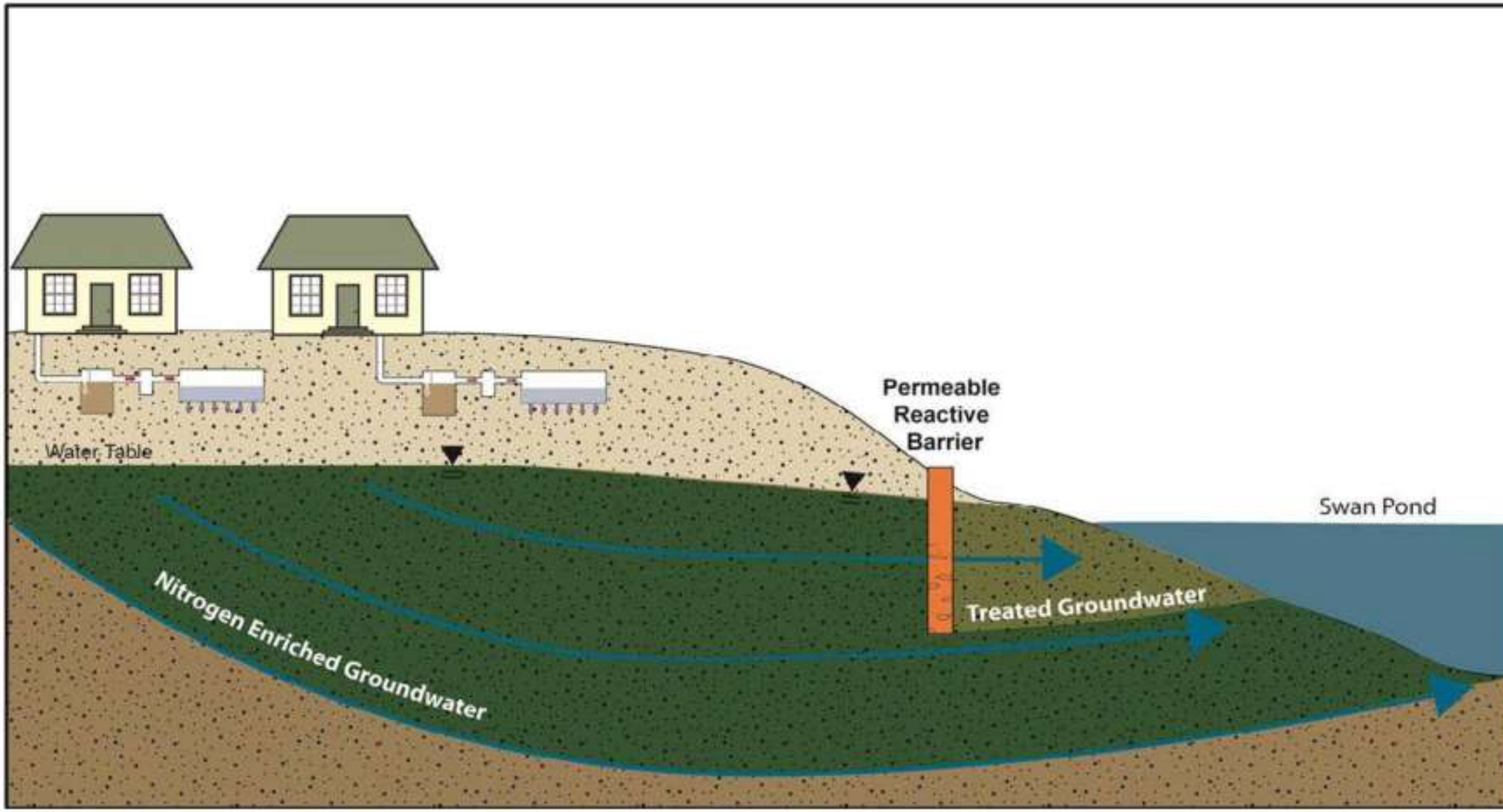


Precedent: PRB

Source: Horsley Witten Group Inc.

Permeable Reactive Barrier

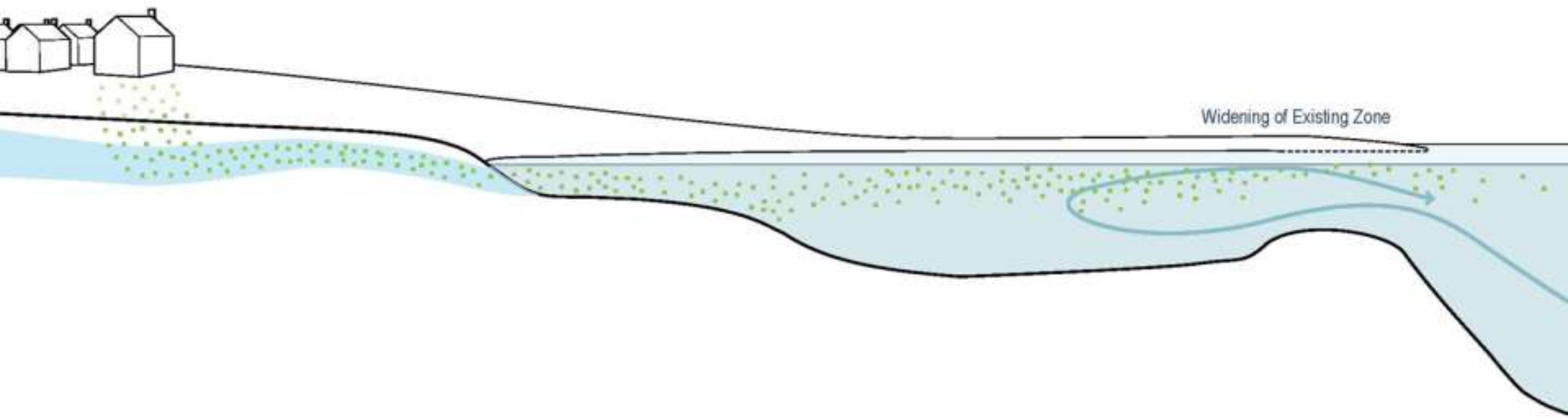
PRB



Precedent: PRB
Source: Horsley Witten Group Inc.

