

Upper Cape West & South



Technologies and Approaches

What is the stakeholder process?

Public Meetings

Watershed Working Groups

Goals,
Work Plan
& Roles

Affordability,
Financing

Baseline
Conditions

Technology
Options
Review

Watershed
Scenarios

July

August

September

October

December

208 Planning Process

Public Meetings

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& Roles

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Advisory
Board

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RLI

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RLI

July

August

September

October

December

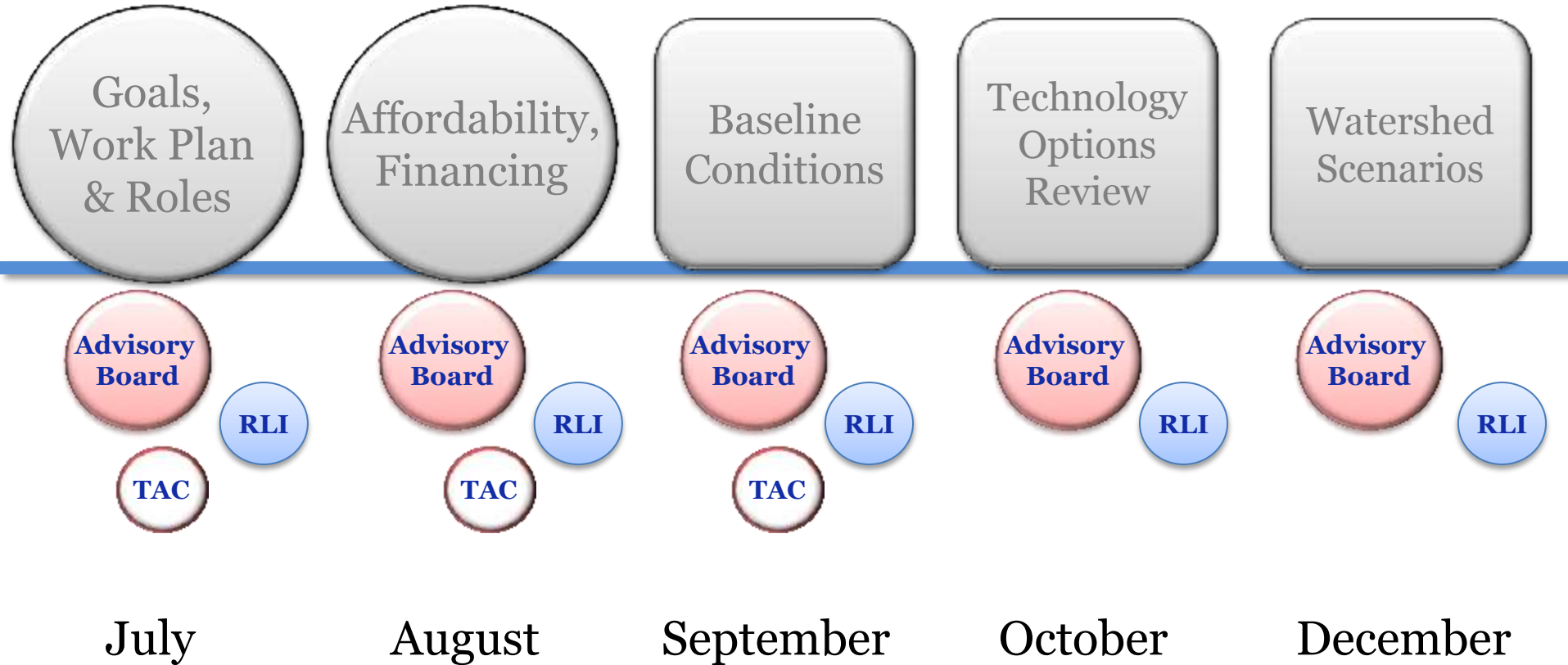
RLI

Regulatory, Legal & Institutional Work Group

208 Planning Process

Public Meetings

Watershed Working Groups



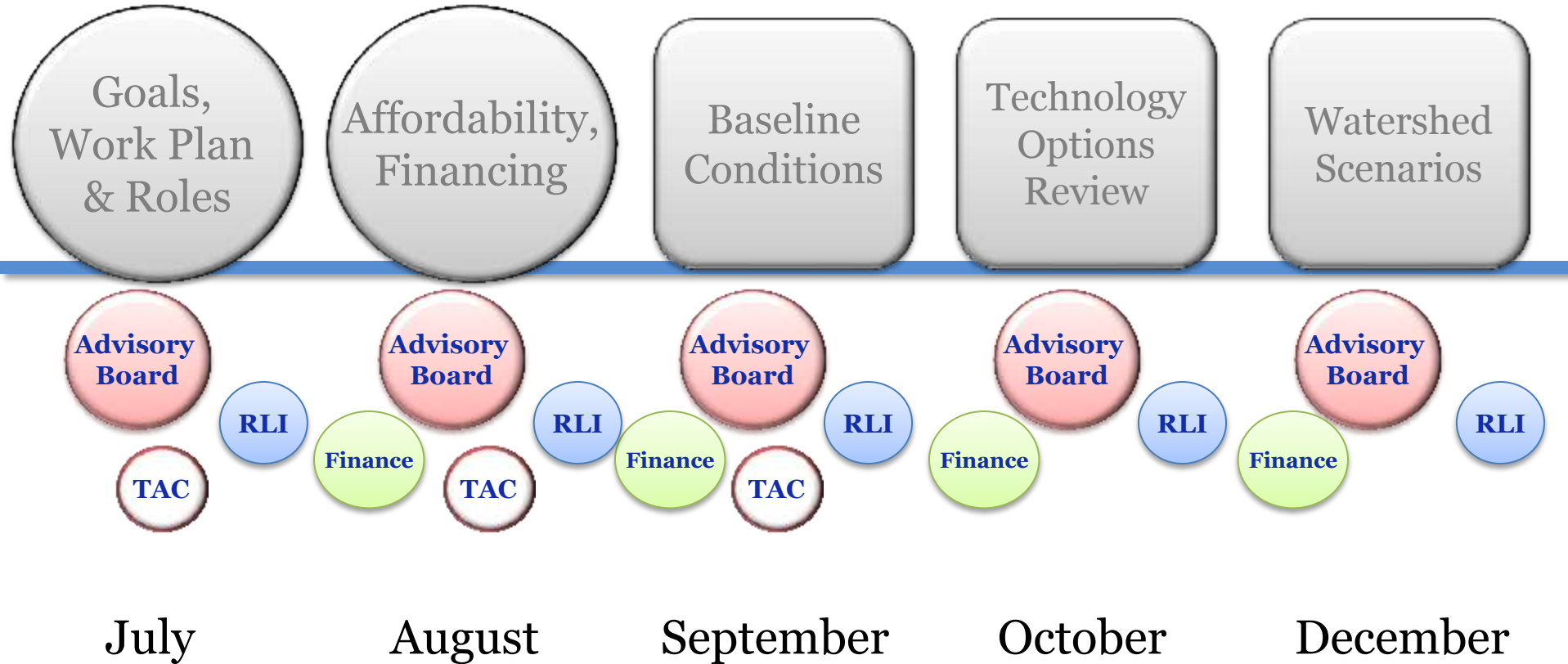
RLI Regulatory, Legal & Institutional Work Group

TAC Technical Advisory Committee of Cape Cod Water Protection Collaborative

208 Planning Process

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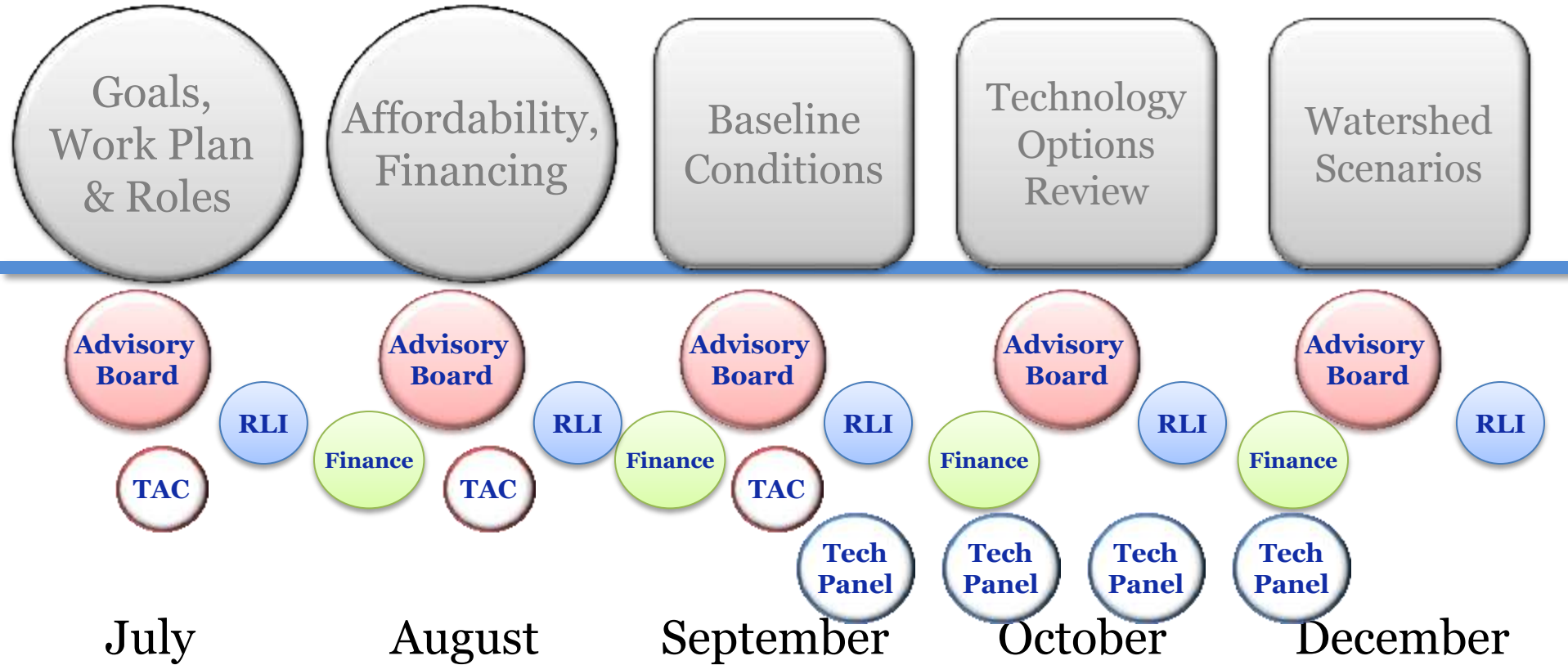


RLI Regulatory, Legal & Institutional Work Group

TAC Technical Advisory Committee of Cape Cod Water Protection Collaborative

Public Meetings

Watershed Working Groups



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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



Baseline
Conditions

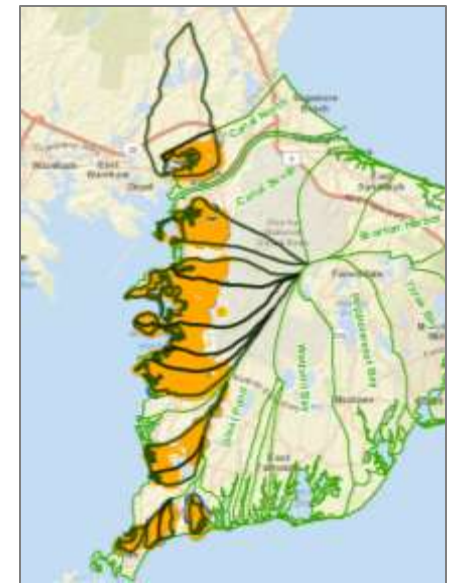
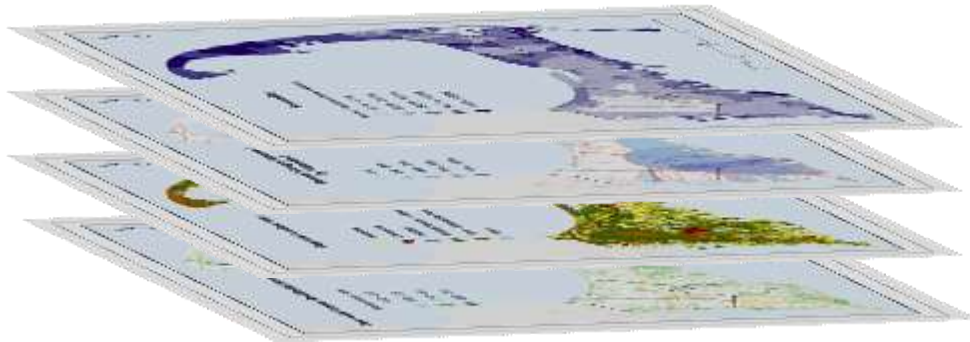
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Watershed
Scenarios

11 Working
Group Meetings:
Dec 2-11



208 Planning Process

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Technology
Options
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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 Cape20: 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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- ❑ Workshop 3 will embark on hands on problem solving in each watershed to meet target load reductions.

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Technologies and Approaches for Improving Water Quality

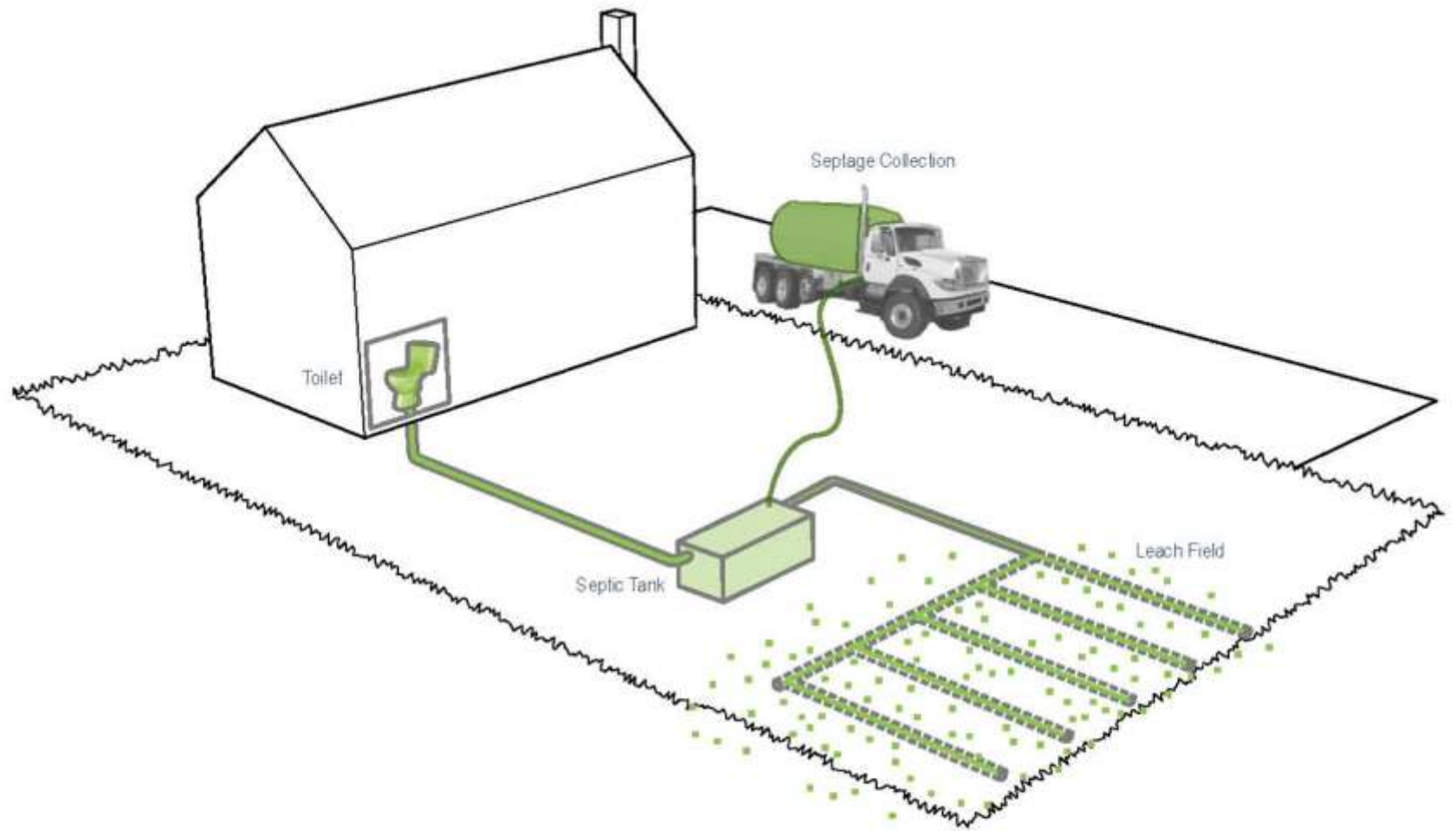
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- ❑ Certain technologies or approaches will be effective at **preventing** nutrients from entering the water body. Others will be effective at **reducing** or **remediating** nutrients that are already in the groundwater or water body.
- ❑ Regulatory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