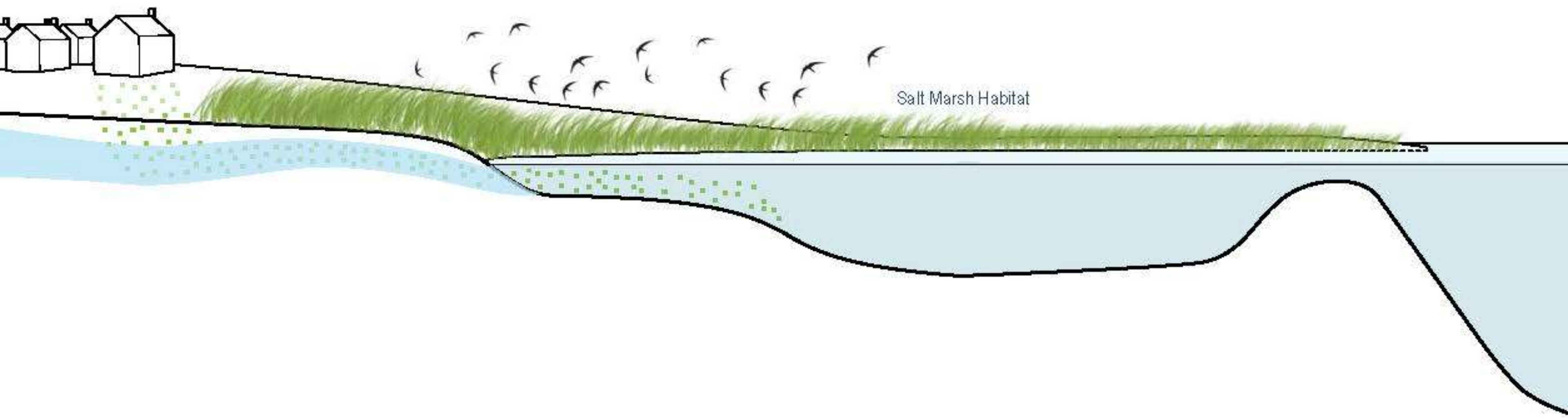
Permeable Reactive Barrier

PRB



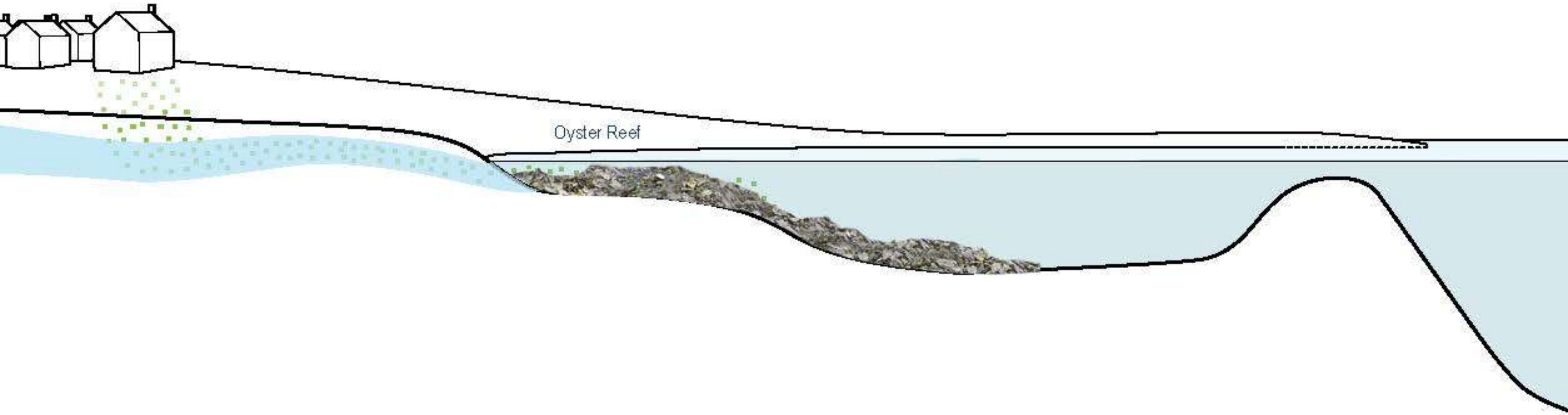
Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Inlet and Culvert Widening



Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Salt Marsh Habitat Restoration



Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

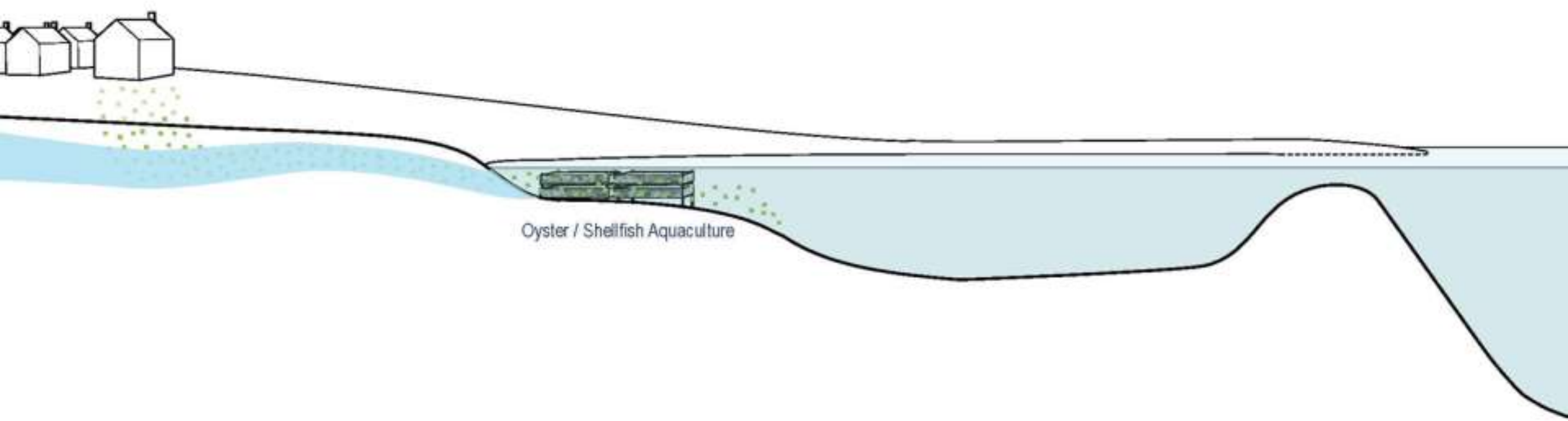
Shellfish Habitat Restoration

Precedent: Wellfleet Oyster Restoration Project
Source: Anamarija Francik

Precedent: Wellfleet Oyster Restoration Project

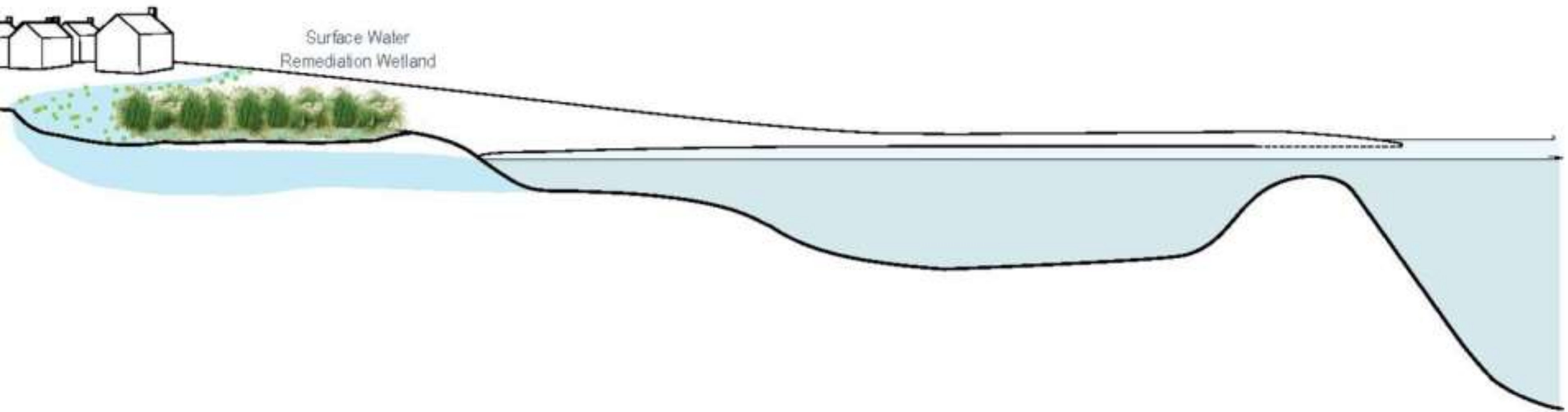
Source: Anamarija Francik

Shellfish Habitat Restoration



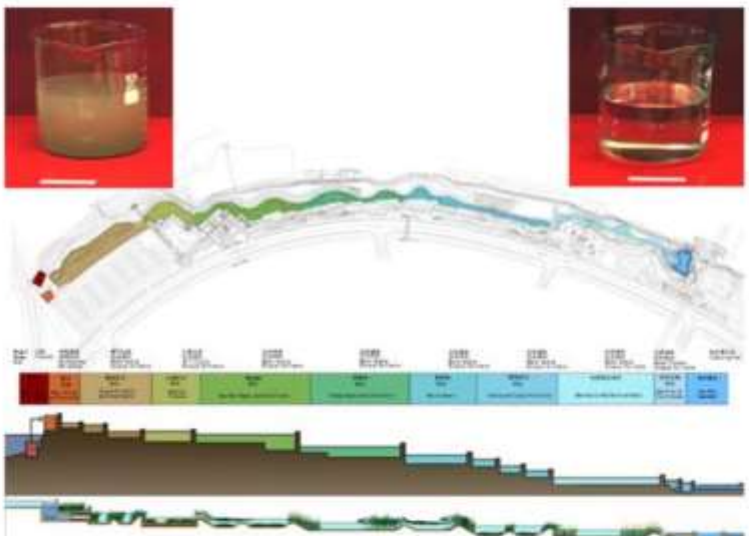
Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Aquaculture / Shellfish Farming



Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

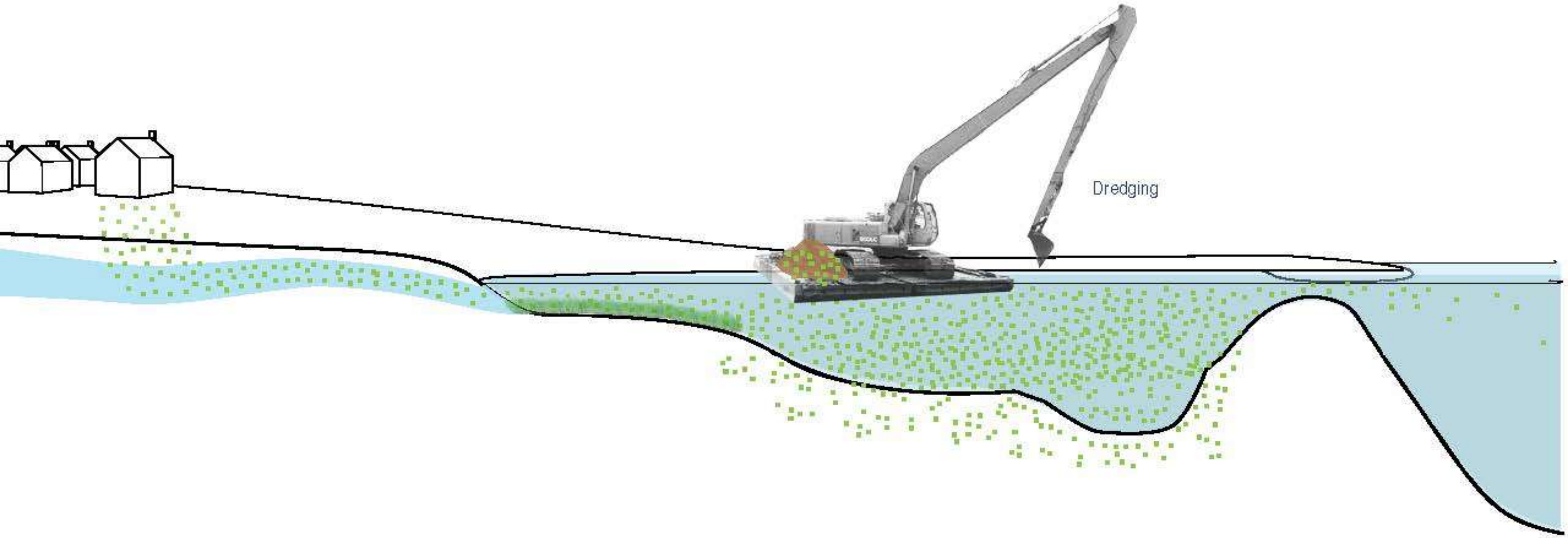
Surface Water
Remediation Wetlands



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

Scale: CAPE-WIDE
Target: REGULATORY

Remediation of Existing Development

Scale: CAPE-WIDE
Target: REGULATORY

Transfer of Development Rights

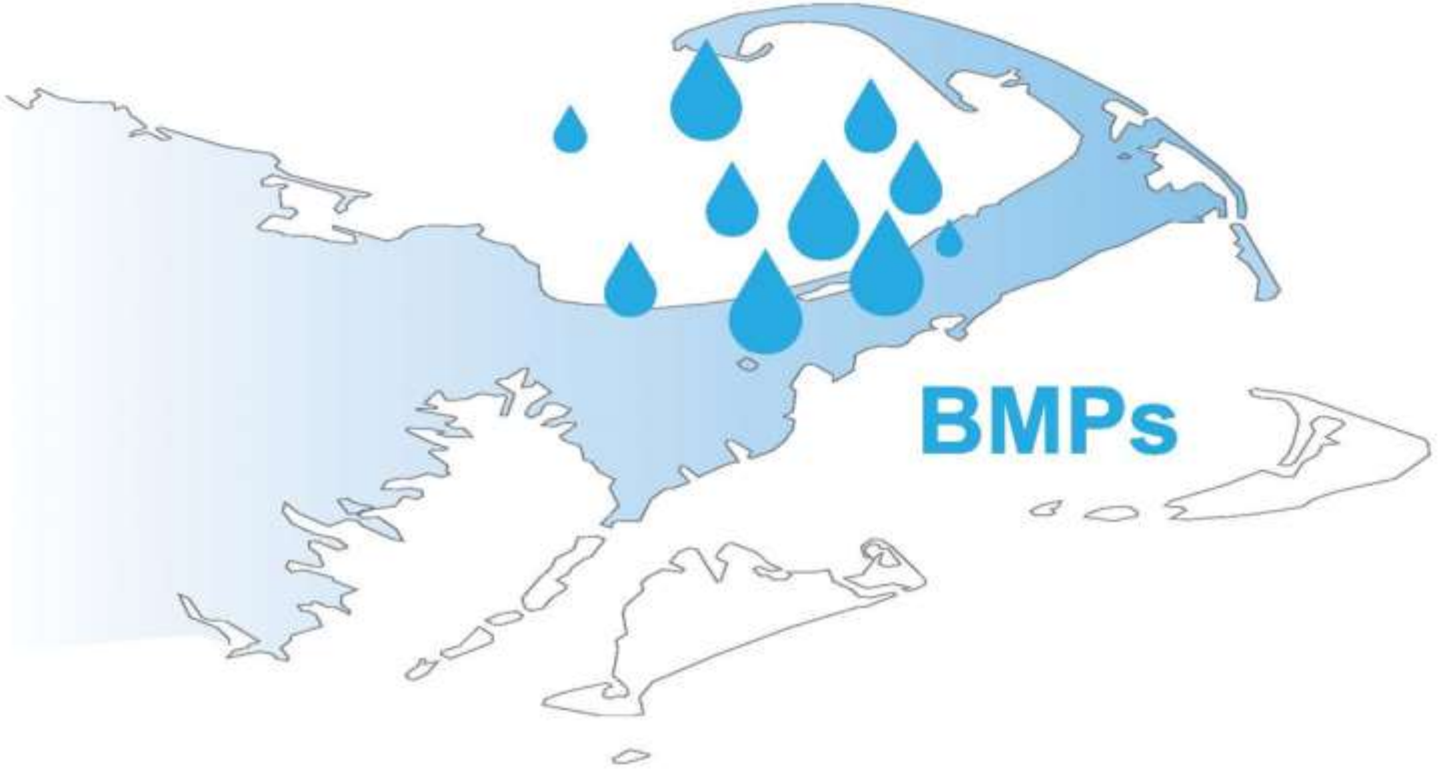
TDR

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
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