Solutions



Solutions: Site

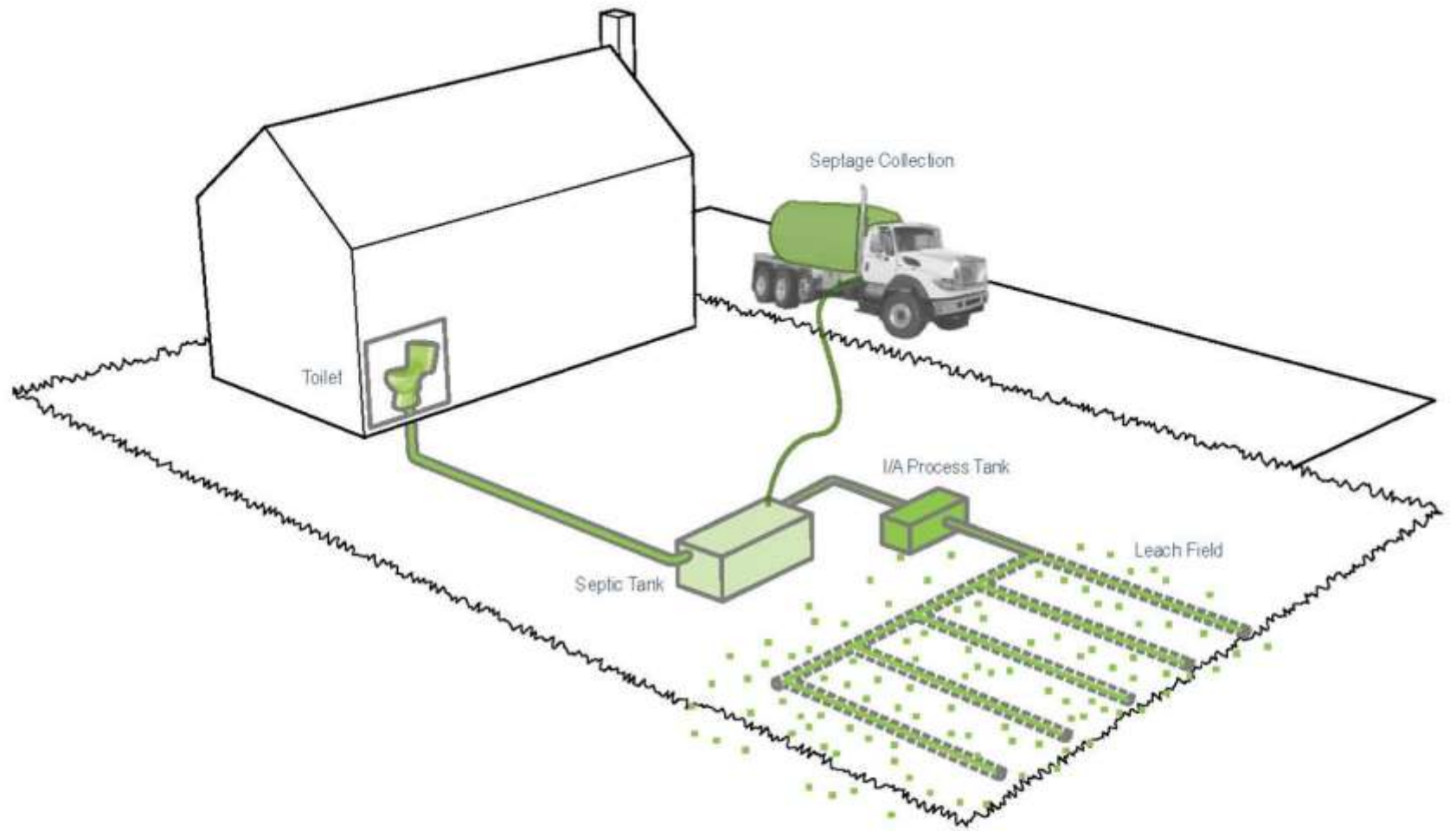




Scale: SITE
Target: WASTEWATER

Standard Title 5 Systems

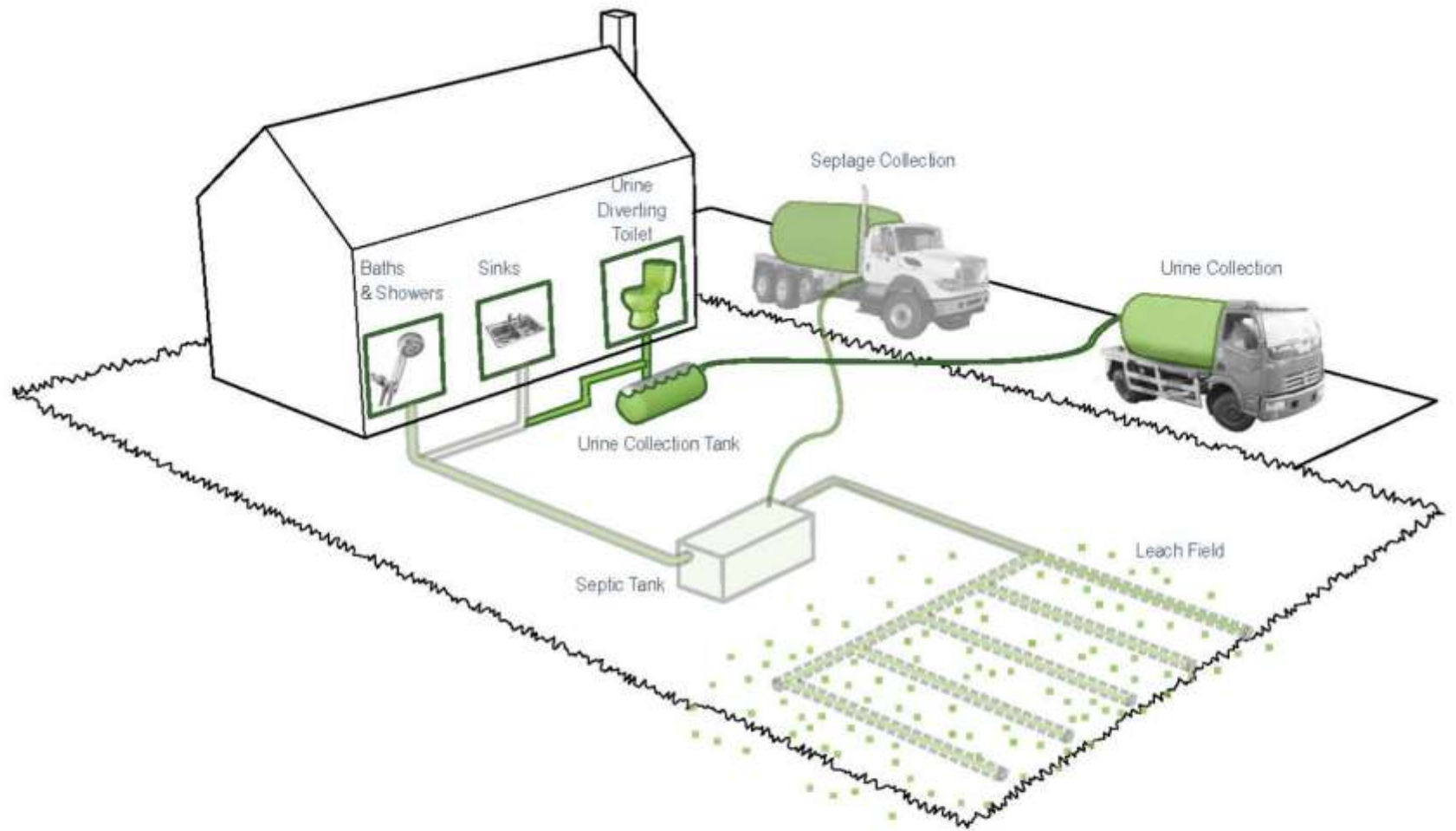
Title
5



Scale: SITE
Target: WASTEWATER

I/A Title 5 Systems

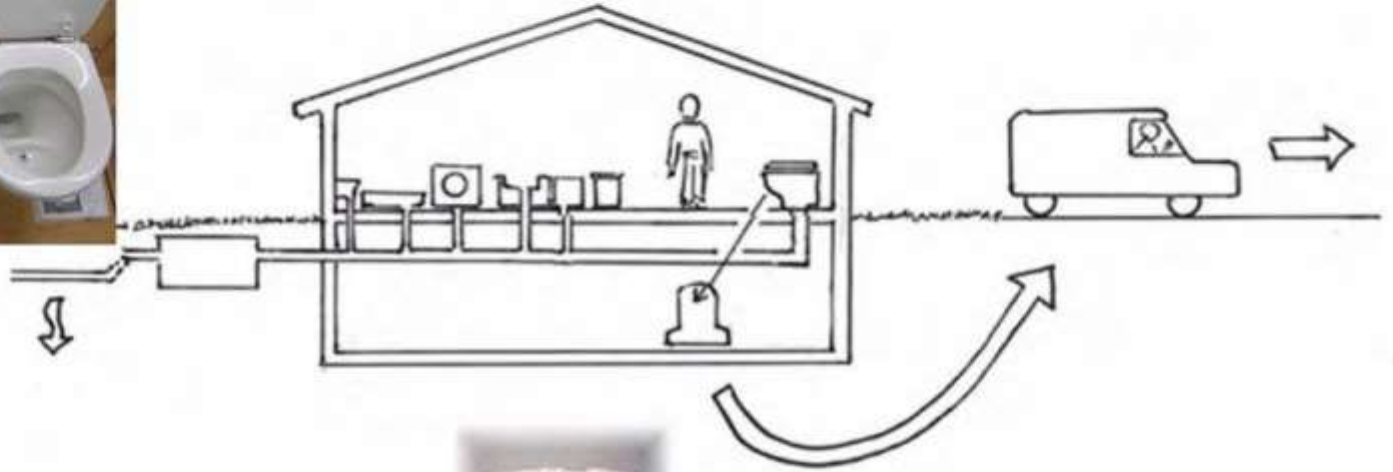




Scale: SITE
Target: WASTEWATER

Toilets: Urine Diverting





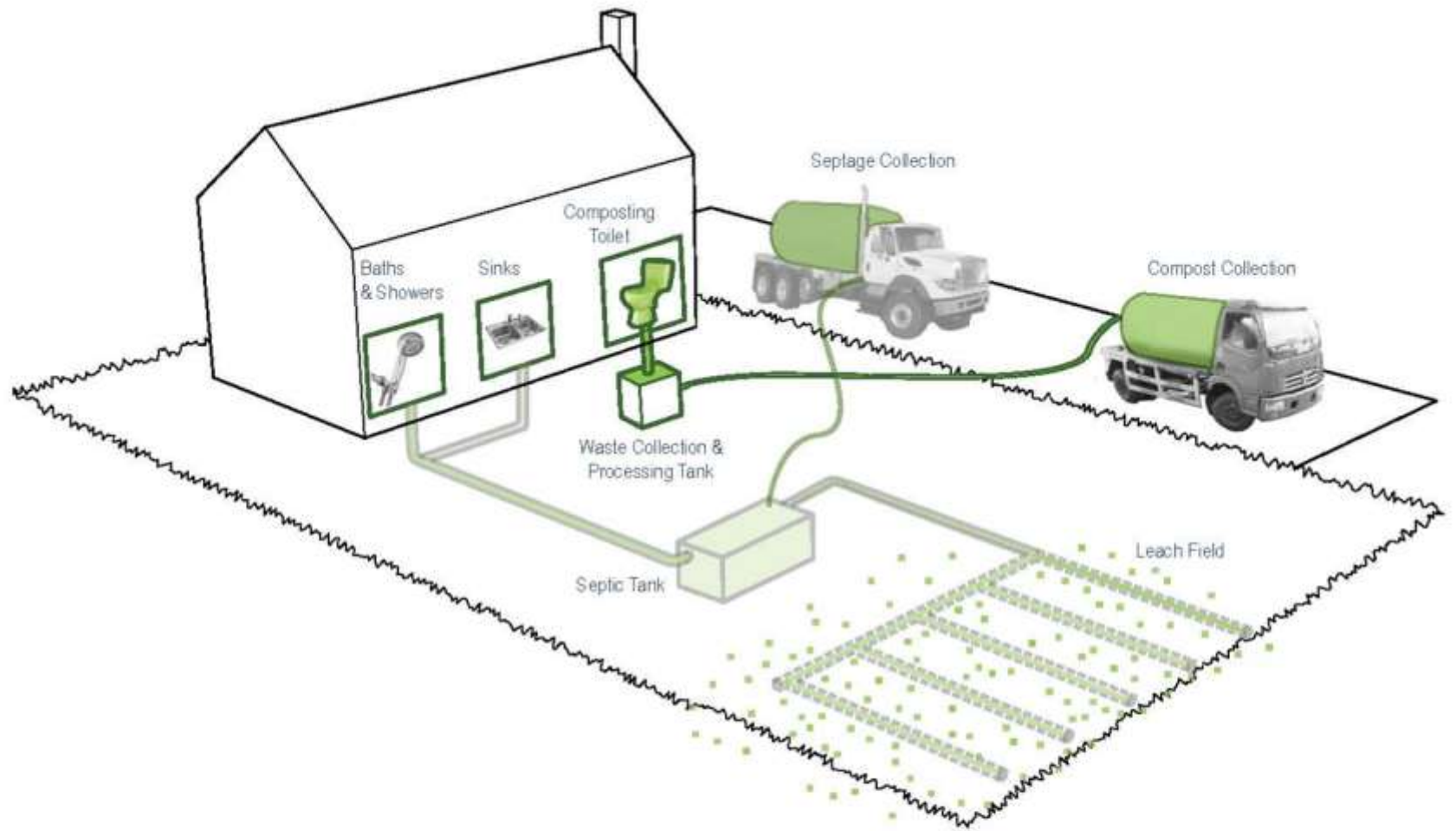
**Waterless
Urinal**

**IBC container
(220 gallons)**



40" x 40" x 48"