Problem Solving Approach

Wastewater | Existing Water Bodies | Regulatory

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

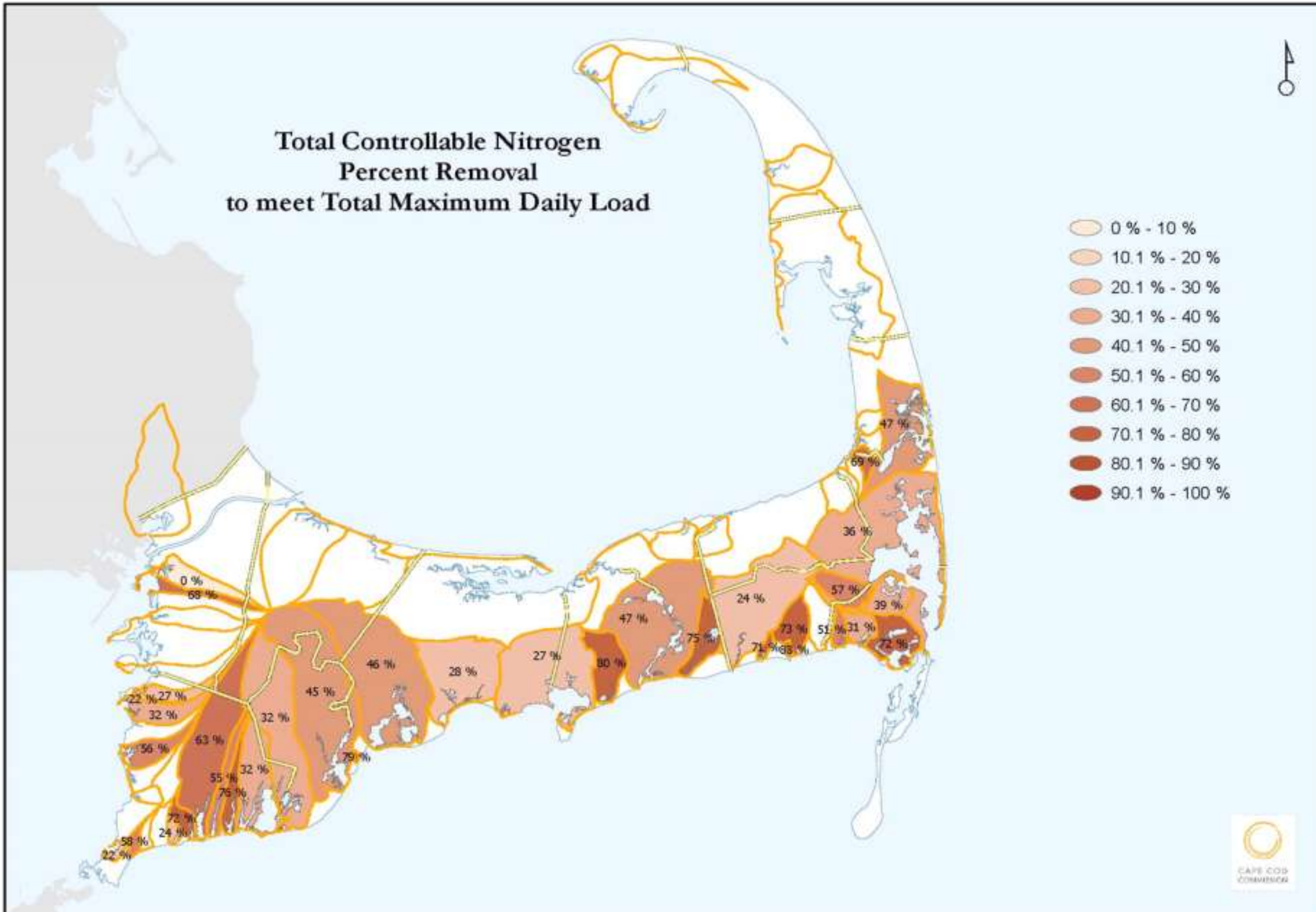
5 Alternative On-Site Options

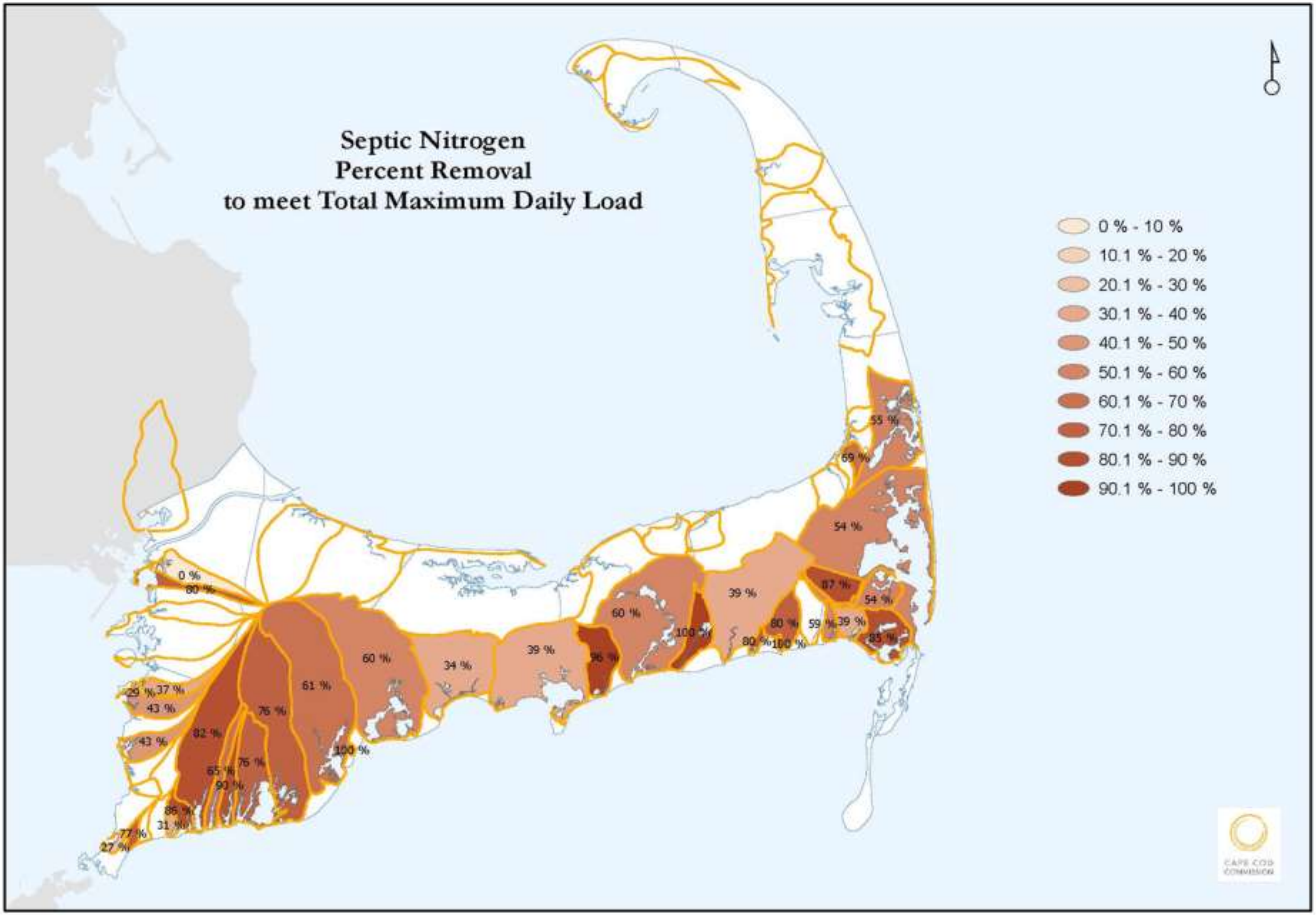
A. Eco-toilets (UD & Compost)
B. I/A Technologies
C. Enhanced I/A Technologies
D. Shared Systems