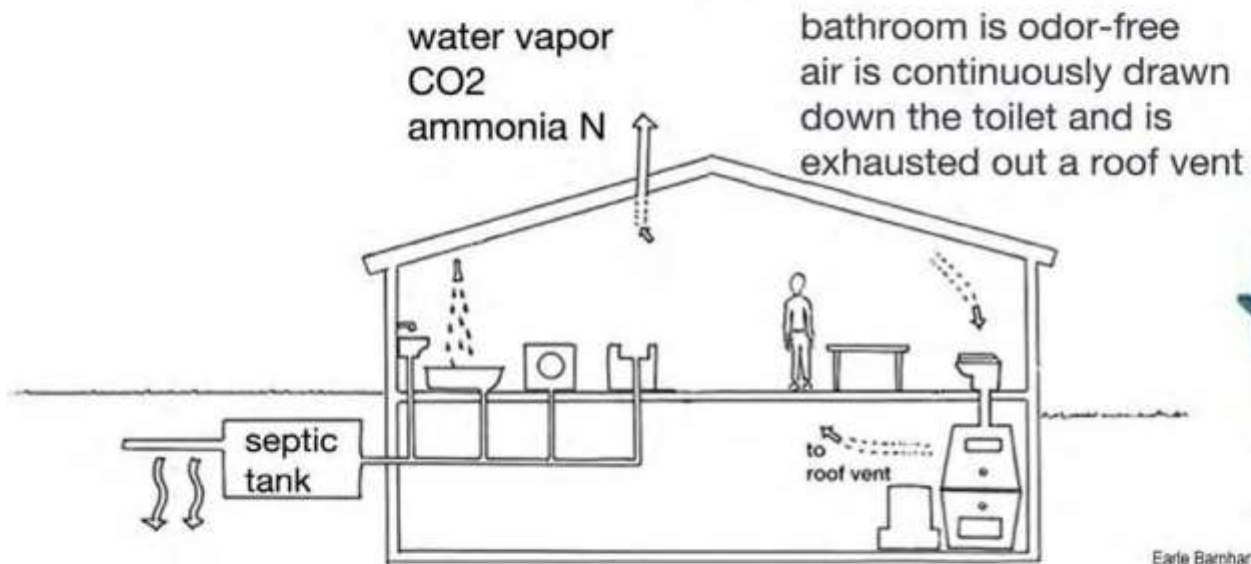




Scale: SITE
Target: WASTEWATER

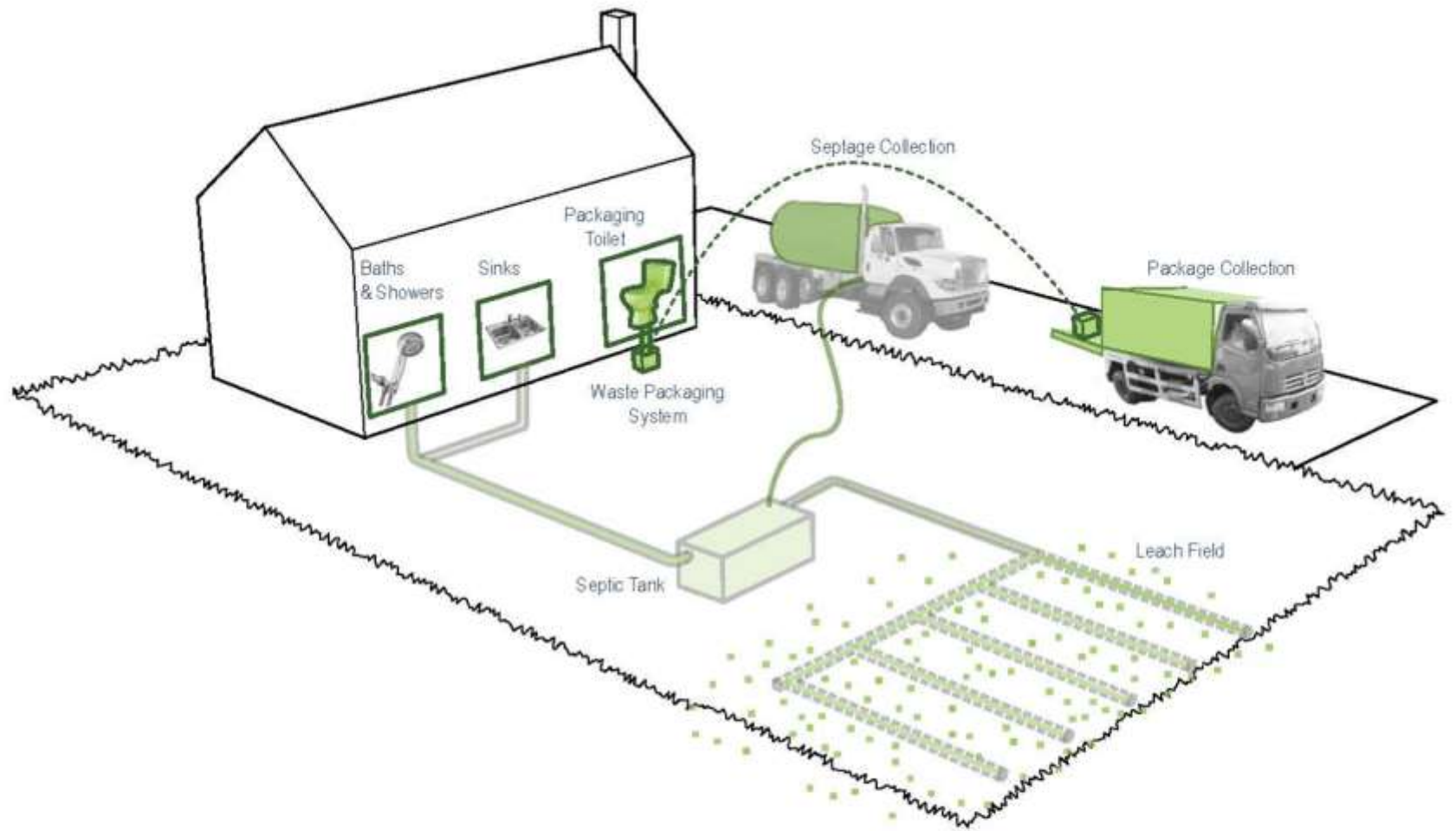
Toilets: Composting





Earle Barnhart
The Green Center, Inc





Scale: SITE
Target: WASTEWATER

Toilets: Packaging

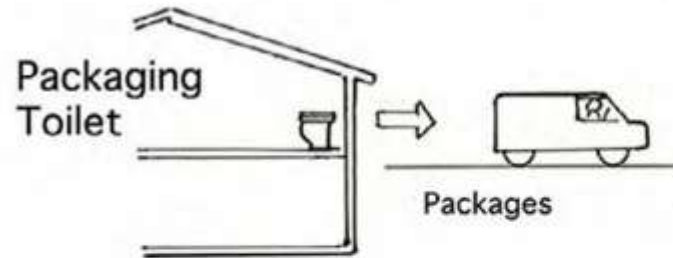


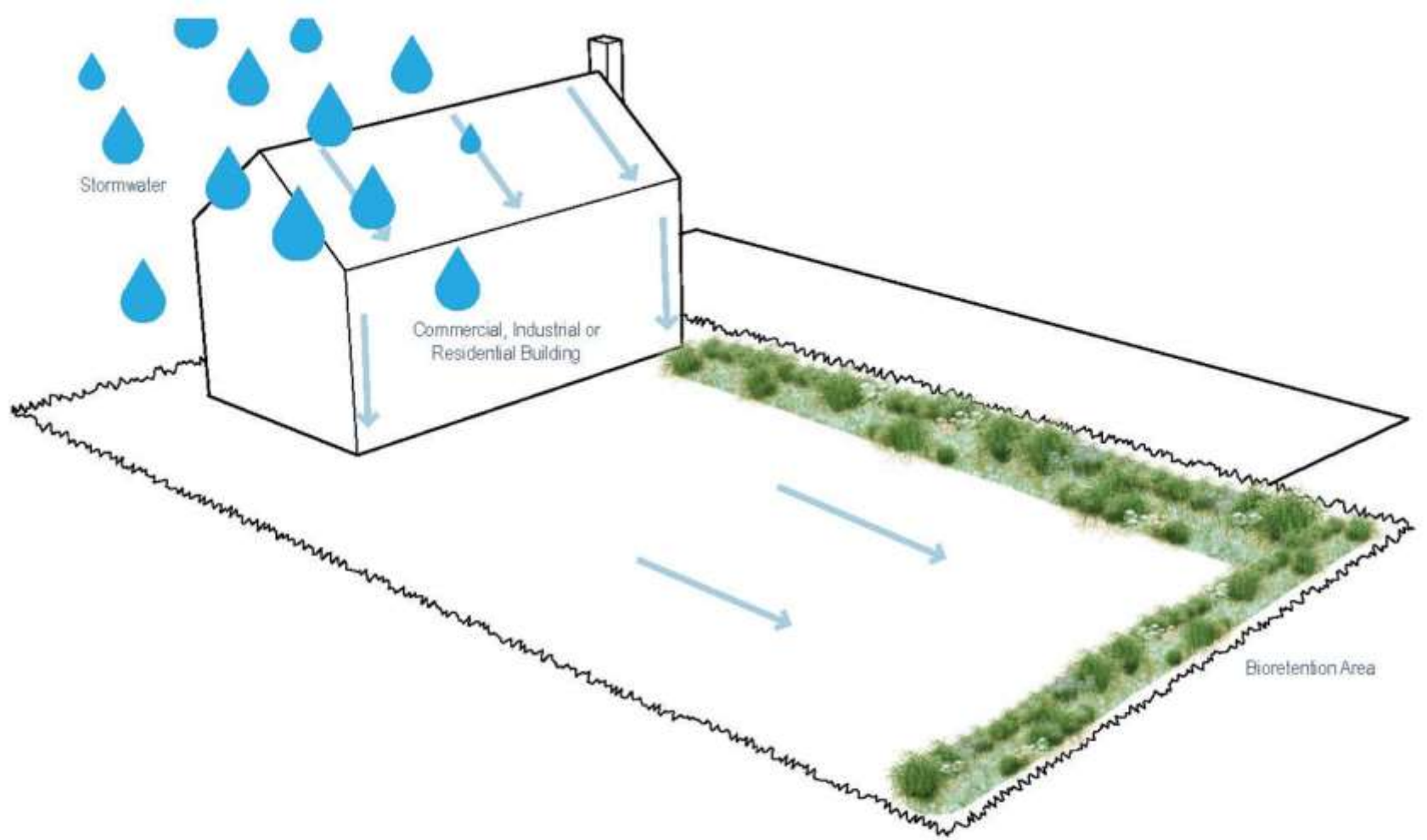


PACTO®



LOOWATT

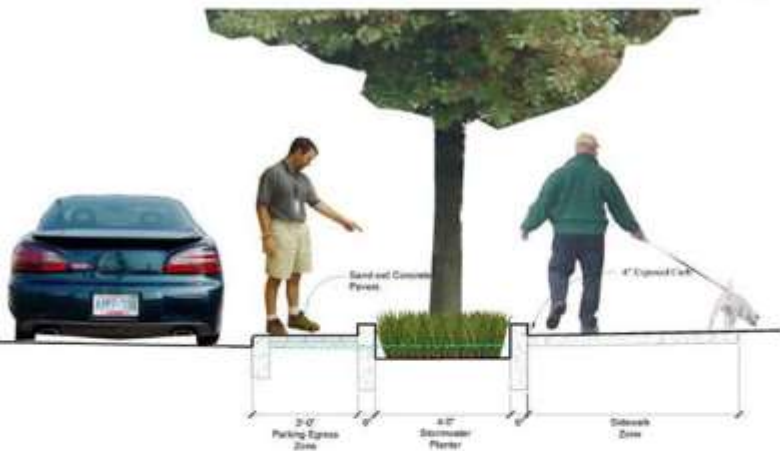




Scale: SITE
Target: STORMWATER

Stormwater: Bioretention /
Soil Media Filters





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

Stormwater: Bioretention /
Soil Media Filters

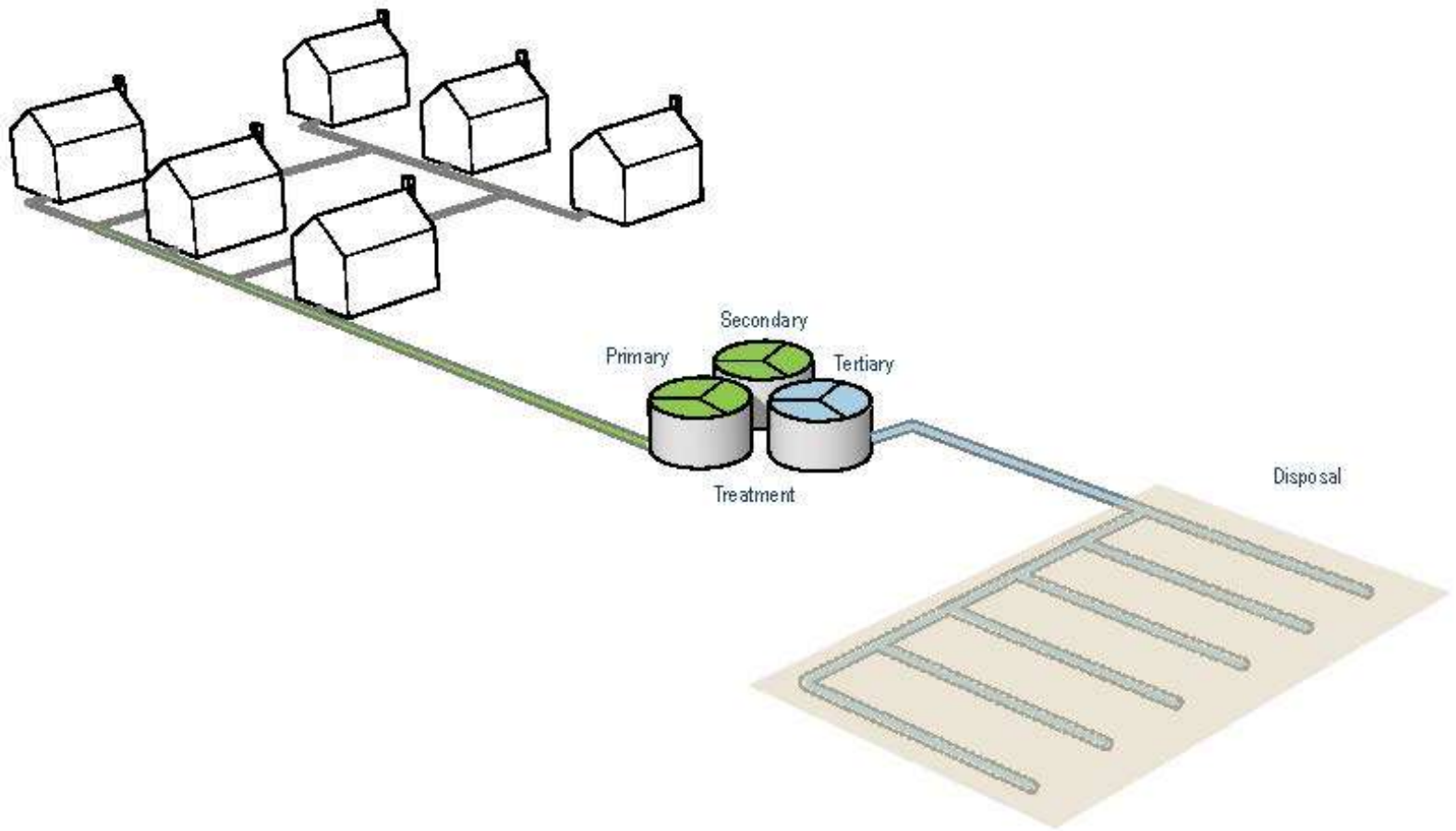




Rain Gardens

Solutions: Neighborhood

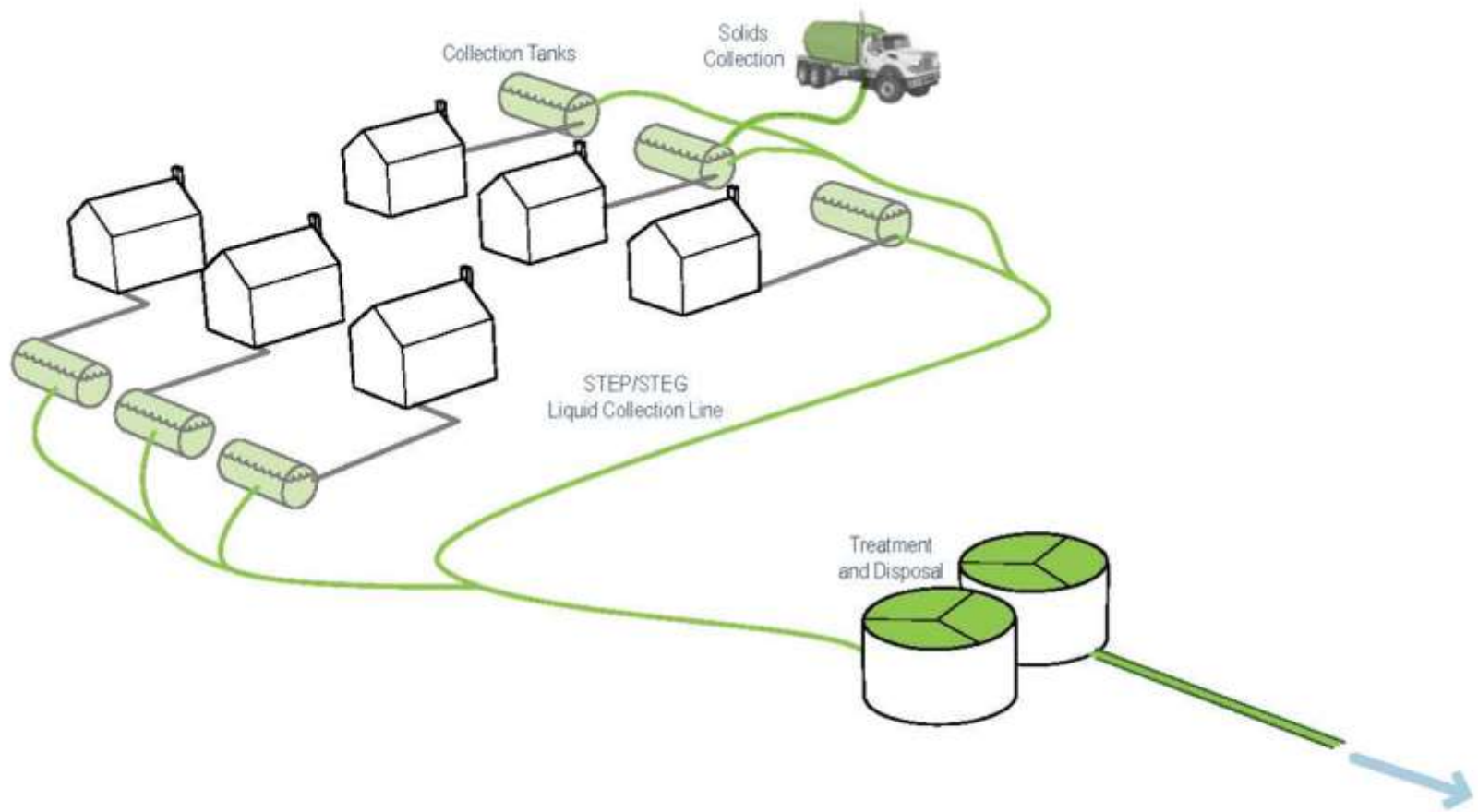




Scale: NEIGHBORHOOD
Target: WASTEWATER

Cluster & Satellite
Treatment Systems

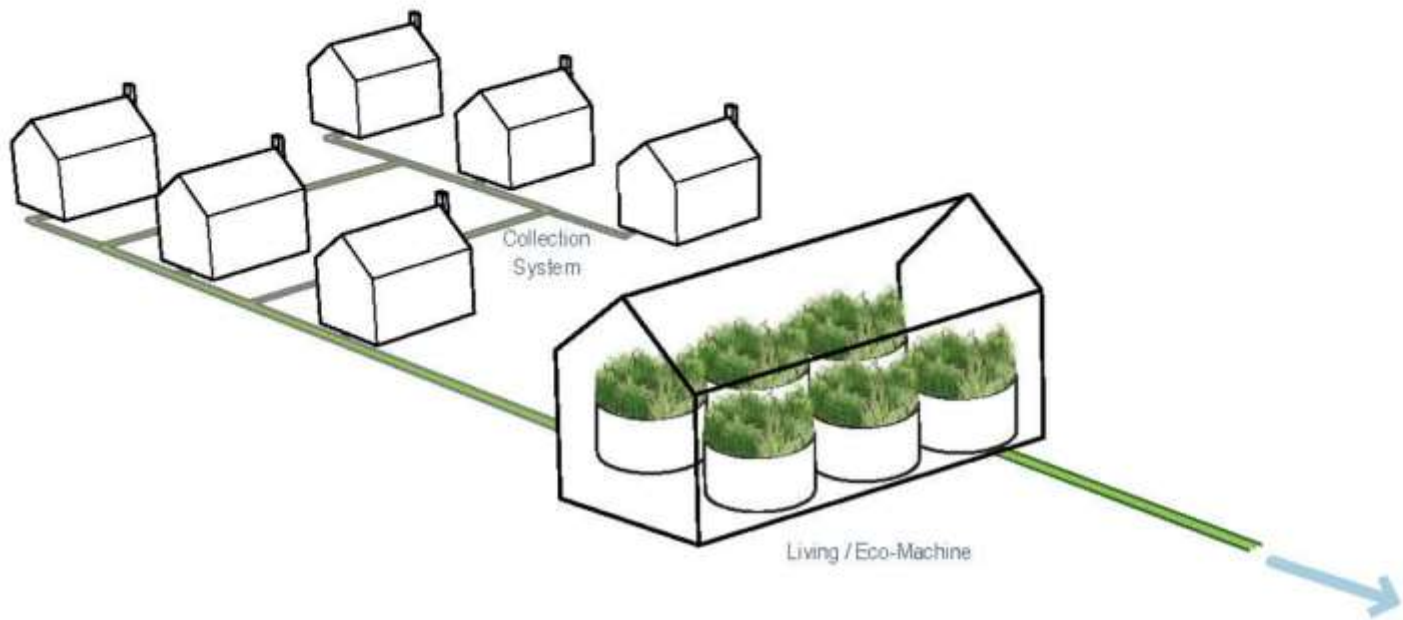




Scale: NEIGHBORHOOD
Target: WASTEWATER

STEP / STEG Collection

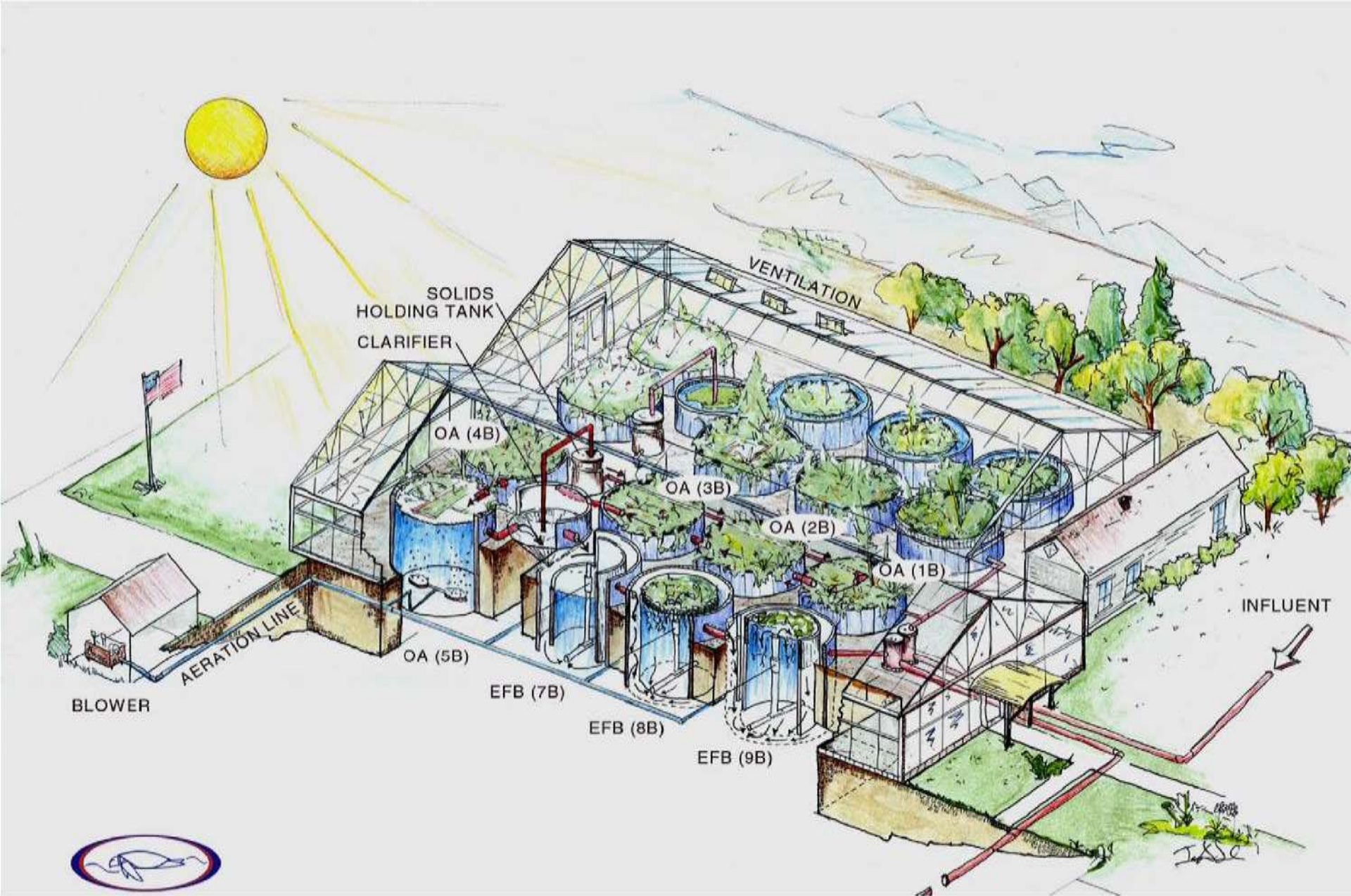
STEP/
STEG



Scale: NEIGHBORHOOD
Target: WASTEWATER

Eco-Machines and
Living Machines





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

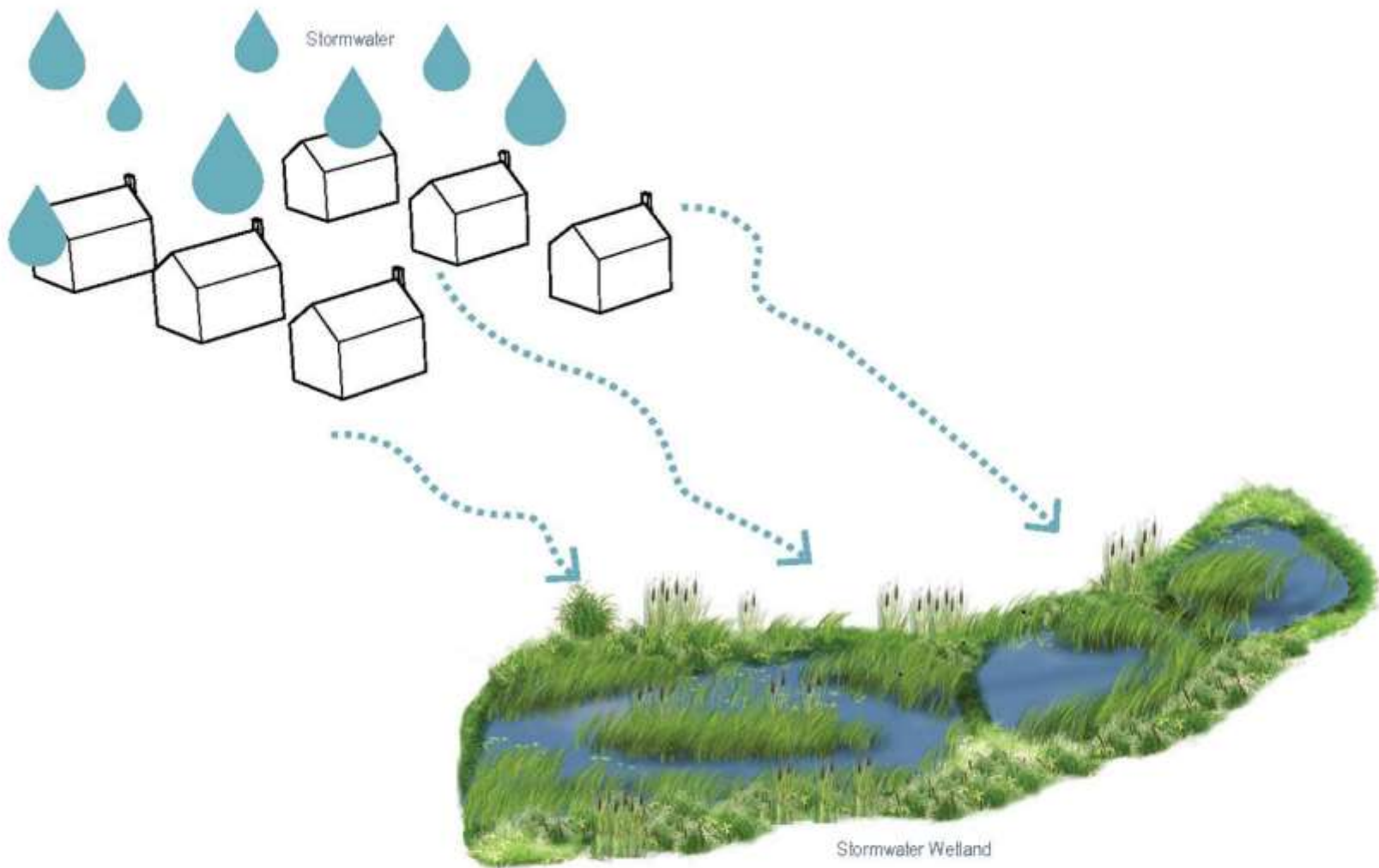




Precedent: Living Machine - South Burlington, VT + Photobioreactors - Falmouth, MA
Source: Todd Ecological and Tom Cambareri

Eco-Machines and
Living Machines





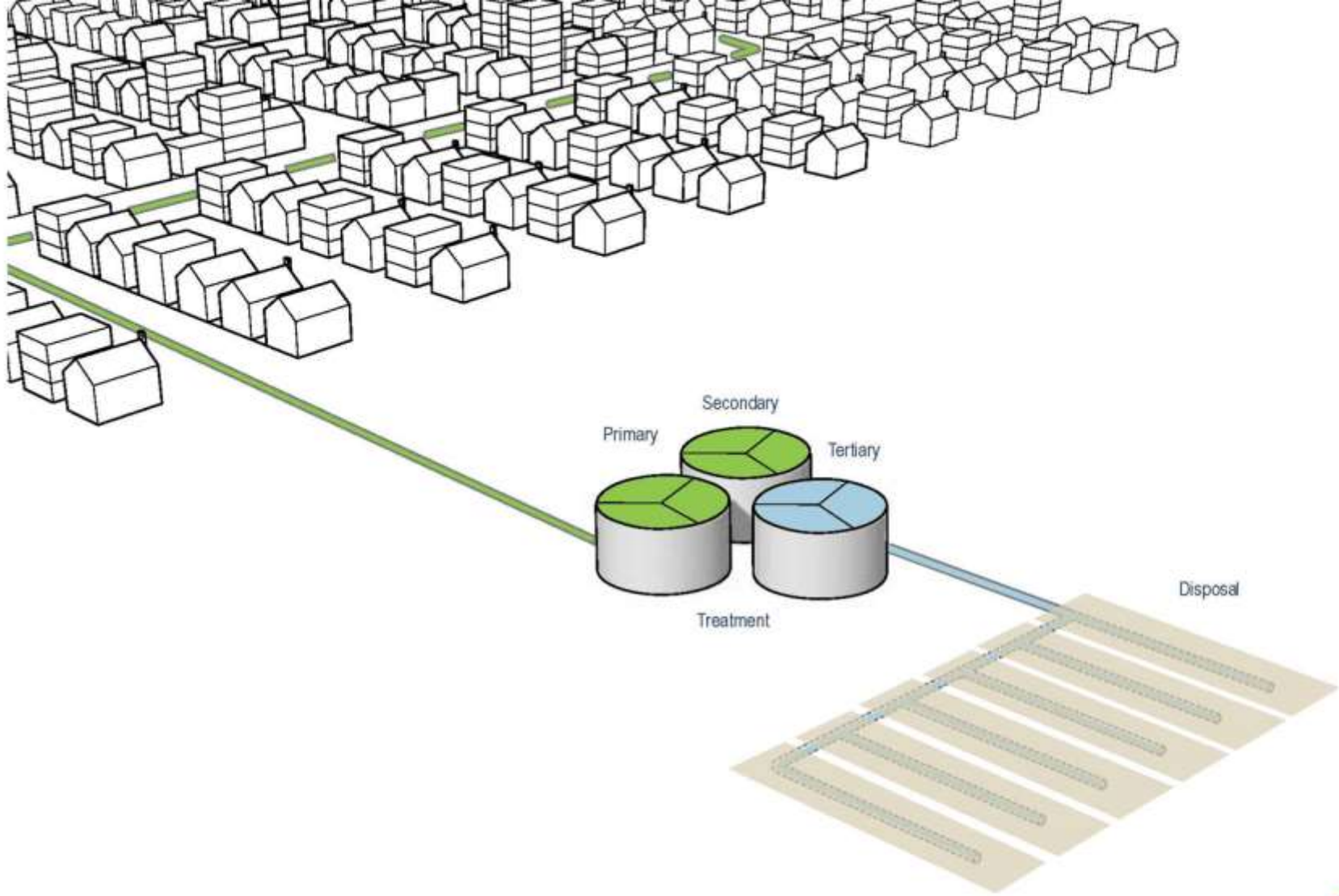
Scale: NEIGHBORHOOD
Target: STORMWATER

Stormwater Wetlands



Solutions: Watershed

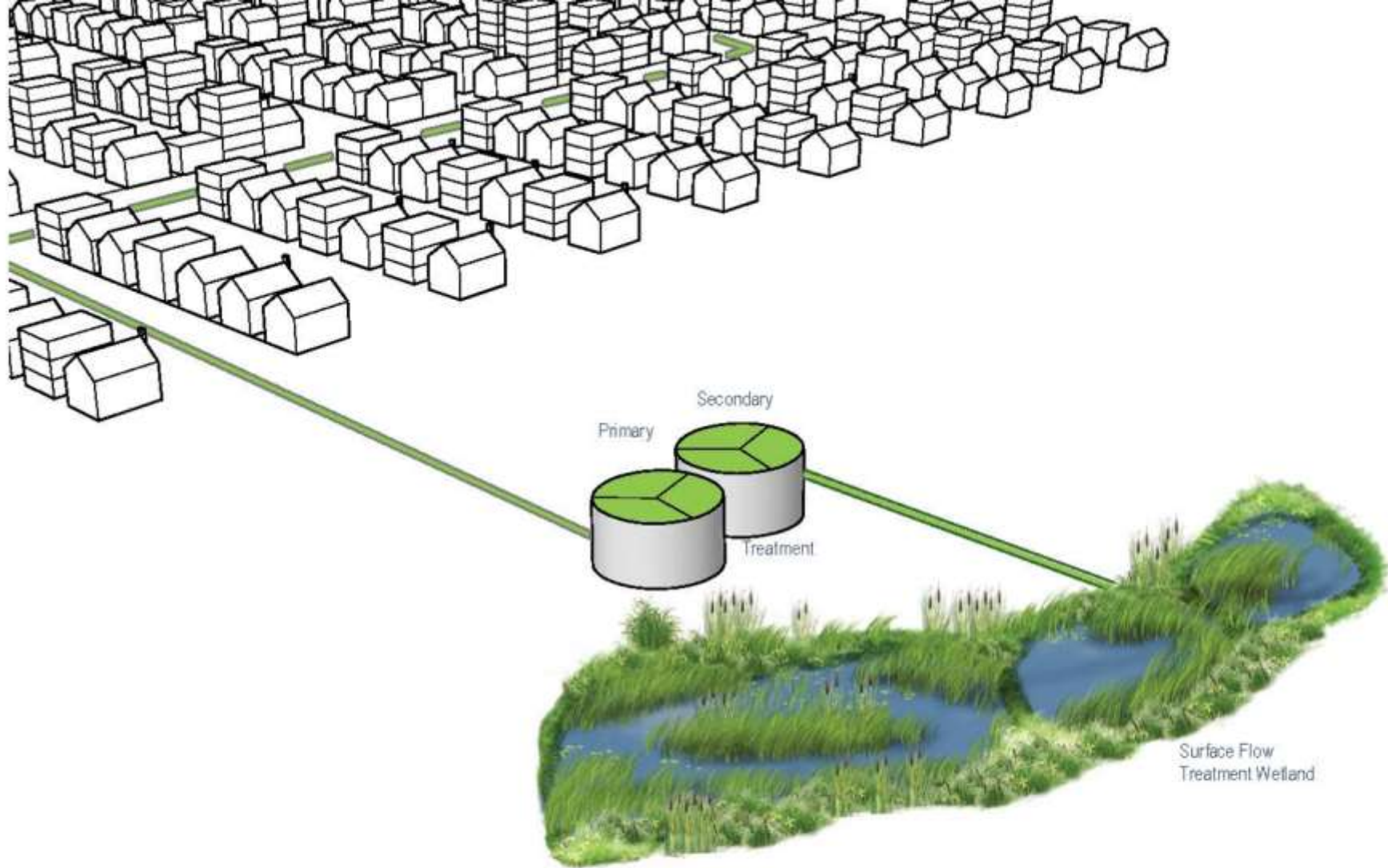




Scale: WATERSHED
Target: WASTEWATER

Conventional Treatment





Scale: WATERSHED
Target: WASTEWATER

Constructed Wetlands:
Surface Flow

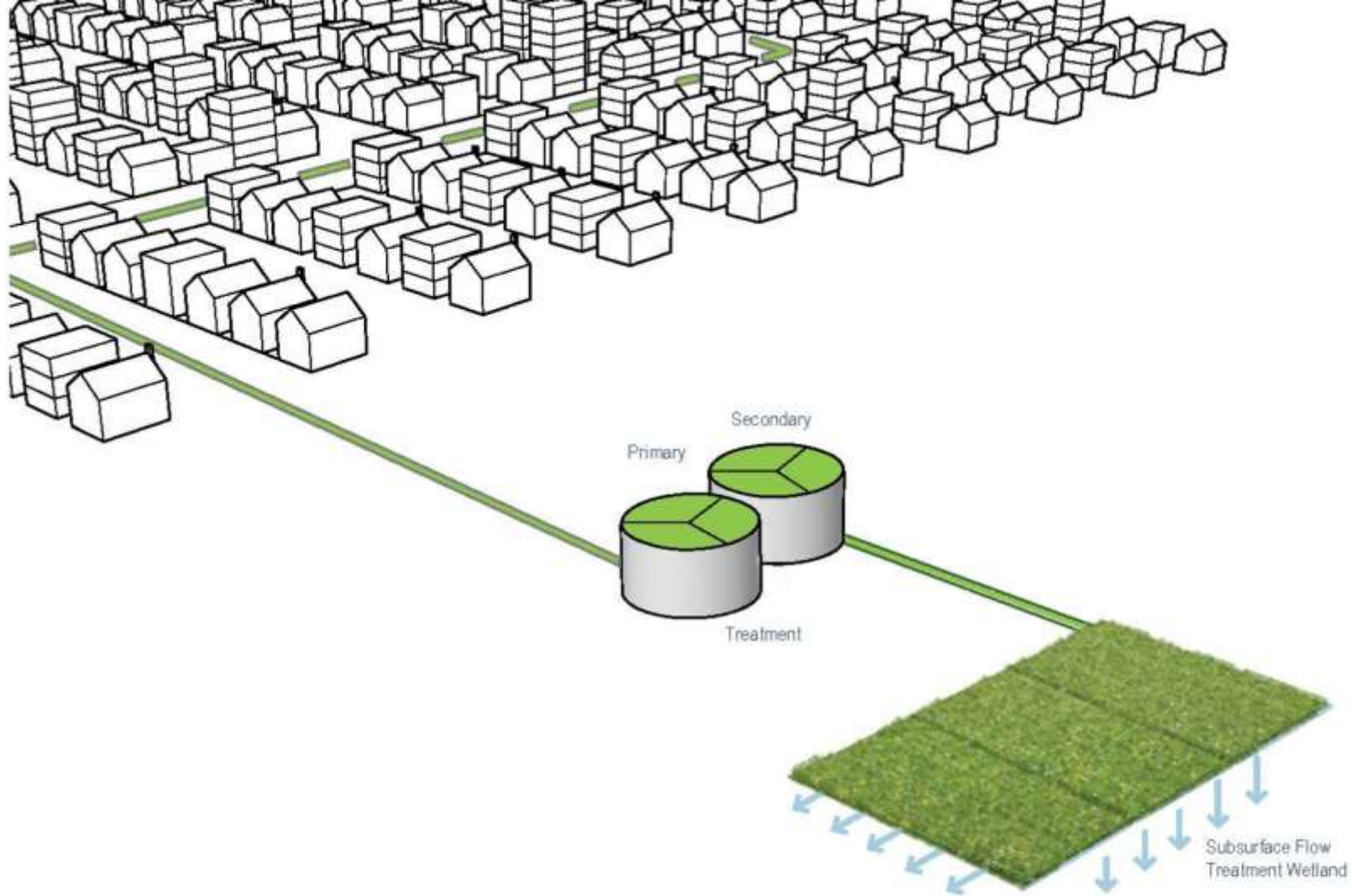




Precedent: Talking Waters Garden - Albany, OR
Source: Kate Kennen

Constructed Wetlands:
Surface Flow

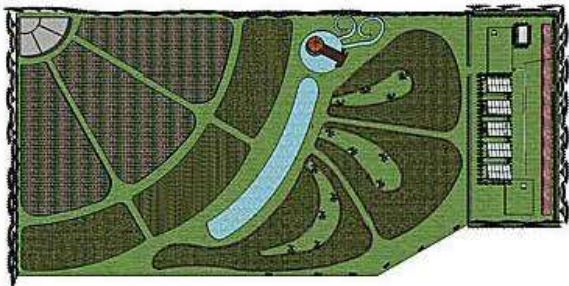




Scale: WATERSHED
Target: WASTEWATER

Constructed Wetlands:
Subsurface Flow

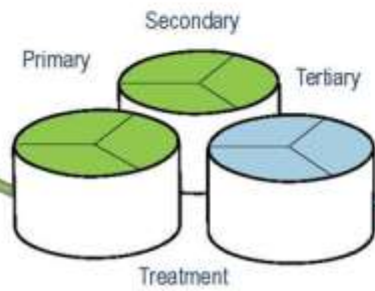
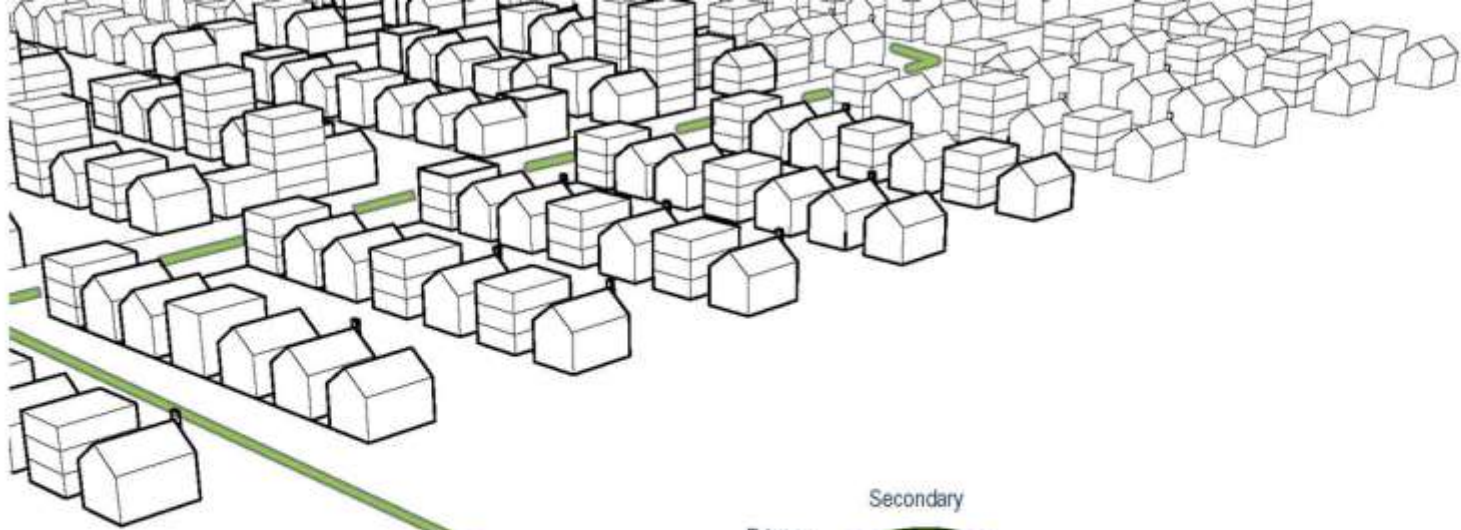