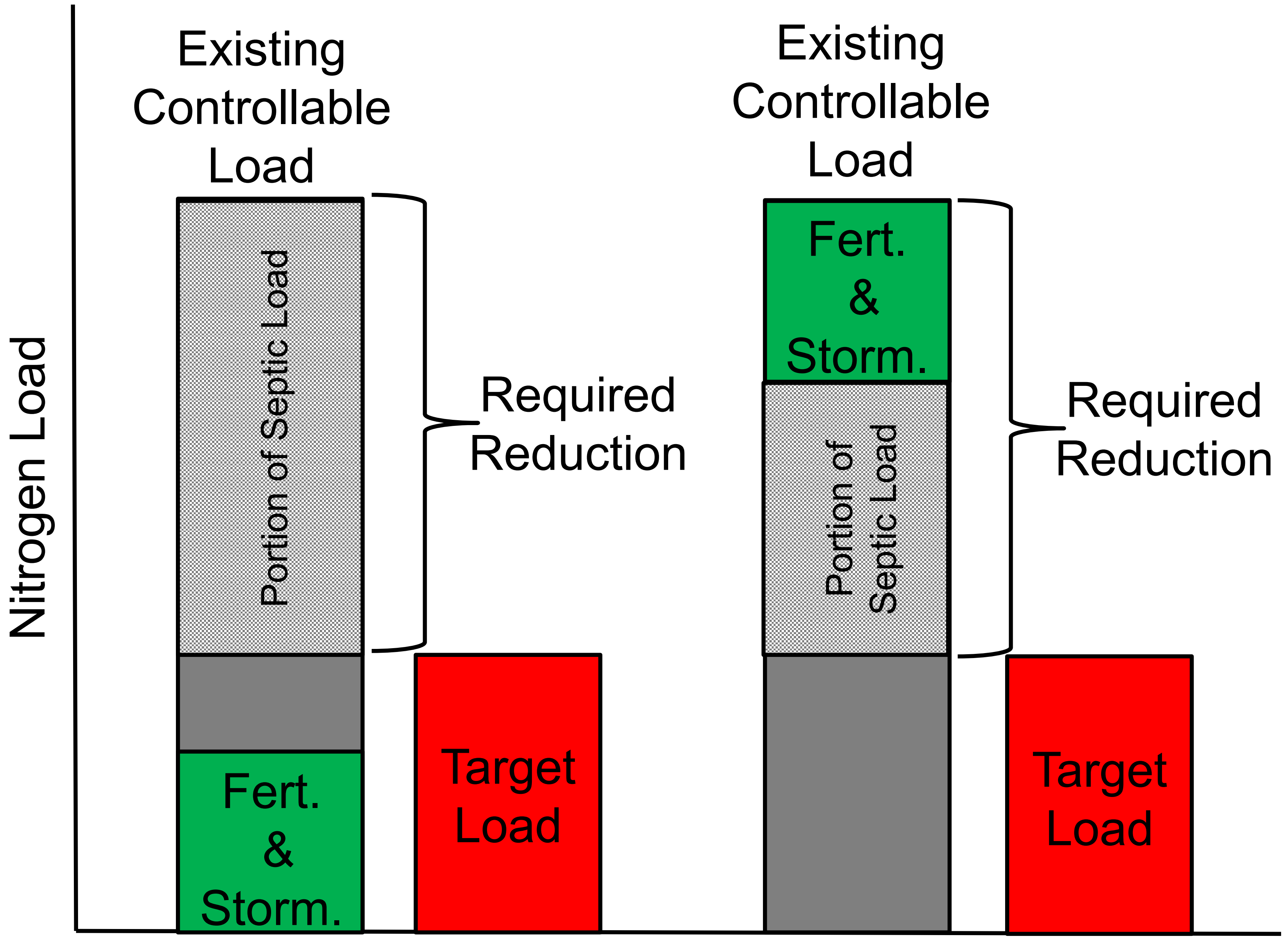
6 Priority Collection/High-Density Areas

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

7 Supplemental Sewering


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 %
55 %
69 %
54 %
87 %
54 %
39 %
60 %
100 %
80 %
59 %
39 %
85 %
80 %
100 %
96 %
39 %
34 %
60 %
61 %
76 %
82 %
100 %
76 %
65 %
90 %
86 %
31 %
77 %
27 %
0 %
80 %
29 %
37 %
43 %
43 %