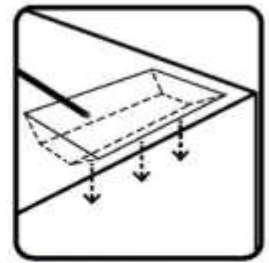
Precedent: Koh Phi Phi Treatment Wetland, Thailand
Source: Hans Brix

Constructed Wetlands:
Subsurface Flow

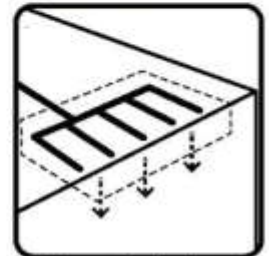




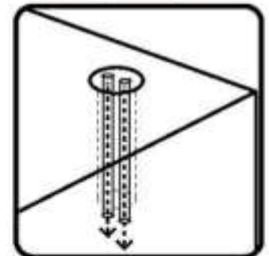
Disposal



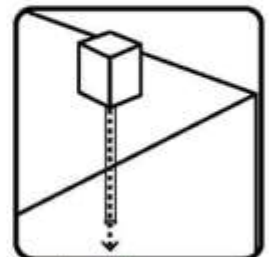
Infiltration Basins



Soil Absorption System



Wick Well

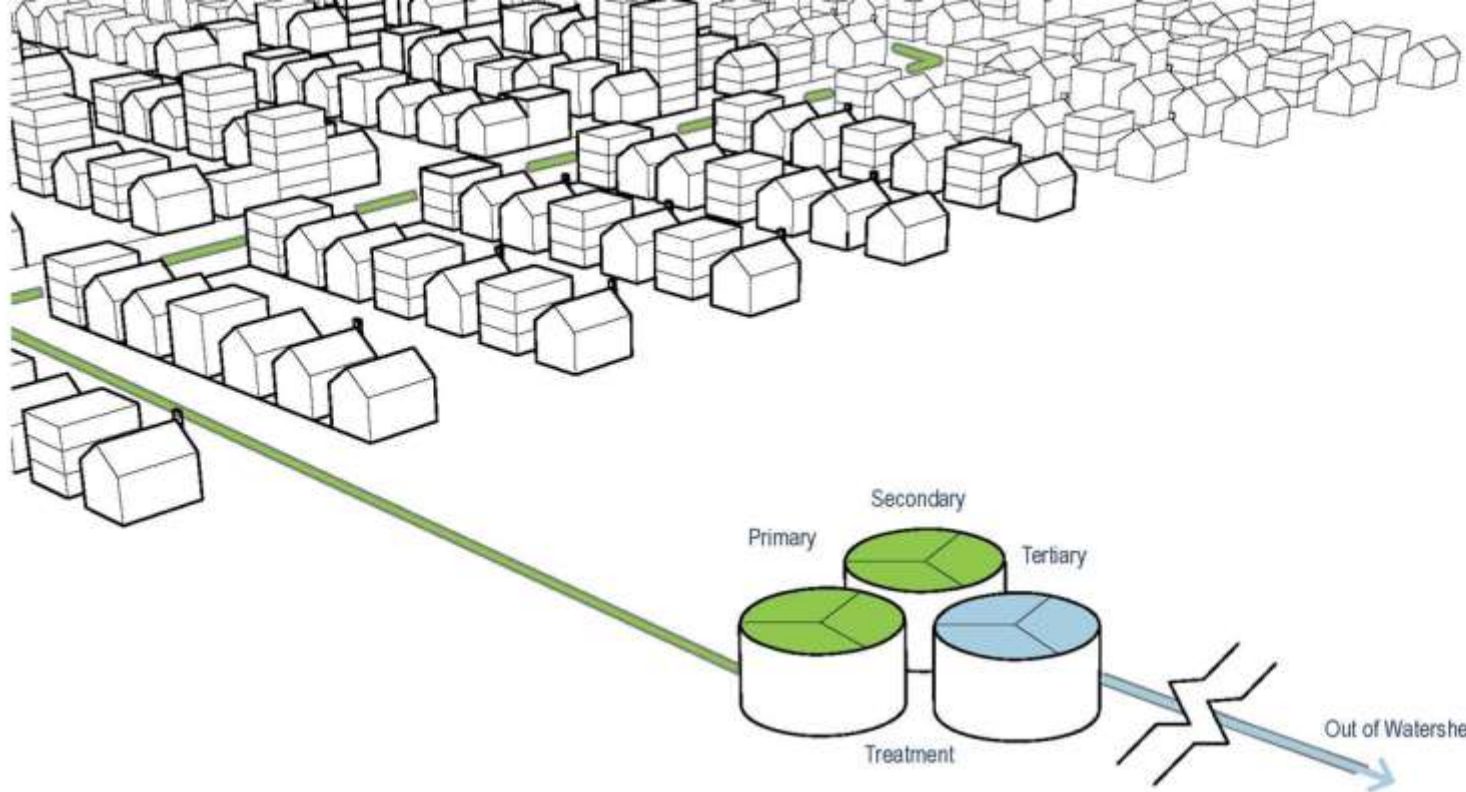


Injection Well

Scale: WATERSHED
Target: WASTEWATER

Effluent Disposal Systems

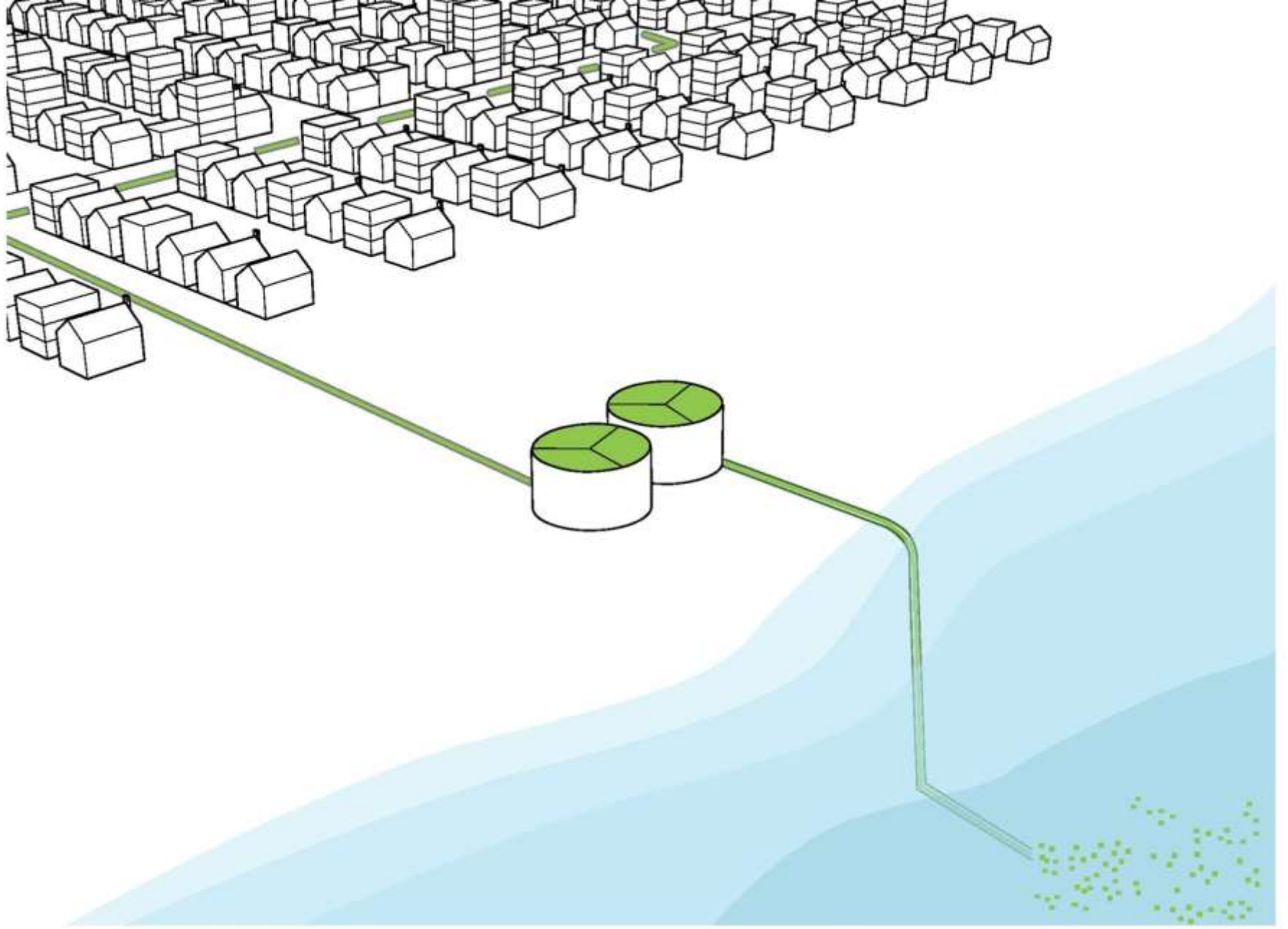




Scale: WATERSHED
Target: WASTEWATER

Effluent Disposal: Out of Watershed

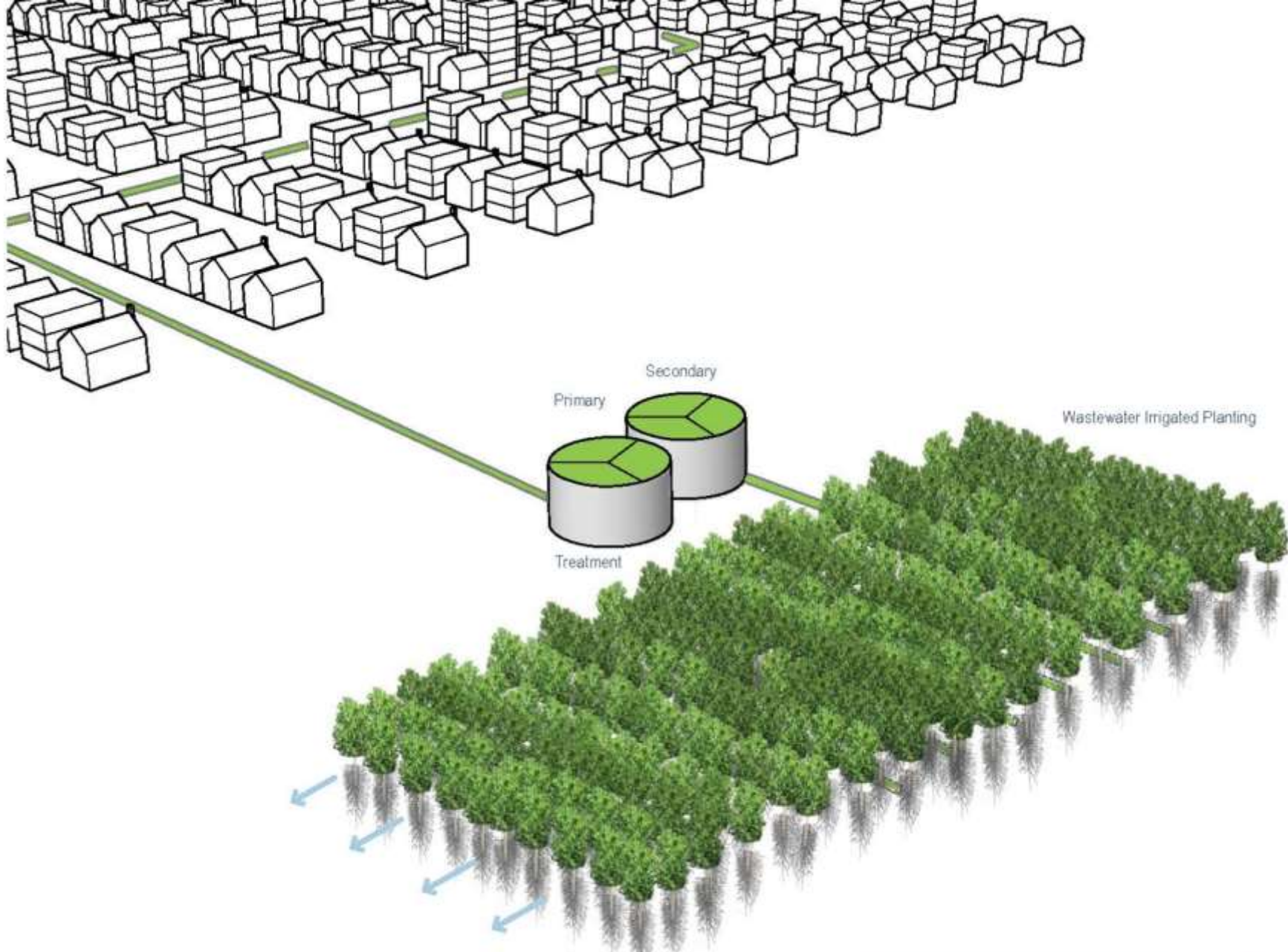




Scale: WATERSHED
Target: WASTEWATER

Effluent Disposal: Ocean Outfall





Scale: WATERSHED
Target: WASTEWATER

Phytoirrigation





Precedent: Woodburn OR, Wastewater Treatment Facility
Source: CH2MHill

Phytoirrigation



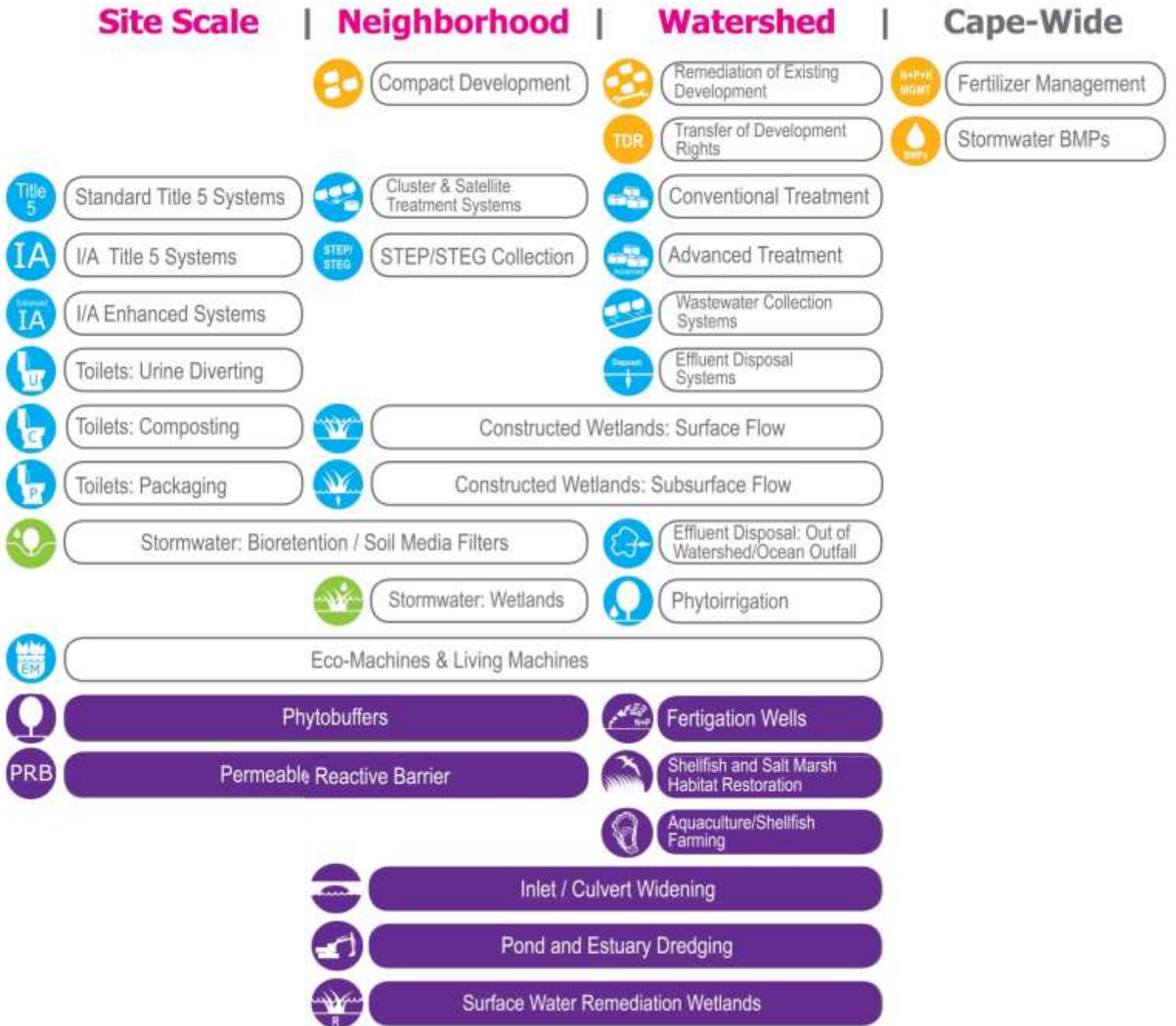


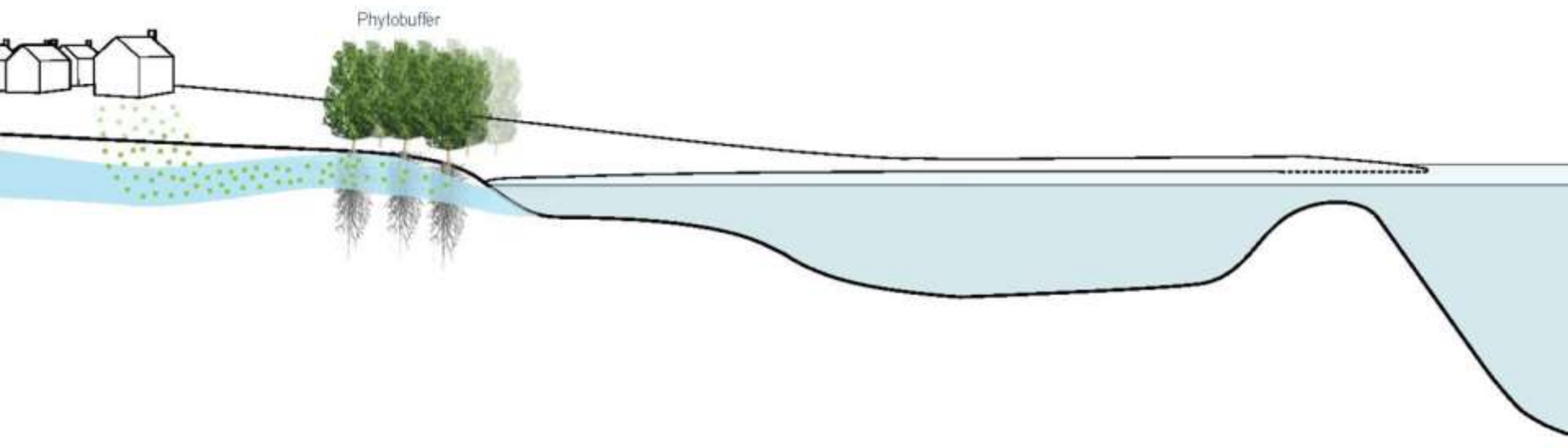
Precedent: Woodburn OR, Wastewater Treatment Facility
Source: CH2MHill

Phytoirrigation



Solutions: Ex. Water





Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Phytobuffers

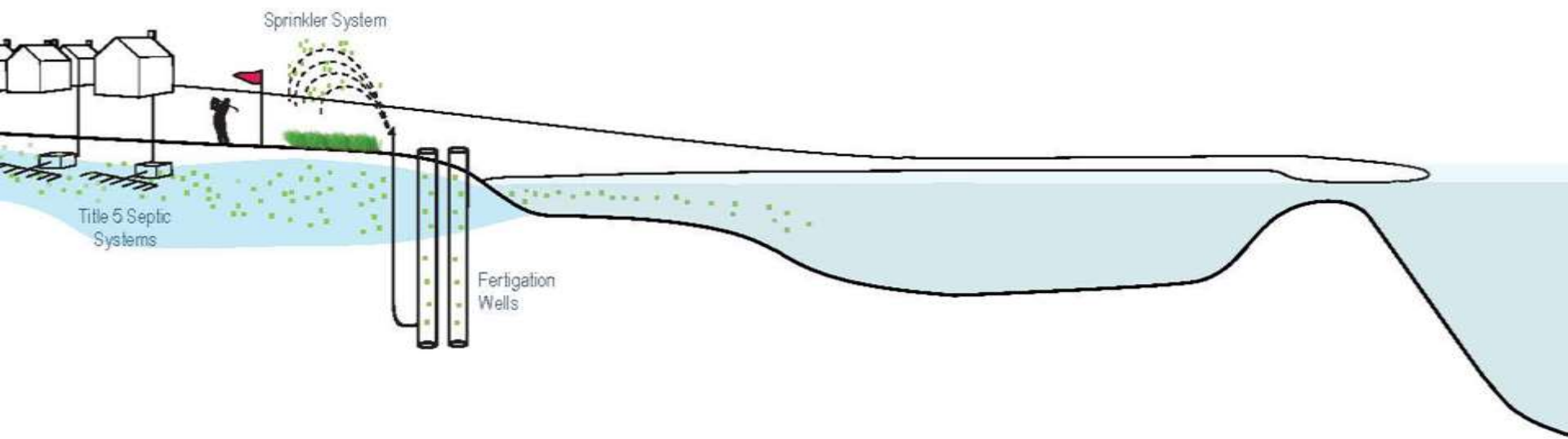




Precedent: Phytobuffer - Kavcee, WY
Source: Sand Creek Consultants

Phytobuffers



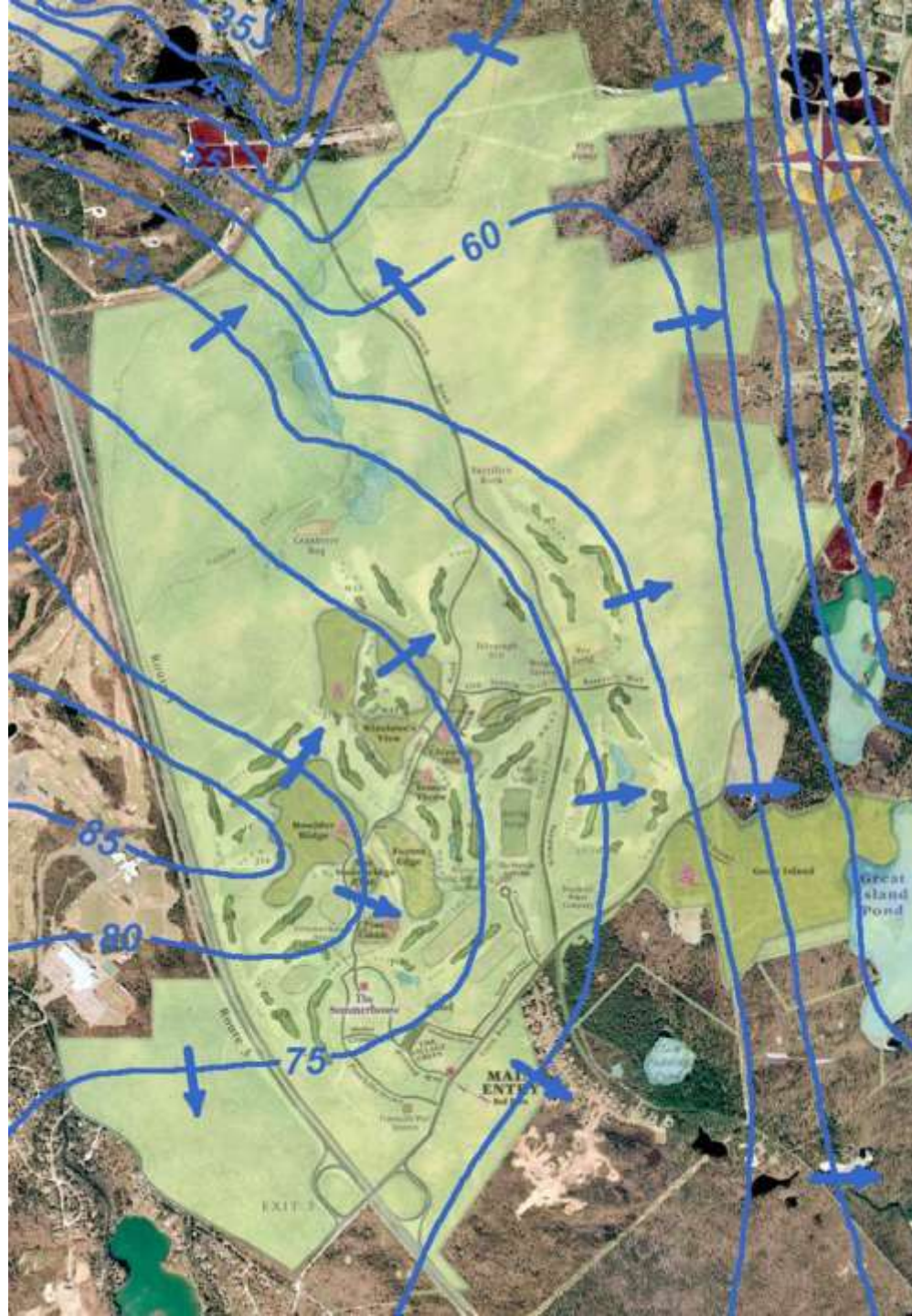


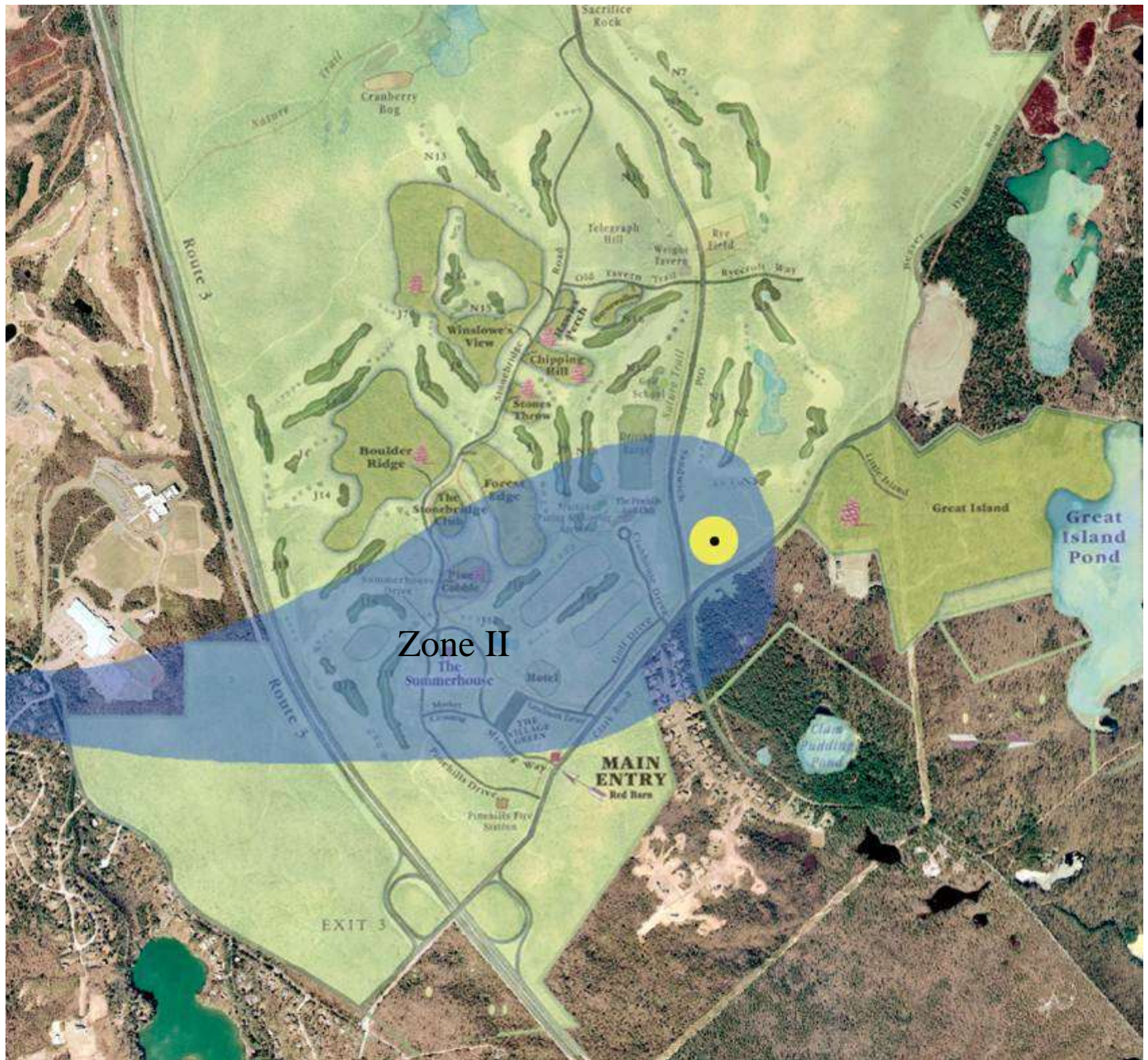
Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Fertigation Wells