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

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

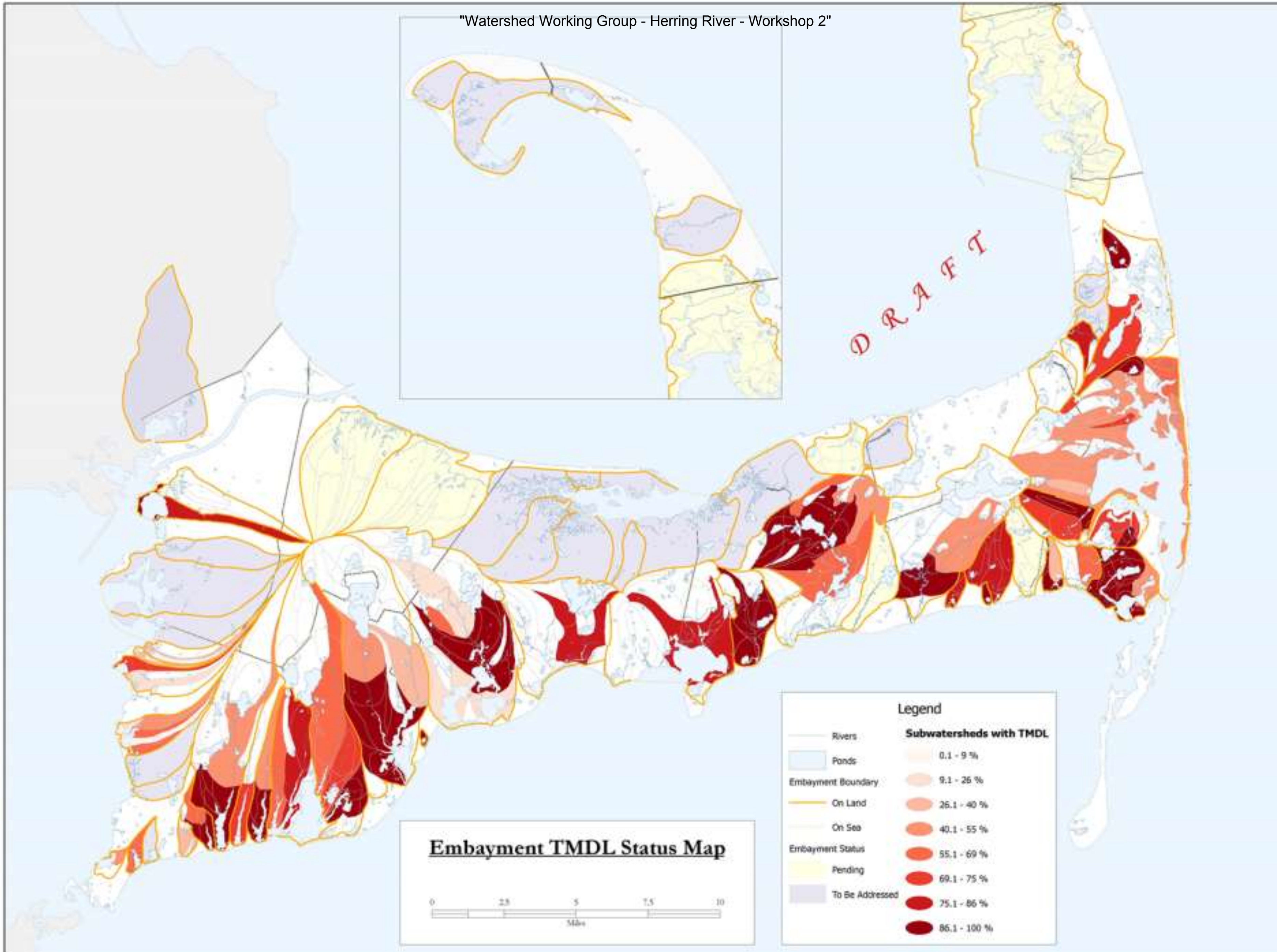
Impacts of Technologies and Approaches

Environmental

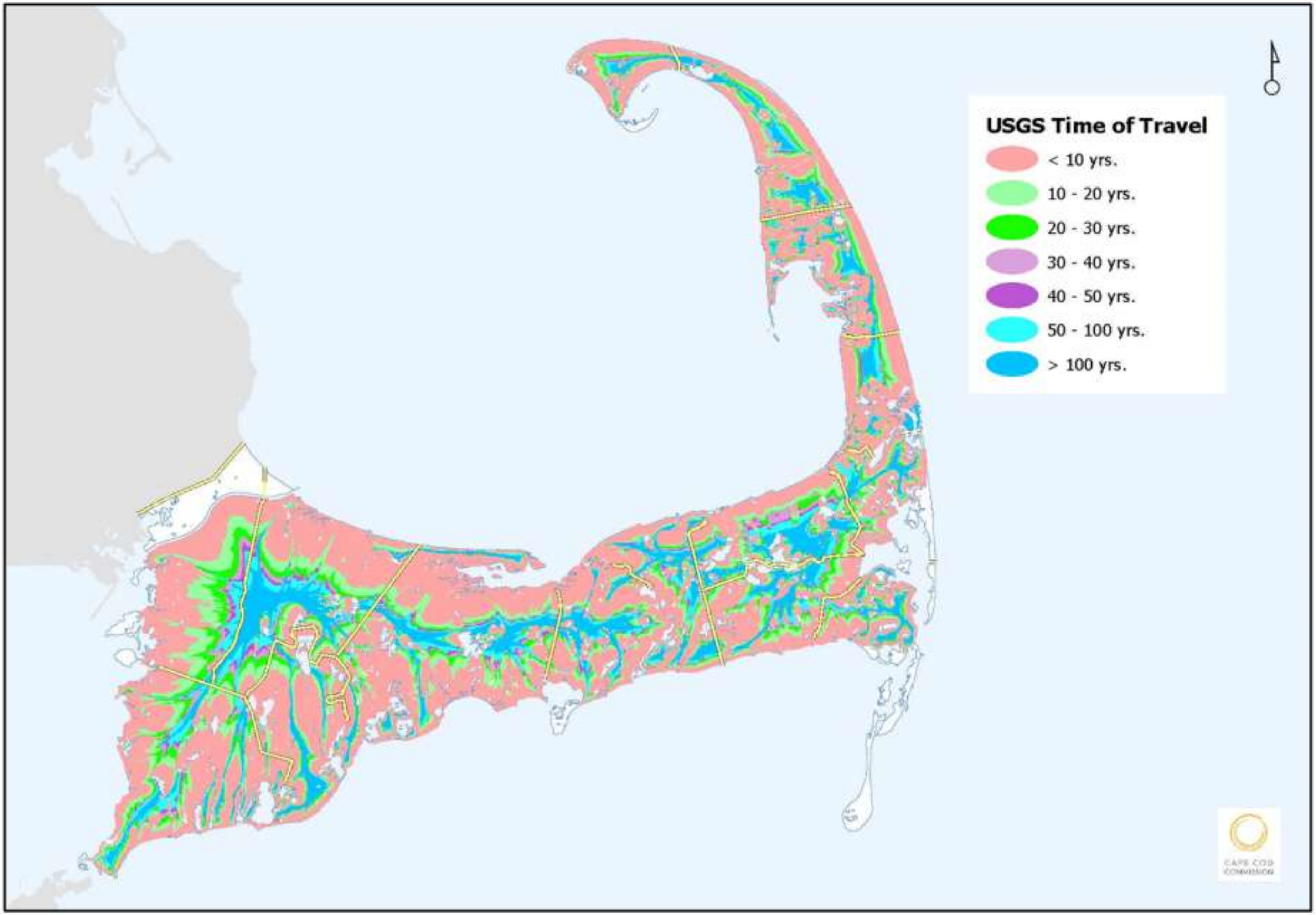
Economic

Social

"Watershed Working Group - Herring River - Workshop 2"



"Watershed Working Group - Herring River - 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

November 13th

Phase 2 of the stakeholder process

6:00
Cape Cod Museum of Art
Dennis, MA

Cape Cod 208 Area Water Quality Planning
Herring River Watershed Working Group

Meeting Two
Monday, October 21, 2013
8:30 am- 12:30 pm
Harwich Town Hall, Selectmen's Meeting Room

Final Meeting Summary Prepared by the Consensus Building Institute

I. ACTION ITEMS

Working Group

- Next meeting: Meeting Three
  Thursday, December 5, 2013
  8:30AM -12:30PM
  Harwich Community Center, 100 Oak Street, Harwich, MA 02645
- Send Kate any additional comments on Meeting One Summary (by Oct 25)
- Continue to prepare thoughts about which technologies/approaches they would like to learn more about for application in the Herring River Watershed. Different scenarios and options will be discussed during Meeting Three.

Consensus Building Institute

- Conduct analysis of all stakeholder groups to present breakdown of interests and stakeholder groups represented; include description of how we're reaching out to groups who may not be at the table
- 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

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

Kristy Senatori, Deputy Director at the Cape Cod Commission, 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 updated comprehensive 208 Plan. The first meetings of the eleven Watershed Working

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

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 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. Senatori, shared 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. Senatori also shared that the second round of Cape2O game is launching on October 22. She noted that over 400 people registered for the first round of the Cape2O 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. Senatori 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 Cape2O: ur in charge!; a summary of planning process to date; discussion of the stakeholder role in the second 6 months of the 208 planning process

Patty Daley, Deputy Director at the Cape Cod Commission and Area Manager for the Herring River Watershed Working Group, welcomed participants and 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; and to identify priorities and considerations for applying technologies and approaches to remediate water quality impairments in your watershed.

Kate Harvey, the facilitator from the Consensus Building Institute, reviewed the agenda and led introductions. A participant list is found in Appendix A.

---

[2] Technology Fact Sheets are available at: http://watersheds.capecodcommission.org/index.php/watersheds/lower-cape/herring-river.

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 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' questions and comments about the technologies are also discussed below (in *italics)*:

Site level technologies/approaches

<u>Standard Title V System</u>*:* 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).

- *Can any of technologies be used to enhance existing systems (e.g. Title V systems)?* Ms. Daley responded that the Cape Cod Commission does not know of any technologies that can enhance existing systems, including Title V systems, and would allow them to remove nutrients. In the case of Title V systems, the next step would be to install a new I/A Title V system.
- *How are Title V systems regulated and maintained?* Title V systems are regulated primarily at the local level, consistent with state regulations. Local regulations generally require that the systems be pumped every three years. Some towns ask septic pumping companies to report on the systems that they service, but in most cases, regular

maintenance is not monitored and is the responsibility of the homeowner.

- *A benefit to some of Title V is the possibility of having multiple houses using one Title V plan.*

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.

- *How many I/A systems are there on Cape Cod?* Ms. Daley noted that the Cape Cod Commission is beginning to map I/A systems on Cape Cod, and she estimated that there are about 1500 existing systems. The Commission plans on adding a GIS layer to the 208 Plan Reference Map to show where I/A systems are located.[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 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 which 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 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 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).

Neighborhood level technologies/approaches

---

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

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 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).

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).

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).