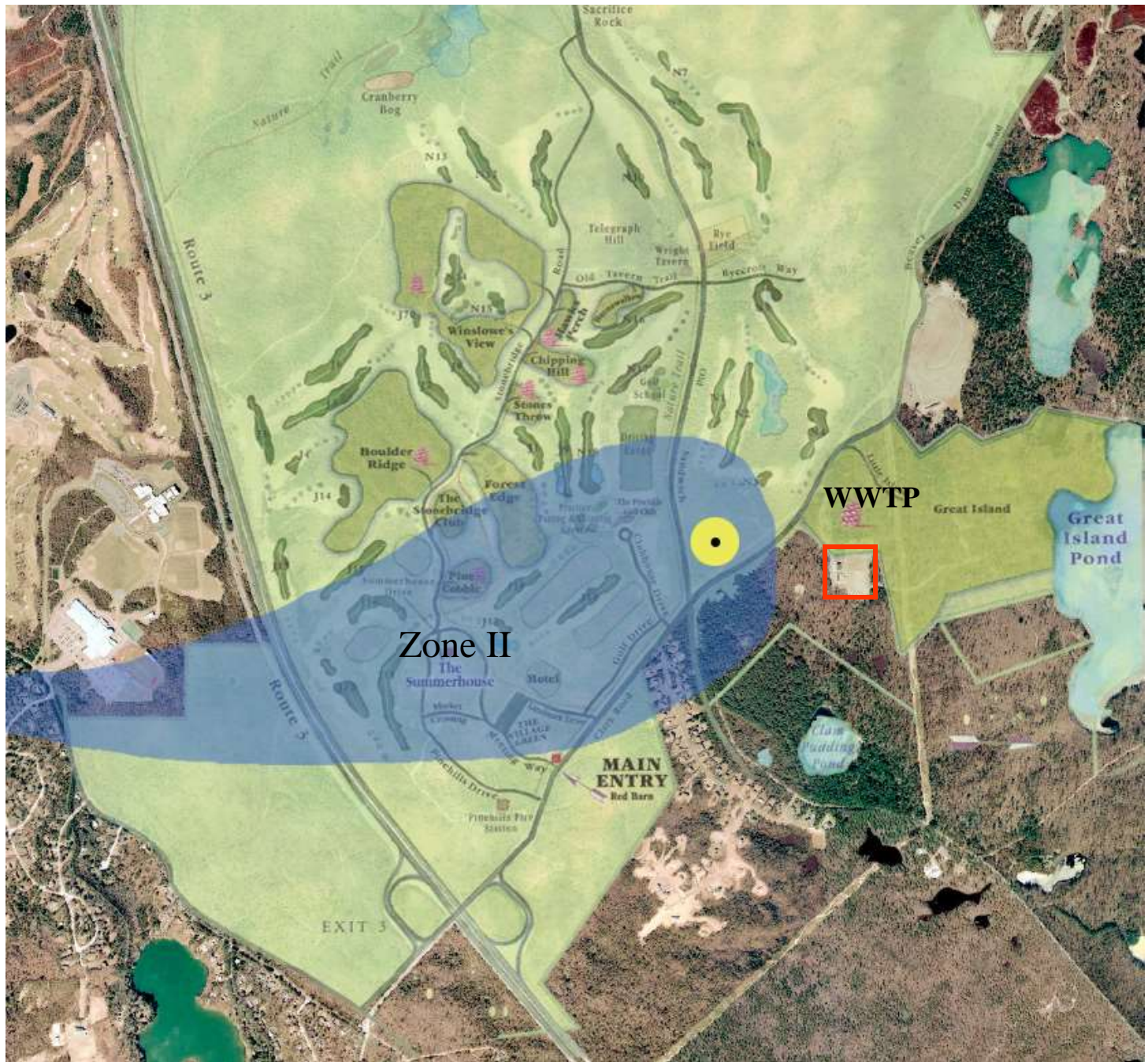


Precedent:
Pine Hills
Plymouth, MA

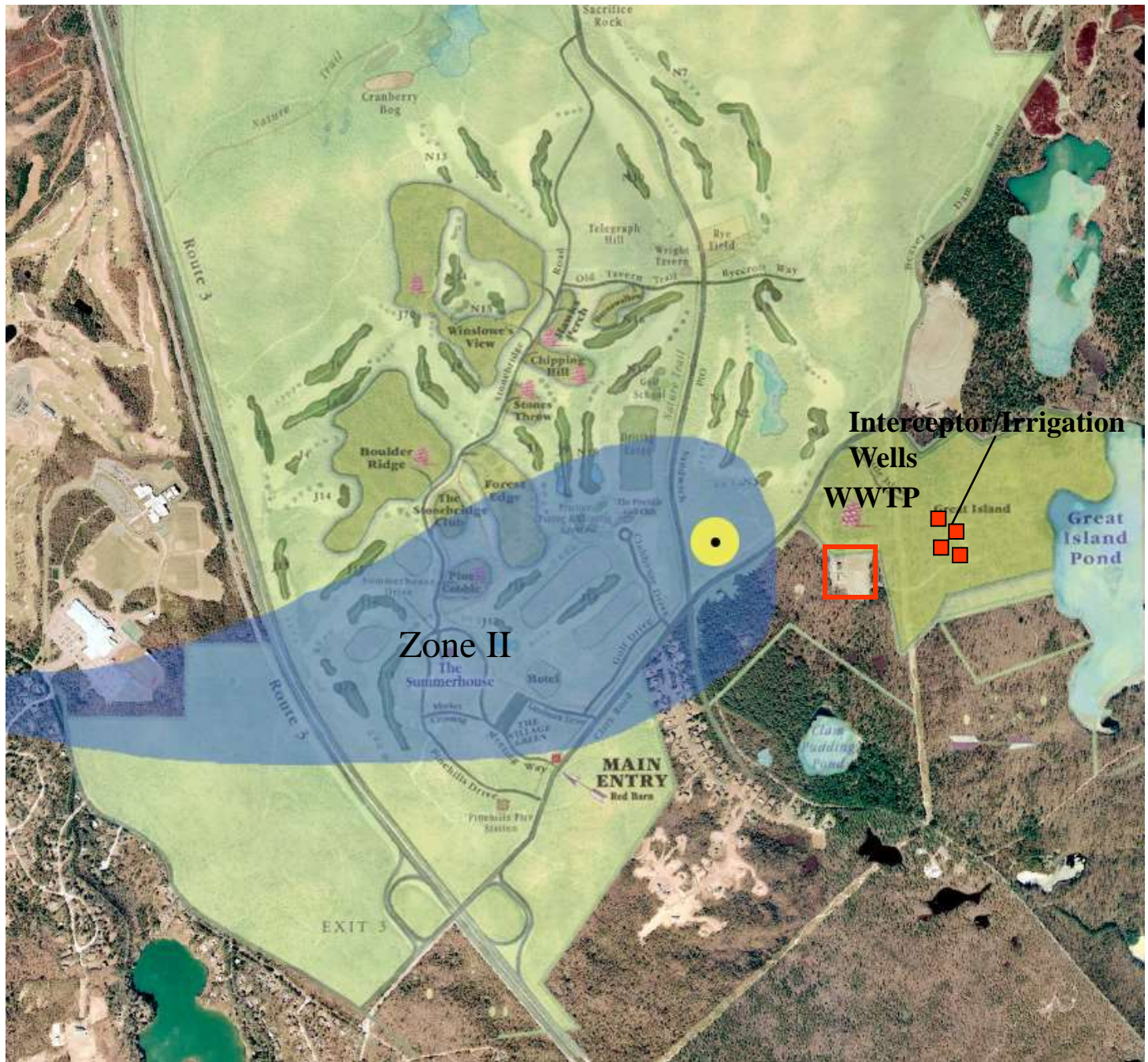




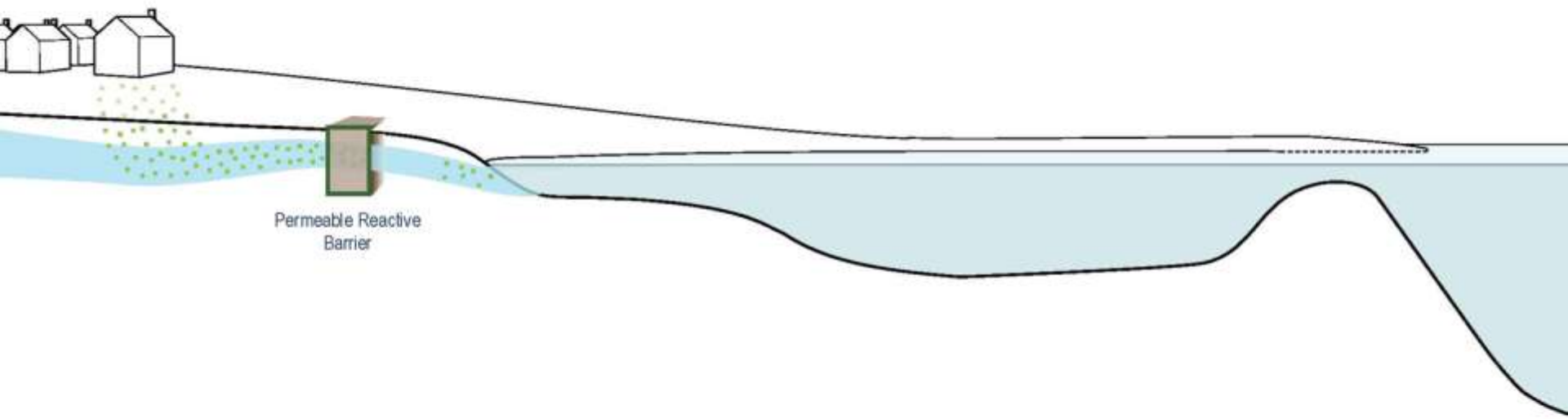
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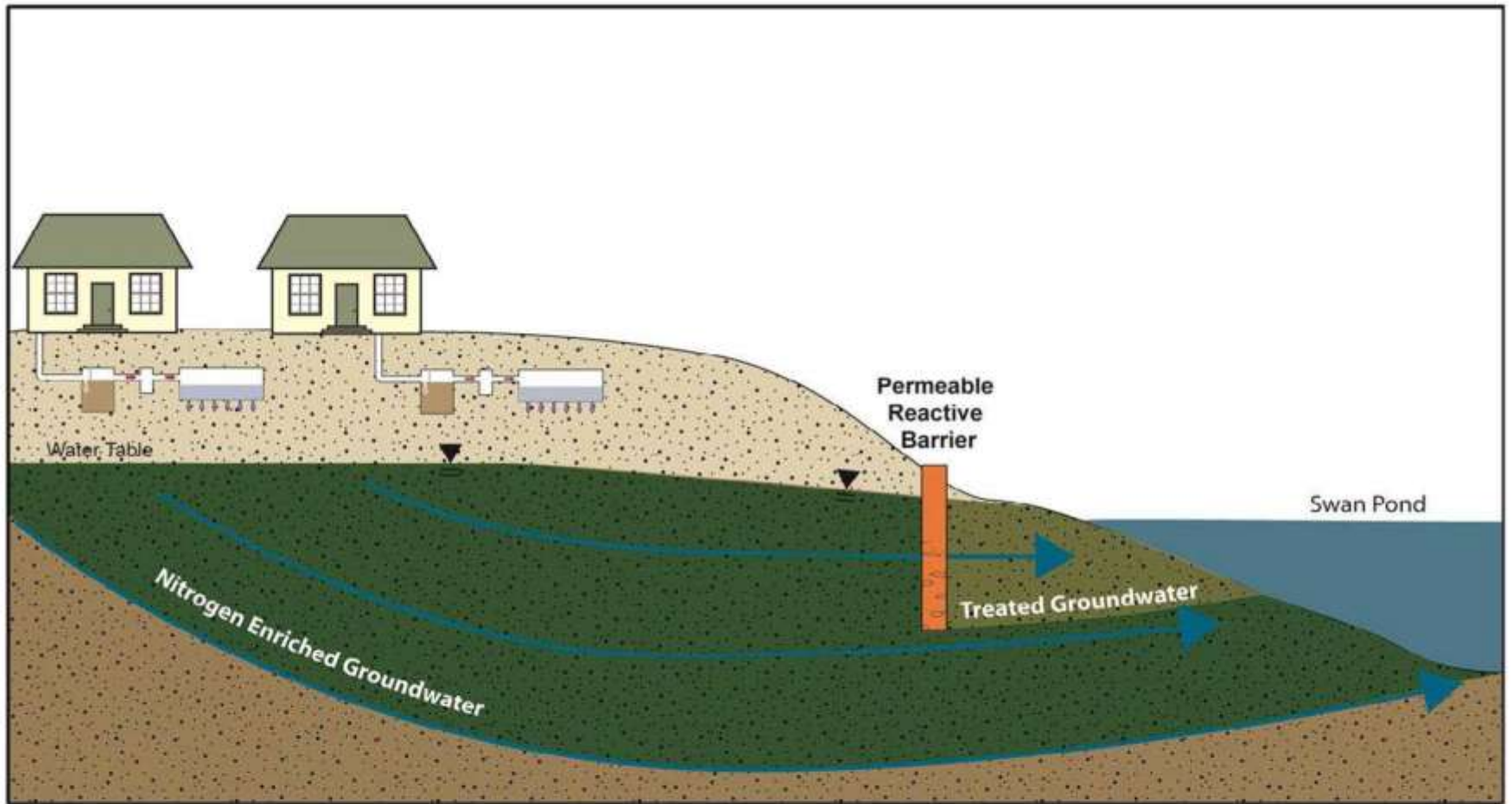


Permeable Reactive
Barrier

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

Permeable Reactive Barrier



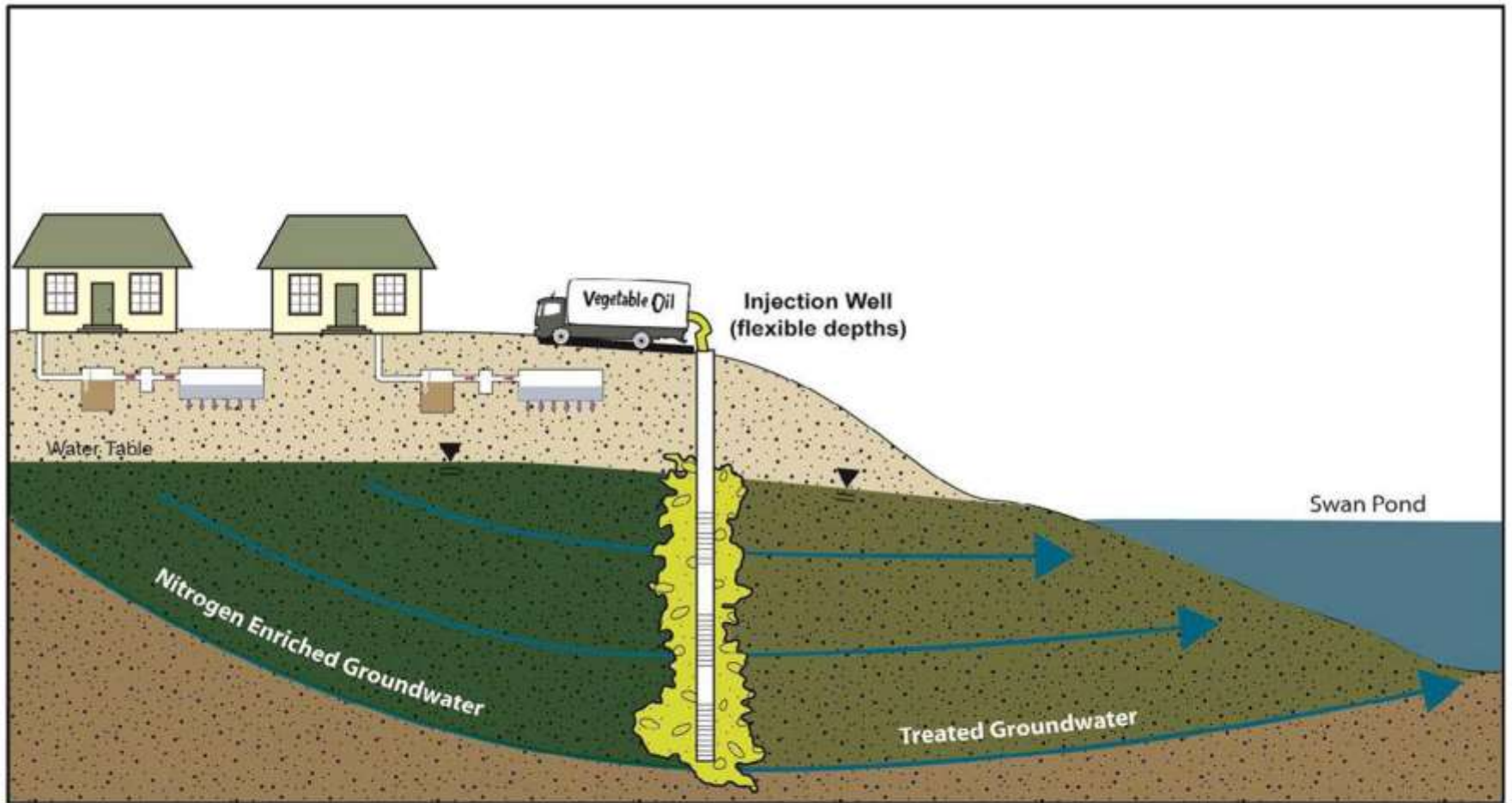


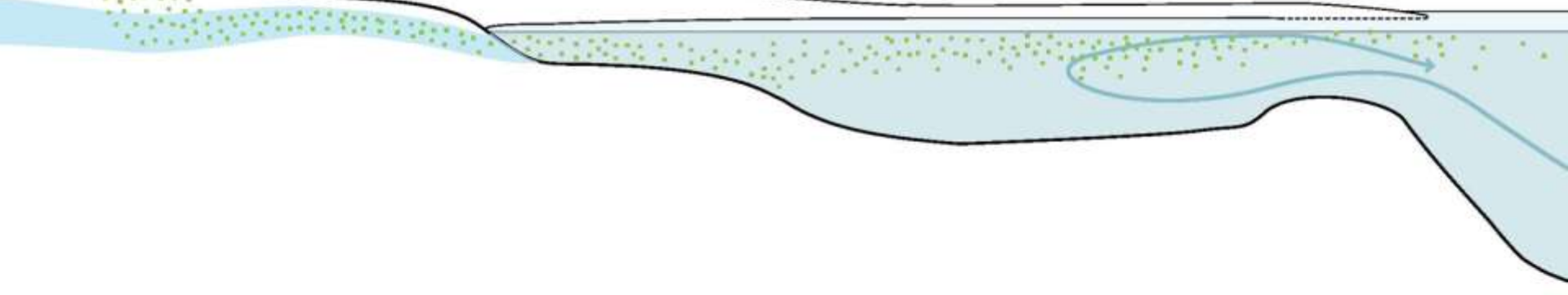


Precedent: Falmouth PRB
Source: Mike Domenica

Permeable Reactive Barrier

PRB

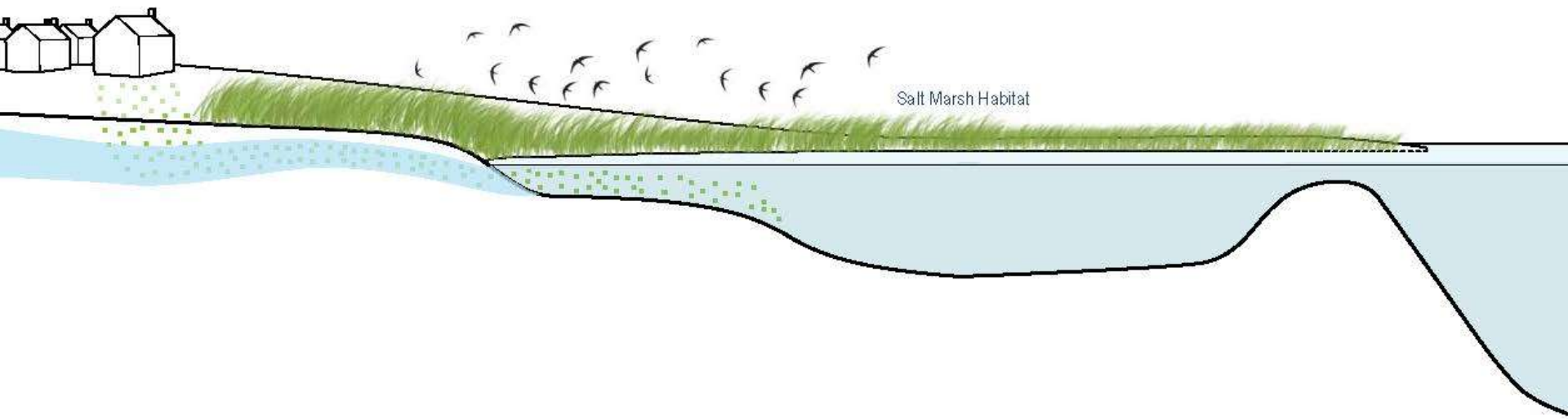




Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Inlet and Culvert Widening

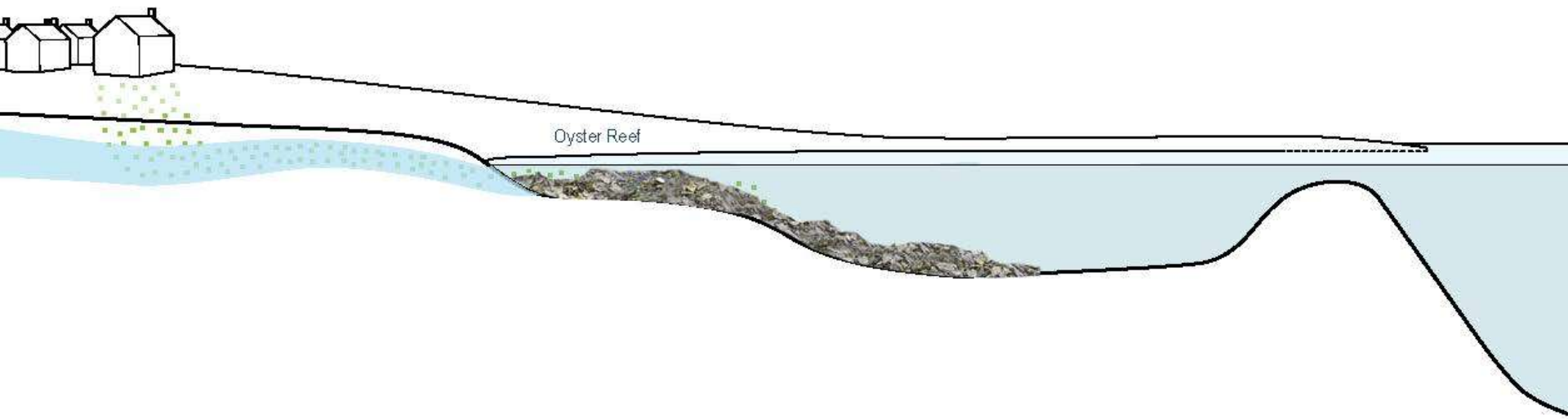




Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Salt Marsh Habitat Restoration





Oyster Reef

Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Shellfish Habitat Restoration



Measuring Oysters' Improvements on Water Quality

Overall project area with new caulk

Oyster Spawning Area (2.04 acres)

New type of traction caulk (small black patches)

132 Meter

- already 2-3 million additional oysters
- post: 5,000 pounds of nitrogen removed per year
- likely increase in commercial shellfish value of \$1 million/year
- increased water filtration approximately 100 million gallons/day
- erosion control
- sediment reduction
- increased mean, red, juvenile fish habitat

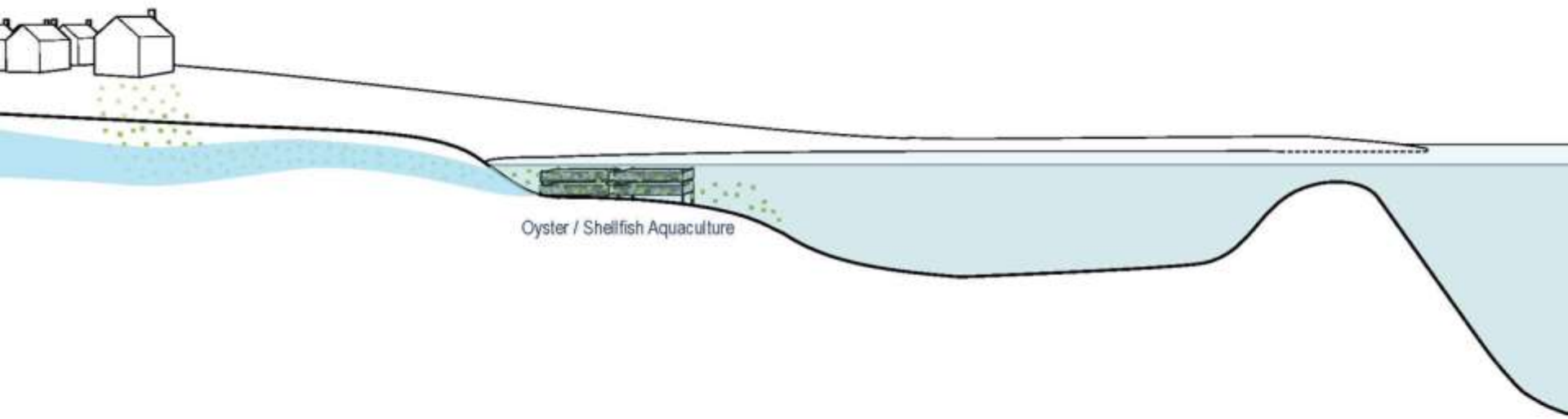
Precedent: Wellfleet Oyster Restoration Project
 Source: Anamarija Francik