- *Why does phosphorus removal in constructed wetlands versus in conventional treatment vary?* Mr. Owen responded that the level of phosphorus removal in wetlands depends on how much acreage you have; if you want to remove more nitrogen AND phosphorus in a constructed wetland then you'd need a large area of land. With a treatment plant, you can get high levels of phosphorus removal but at great expense and with a lot of chemicals. Since phosphorus is really not an issue in the estuaries- rather it is an issue in surface waters – it is important to consider where the phosphorus is likely to end up to determine the best treatment option. If it is going into stormwater, then a more aggressive treatment process is needed. If it is going into groundwater, the soil has a good capacity to uptake phosphorus, so it is less of a concern.
- *Why are phosphorus levels more likely to reduce over time with subsurface flow constructed wetlands rather than surface flow constructed wetlands?* Tom Cambareri, Cape Cod Commission, responded that the subsurface flow wetland is more anaerobic so you have a different group of microbes. As the wastewater moves through the wetland, it goes through more slowly and the microbes have more time to tackle the phosphorus.

<u>Effluent disposal: out of watershed</u>: 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.

- *Is effluent disposal in other watersheds the same as sending trash off Cape?* Mr. Cambareri responded that transfers of effluent between the watersheds on Cape Cod are considered by the Massachusetts Department of Environmental Protection (MassDEP) to be transfers within a single basin because the Cape is a single source aquifer. Because the transfer would occur within a single basin, there would not be significant state regulatory challenges related to moving treated effluent between watersheds, however, the potential local impacts would still need to be considered by Cape Cod decision-makers.

<u>Effluent disposal: ocean outfall:</u> 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.

- *If the nitrogen were sent out into the ocean, how far out would it go and has anyone studied the effects?* Ms. Daley responded that the reason that there are many regulatory hurdles associated with this solution is because site-specific effects must be studied. Were this option to be seriously considered, there would be many studies required. Mr. Cambareri noted that the ocean outfall associated with the Massachusetts

Water Resources Authority (MWRA) goes out about nine miles into 150 feet of water and disposes of 300 million gallons of effluent per day. He estimated that Cape Cod would need to dispose of significantly smaller effluents amounts, which would need to be treated to a high level before being discharged. However, these effluents would be discharged into near shore waters that are more shallow than 150 feet.

- *There could be significant ecosystem effects that could impact the whole Atlantic seashore, not just Massachusetts Bay.*

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).

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 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).

- *A participant expressed concerned about technologies that require a lot of maintenance, such as PRBs.* Ms. Daley noted that for PRBs, there is data from Canada on barriers that have been installed for 15 years which are still working.
- *PRBs would not be installed along the whole coast, correct?* Ms. Daley affirmed that you would site a PRB perpendicular to the groundwater flow and also correlated with roadways and powerlines.

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).

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).

- *Are the oysters edible?* Ms. Daley responded that it depends on the water quality in the embayment. If the water quality is good, the oysters can be harvested for food, however, if you have coliform bacteria or other contaminants, then they can't be eaten.

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.

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 seems like many towns are already dredging for other reason or doing projects that* *increase flushing. Is there a way to get credit for this work as a nitrogen reducing method?* Mr. Cambareri responded that state agencies are looking at how to permit and credit these types of projects; the requirements will be monitoring and will require that detailed engineering solutions be presented. They're considering both pre and post monitoring and it is expected that these measures will get a nitrogen credit.

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".

- *It is nice to see alternatives being presented. In the Herring River watershed, if you want to achieve certain levels of buildout, it is important to consider the simplest way to achieve the desired growth? Growth planning and wastewater planning should also be paired with planning for open space recreation.*

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.

- *What is happening with fertilizer regulation on Cape Cod?* Ms. Daley responded that 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.
- *The golf industry has trended downward in its use of fertilizers with an estimated 40% less use today than in the past. Additionally, most modern man-made fertilizers do not contain phosphorus (organic fertilizers do), so moving forward, phosphorus load from fertilizers across Cape Cod should be reduced which would improve phosphorus in catch basins.*

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.

- *Do towns map existing stormwater utilities*? Ms. Daley responded that many towns do map existing stormwater utilities. She suggested that the Commission would try to add those data to the 208 Plan Reference Map.
- *Have there been any studies that look at surface stormwater runoff catch basins?* Sue Leven, Brewster, responded that towns across Cape Cod are just starting to look at catch basins in their communities with funding from state programs. In Brewster, there are 1,800 catch basins identified so far and the town is in process to identify direct outfalls, which will take several years. She noted that most towns clean the catch basins on a regular, but not yearly basis. Ms. Senatori added that in March-April 2014, the Cape Cod Commission will begin a project to do flyover photography of the whole Cape, which will help towns to map all catch basins on GIS. Mr. Cambareri added that on Cape Cod, we should be more focused on treating stormwater run off rather than just getting rid of it. He noted that the stormwater percentage in embayments is usually about 5-10% but by routing stormwater through natural and manmade green systems, nutrient loads can be reduced significantly before being discharge in the embayments.

General questions and comments:

- *What is the difference between primary, secondary, tertiary treatment levels and what levels are currently required?* Mark Owen, Consultant from AECOM, responded that primary treatment results in nitrogen removal of 20-30 mg/L, secondary treatment results in nitrogen removal of 10 mg/L, and tertiary treatment results in nitrogen removal of 2-5 mg/L. The level of treatment required depends on the watershed or subwatershed and how much nitrogen needs to be removed. In many of the Cape's watersheds, secondary or tertiary treatment is necessary.

- *Do any of these technologies remove heavy metals or pharmaceuticals*? Mr. Owen responded that as a general rule, the more treatment that is done, the more heavy metals are removed. However, for pharmaceuticals or containments of emerging concern (CECs), the removal rate is dependant on the chemical composition because some compositions are resistant to removal while others are easy to remove. He added that, in general, if you were to compare a septic system to a treatment plant, you would achieve a higher percentage of removal from a treatment system. However, some chemicals do not really get removed and others are just beginning to be studied, including the human impacts of low levels of exposure and options for removing them from wastewater. Ms. Daley added that some of the phytoremediation or subsurface wetlands remove some CECs and that trees are sometimes used to remove chemicals from hazardous waste sites.

- *The fact that they are contaminants of "emerging" concern, does not mean that we should ignore them until more information is available. There are already studies that demonstrate that they are a big problem. We should pursue solutions that we know remove CECs and reduce human and animal exposure to them.* Ms. Daley added that there are currently no regulatory standards to drive removal of CECs, so the 208 Plan update currently focuses on nitrogen and phosphorus removal. However, the plan will still consider the additional ability of specific solutions to deal with CECs or other concerns beyond nitrogen and phosphors removal.

- *Are communities using wireless technologies to monitor systems?* Ms. Daley responded that Wellfleet is using a wireless monitoring system, however, she was not aware of other towns using similar systems. She noted that such monitoring systems would be very helpful for communities across the Cape to better understand how their systems and/or new technologies are performing.

- *In general, technologies/approaches with fewer moving parts that remove target substances earlier rather than later seem preferable. There are also significant political questions since society generally does not want to pay to address the problems we've created. As a result, what we put in place will need to be there for 50-100 years, so some of the newer technologies and approaches might not have been tested enough.*

- *Most of the solutions seem to lack a definable path through regulatory obstacles. Is the RLI looking at this issue, and will there be more information about it by the December meeting?* Ms. Senatori responded that the RLI group is looking at whether the different technologies are permitable under current regulatory environments and will focus on developing strategies for permitting and implementing promising technologies. Ms. Daley added that if the Working Groups identify specific solutions that seem very promising, the Cape Cod Commission will let the regulatory agencies know that there is a great deal of support and push for demonstration projects or funding for these solutions.

- *A stakeholder raised a concern about the fact that builders, developers, and fisherman are not at the table in this Working Group and expressed concern that once the working groups finish coming up with solutions, and the builders and developers will fight back.* Ms. Harvey explained that the Herring River group is one of eleven Working Groups across Cape Cod and the facilitators worked to achieve stakeholder diversity all of the groups. She added that it has been hard to get every perspective at every group, and that CBI reached out to builders, fisherman, and developers in every watershed. She suggested that the facilitation team would do an analysis of all of the groups to ensure that there is adequate stakeholder representation across the groups. Ms. Senatori added that the Cape Cod Commission has reached out to builders and last week attended an event with 150 builders where they shared information and solicited input.

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. 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

She further 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.

She noted that in many instances, one of the solutions may not achieve the TMDL, but if you pair multiple solutions you may be able 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- *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*

A stakeholder added that the Muddy Creek project is a cooperative project between the towns of Harwich and Chatham.

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). Ms. Harvey asked participants to consider the environmental, economic, and community impacts of the possible technologies and approaches and asked them what evaluation criteria/factors they might consider when evaluating the range of possible solutions. Working Group members offered the following suggestions:

<u>Environmental</u>

- *Shellfish:* Participants noted that the health of the region's shellfish habitat would be important to consider given its important cultural and economic roles in the community.
- *Contaminants of emerging concern (CECs)*: As noted earlier, participants felt that the impact of solutions on CECs should be considered. Technologies that address CECs might be worth considering more heavily.
- *Time of travel:* Some options address the problem before it enters the groundwater. These might be preferable in many circumstances.
- *Phosphorus vs. nitrogen impacts*: Ponds are important and some technologies are better at removing phosphorus while others better at removing nitrogen.

<u>Economic</u>

- *Shellfish*: As noted earlier, the impact of technologies on shellfish businesses is important because shellfish businesses are among the few economic drivers in the watershed.
- *Efficiency*: Stakeholders noted that technologies should be efficient in terms of cost, impact, and resources used. Towns will not support options that are not efficient over

the long and short term.
- *Operations and maintenance (O&M)*: In addition to installation costs, the long term costs for O&M should be considered because towns might not be able to support costly O&M.
- *Costs:* Costs will always be important. It might be worth pursing options with the least cost first. Or exploring options that have a lower cost per unit of nitrogen removed.
- *Agriculture:* How do technologies impact agricultural sectors in the watershed?

<u>Social</u>
- *Secondary benefits/opportunities*: It might be valuable to explore options that create useful secondary benefits for communities, such as additional recreational space or conservation area.
- *Unintended consequences*: There may be unintended consequences to people (e.g. higher costs for low income residents), businesses (e.g. tourism) or other which should be anticipated, to the extent possible.
- *Economies of scale*: Some options may create opportunity for scaling up, which could provide cost benefits for the towns and/or residents (e.g. multiple units using a single Title V system).

<u>Implementation</u>
- *Retrofit or New Requirements*: To what extent will technologies be retrofits or be required for new construction? At what cost and what are the mechanisms for implementation?
- *Seasonal variability*: How do the technologies work with seasonal variability (e.g. I/A systems don't work as well if they are not run regularly).

<u>Politics</u>
- *Buy-in*: It will important to know how what interests decision-makers have and be able to sell options that are correlated to communities' goals and interests. Also important is understanding the political implications and consequences (intended or unintended) of options.

<u>Siting</u>
- *Size/Space Requirements*: The size of the technology may sway public acceptance. Generally, the smaller the better.
- *Abutters*: The potential impacts and reactions of abutters to specific technologies should be considered. Some may be opposed to land clearing, hard infrastructure or clearing.
- *Long-term buildout and land use*: The impact of technologies on land use and build out should be considered. There may be unintended consequences (positive and negative) that could result from certain technologies (e.g. smart growth, sprawl, growth neutral, etc.)

- *Risk management*: Technologies should consider flood zones and climate change infrastructure needs and changes.

Priorities for this Watershed
Ms. Harvey asked participants to hone in on the specific environmental, economic, and social trade-offs or consequences that they felt would be important to consider for this watershed? Working Group members offered the following suggestions:

- *Who pays- users vs. whole town*: Residents will want to know who pays and who benefits. Equalizing costs and spreading the costs across users, towns, and watersheds could be an important principle to pursue (e.g. Harwich has worked hard to equalize costs associated with water system.)

- *Who is responsible*: There are risks associated with options/systems if they are not maintained or used properly. Who has responsibility for maintaining the systems and ensuring that they are used responsibly (e.g. not turning off I/A systems because they have higher energy costs)? There is a balance between individual responsibility and municipal responsibility; testing and monitoring often fall under town permitting processes, but individuals should also hold some responsibility. Implementation of shared systems may result in "commons" problems where individuals shirk personal responsibility at the expense of the greater group. There is a need for public education because some technologies require changing long-term behaviors of residents and systems users.

- *Space requirements (small area vs. larger systems):* The size of the technology will influence public acceptance. Some residents will support smaller systems that take less room and are located in less visable areas, while others may be okay with larger systems. In general, participants indicated that smaller systems would likely be preferable.

- *Adaptability*: It could be helpful to have technologies that are adaptable over time and can be modified to meet changing conditions or needs.

- *Costs:* In addition to who pays questions, the installation costs and the long term costs for O&M will be important because towns might not be able to support costly O&M.

- *Regulatory consistency*: There may be unintended inconsistencies between existing regulations and new technologies. New systems may require updates to health, building codes, land use regulations, etc. Technologies that are more consistent with current land use regulations and other existing codes and plans may be more acceptable to the public. These include current visions for growth and open space management.

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 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 5, 2013
8:30AM -12:30PM
Harwich Community Center, 100 Oak Street, Harwich, MA 02645

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 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

Hilde Maingay, (Falmouth, MA). There are errors and issues of concern in the fact sheets. She has shared these concerns with the Commission and would like this list of errors/concerns to be sent to all stakeholders. One example: Composing toilets have already been permitted in MA for decades. She would also like to see other issues added to the list of how solutions are evaluated:

- Energy consumption: how much fossil fuel does each solution use, CO2 emissions, other factors

- Resource recovery: the “waste” is very valuable and should be recovered and reused rather than “disposed of”.
- Feels that people need to think more broadly about what can be done and be more willing to make sacrifices and behavior changes.

Shawn Fernandez, (Cranberry Valley Golf Course) Golf courses have changed the way operated over the past 15 years. They have reduced the amount of nitrogen, reduced fertilizer use, and have returned to more cultural practices. At Cranberry Valley, they are currently applying to become an Audubon sanctuary which involves a lot of planning and nutrient/pesticide reduction.

Bob Kingsbury, (Harwich Port Golf Course). All superintendents of golf courses view themselves as environmental stewards and take it very seriously. Contrary to public opinion, they don’t simply dump products onto the turf. We do the best we can. Some do it better than others. At Harwich Port we have reduced fertilizer usage substantially, and have also reduced the amount of turf they have; has led to 41% reduction in nitrogen. Reduction can be achieved partly through mandates, but largely through education. Education should be held in higher regard as part of this process.

APPENDIX ONE: MEETING PARTICIPANTS

Name	Affiliation
Working Group Members	
Larry Ballantine	Harwich Board of Selectman
Peter deBakker	Harwich Water Quality Task Force
Diane Chamberlain	Dennis Board of Health and Comprehensive Water Management Task Force
Joan Kozar	Harwich Planning Board
Jason Klump	Brewster Planning Board
Michael Lach	Harwich Land Trust
Sue Leven	Town of Brewster, Planner
Ed Nash	Golf Course Superintendents Association
Russell Schell	Brewster Comprehensive Water Planning Committee
Steve Swain	Concerned Citizen
Brooke Williams	Harwich Civic Association
Public	
Shawn Fernandez	Cranberry Valley Golf Course
Bob Kingsbury	Harwich Port Golf Course
Hilde Maingay	Upper Cape North and South Watershed Working Group member
David Stott	Chequessett Golf Course
Staff and Consultants	
Tom Cambareri	Cape Cod Commission
Patty Daley	Cape Cod Commission
Kate Harvey	Consensus Building Institute
Carly Ipken	Consensus Building Institute
Maria McCauley	Cape Cod Commission
Scott Michaud	Cape Cod Commission
Mark Owen	AECOM
Kristy Senatori	Cape Cod Commission