Precedent: Wellfleet Oyster Restoration Project
Source: Anamarija Francik

Shellfish Habitat Restoration



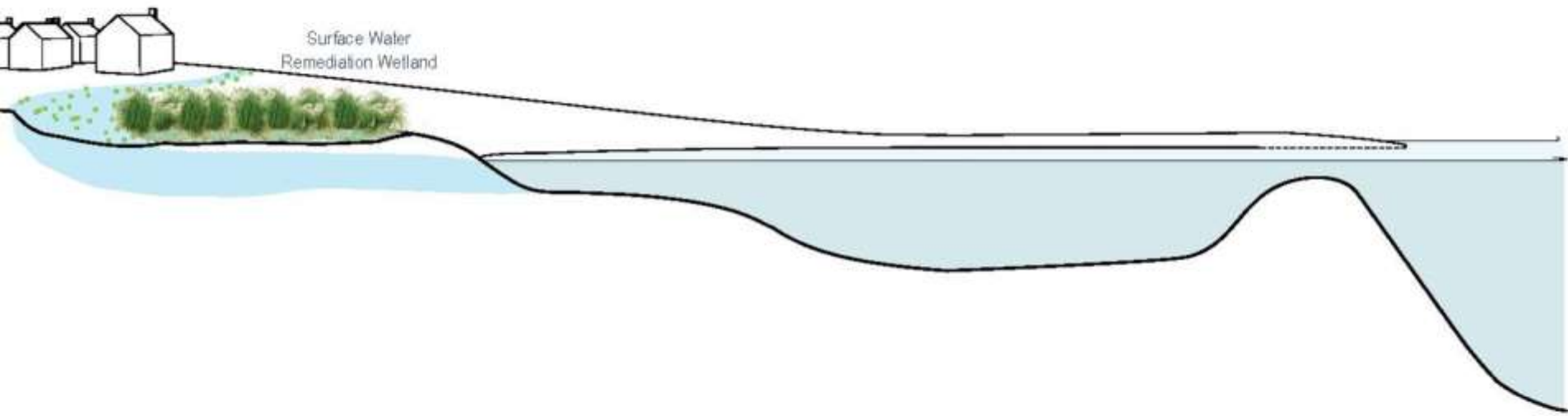


Oyster / Shellfish Aquaculture

Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Aquaculture / Shellfish Farming

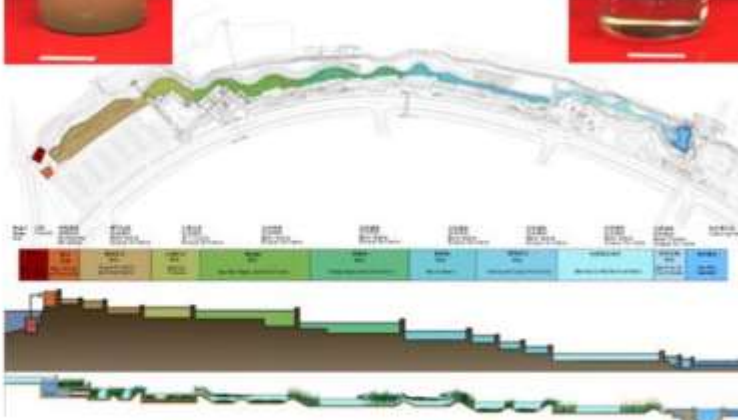




Scale: NEIGHBORHOOD/ WATERSHED
Target: EXISTING WATER BODIES

Surface Water
Remediation Wetlands

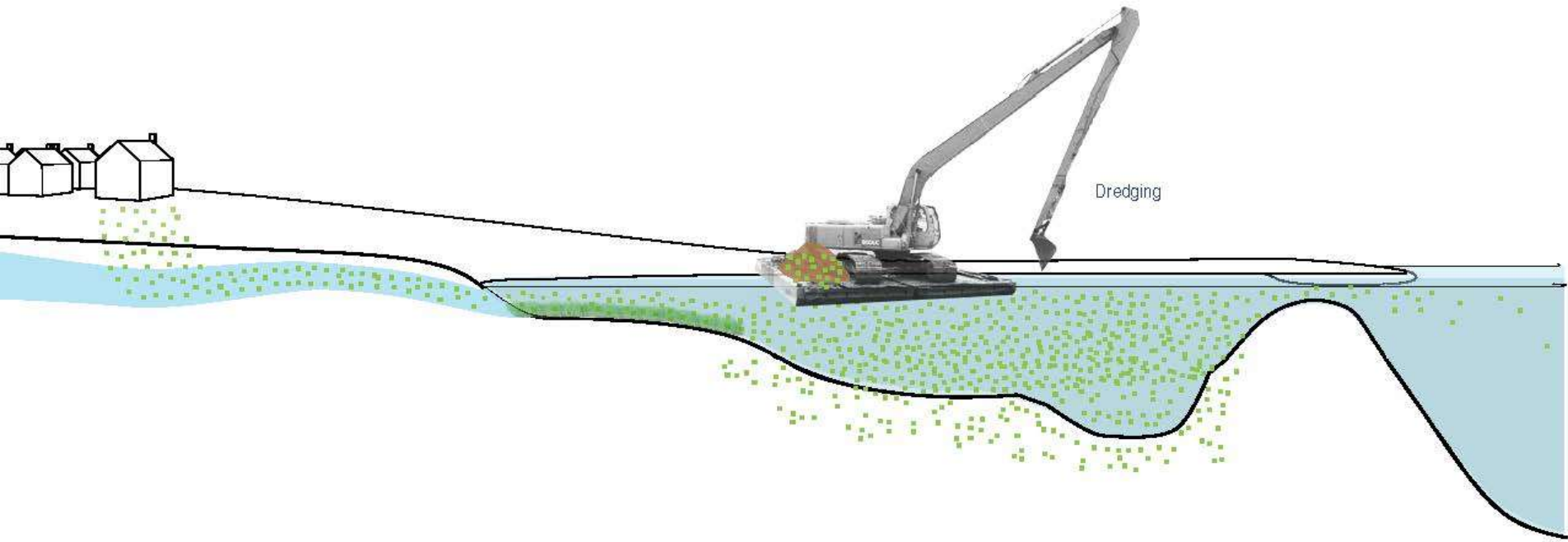




Precedent: Shanghai Houton Park
Source: Turenscape

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





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

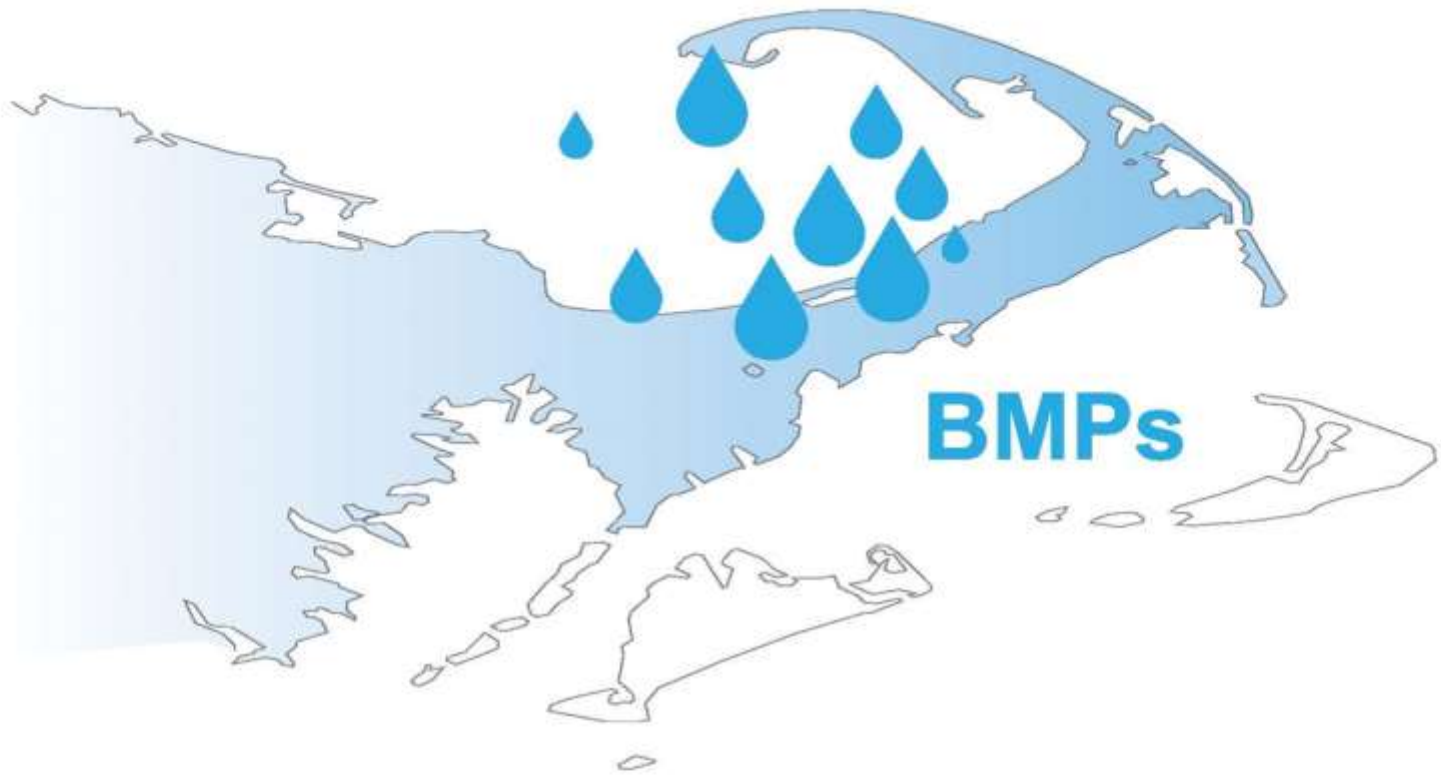
Transfer of Developments Rights

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.



Scale: CAPE-WIDE
Target: REGULATORY

Stormwater BMPs



Town Consideration of Alternative Technologies & Approaches

Wellfleet-	<i>Coastal habitat restoration & aquaculture</i>
Mashpee-	<i>Aquaculture & Expanding Existing Systems</i>
Brewster-	<i>PRB & Bioswales</i>
Orleans-	<i>Fertilizer Control By-Law</i>
Harwich-	<i>Muddy Creek & Cold Brook Natural Attenuation</i>
Falmouth-	<i>Aquaculture Inlet Widening Eco-Toilet Demonstration Project PRBs Stormwater Management (Little Pond Watershed) Fertilizer Control By-Law Subsurface Nitrogen Removal Septic Systems</i>

Solutions



Problem Solving Approach

1
2
3
4
5
6
7

 Wastewater

 Existing Water Bodies

 Regulatory

Targets/Reduction Goals

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

Other Wastewater Management Needs

- A. Title 5 Problem Areas
- B. Pond Recharge Areas
- C. Growth Management

Low Barrier to Implementation

- A. Fertilizer Management
- B. Stormwater Mitigation

Watershed/Embayment Options

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

Alternative On-Site Options

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

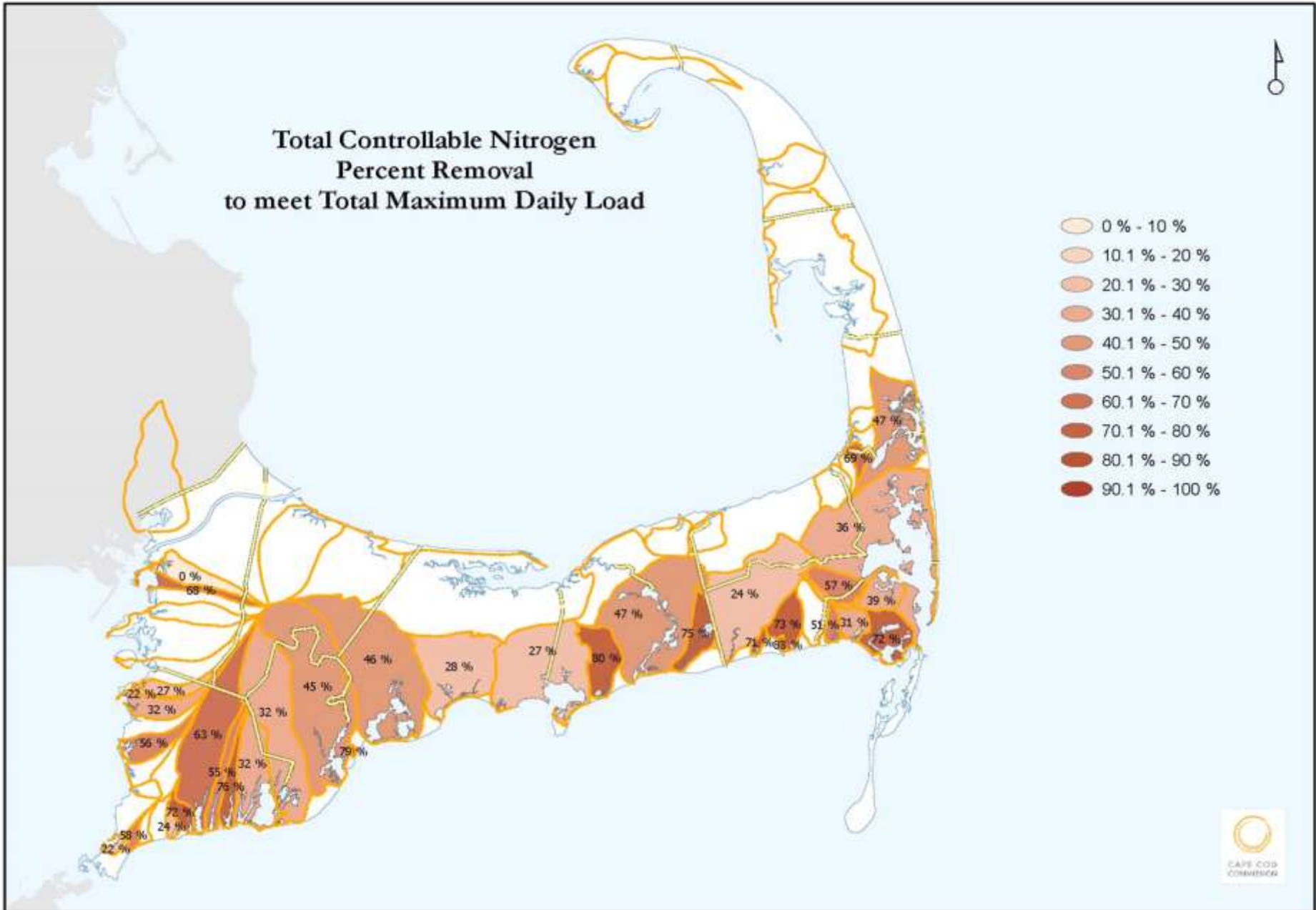
Priority Collection/High-Density Areas

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

Supplemental Sewering



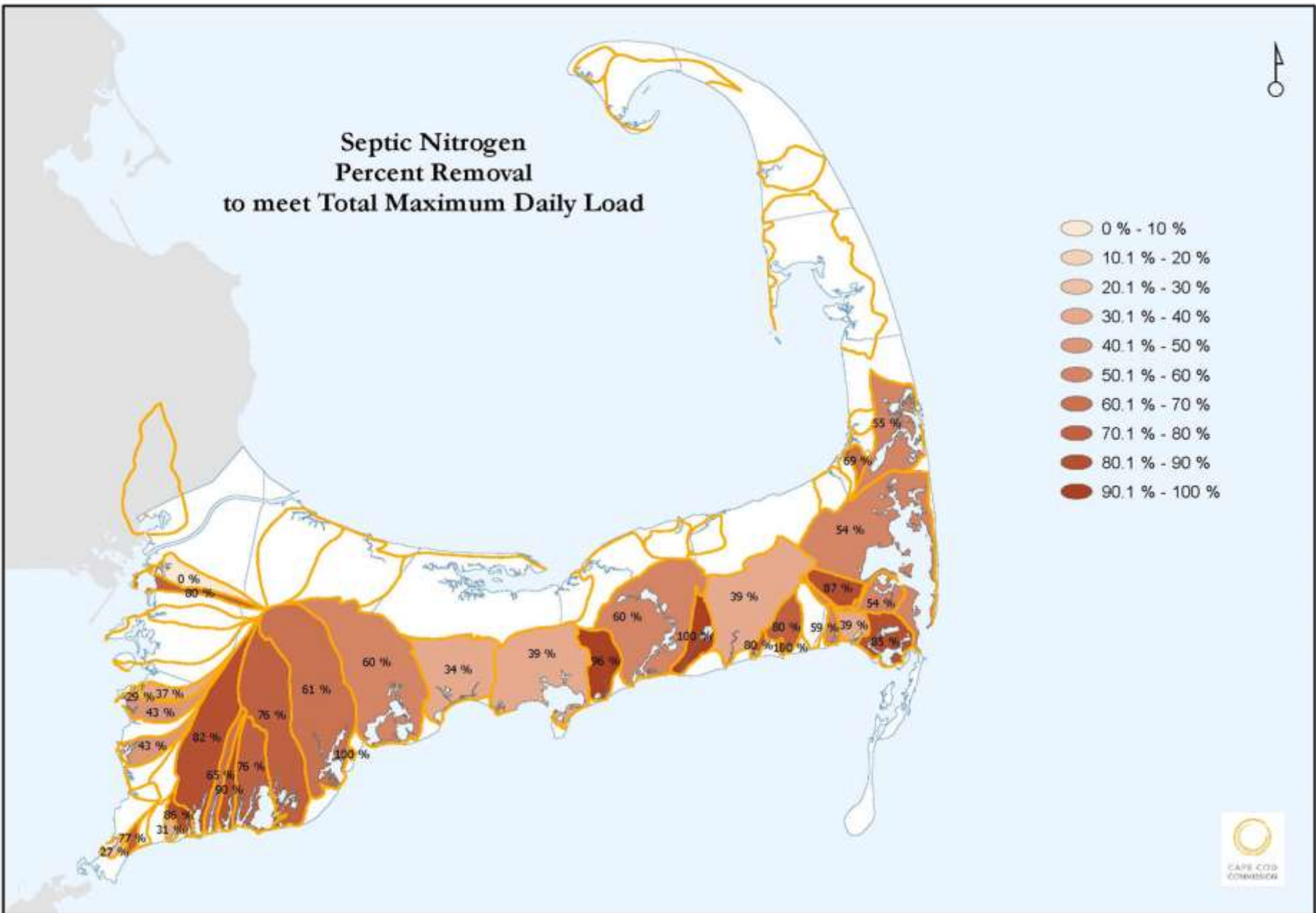
Total Controllable Nitrogen Percent Removal to meet Total Maximum Daily Load

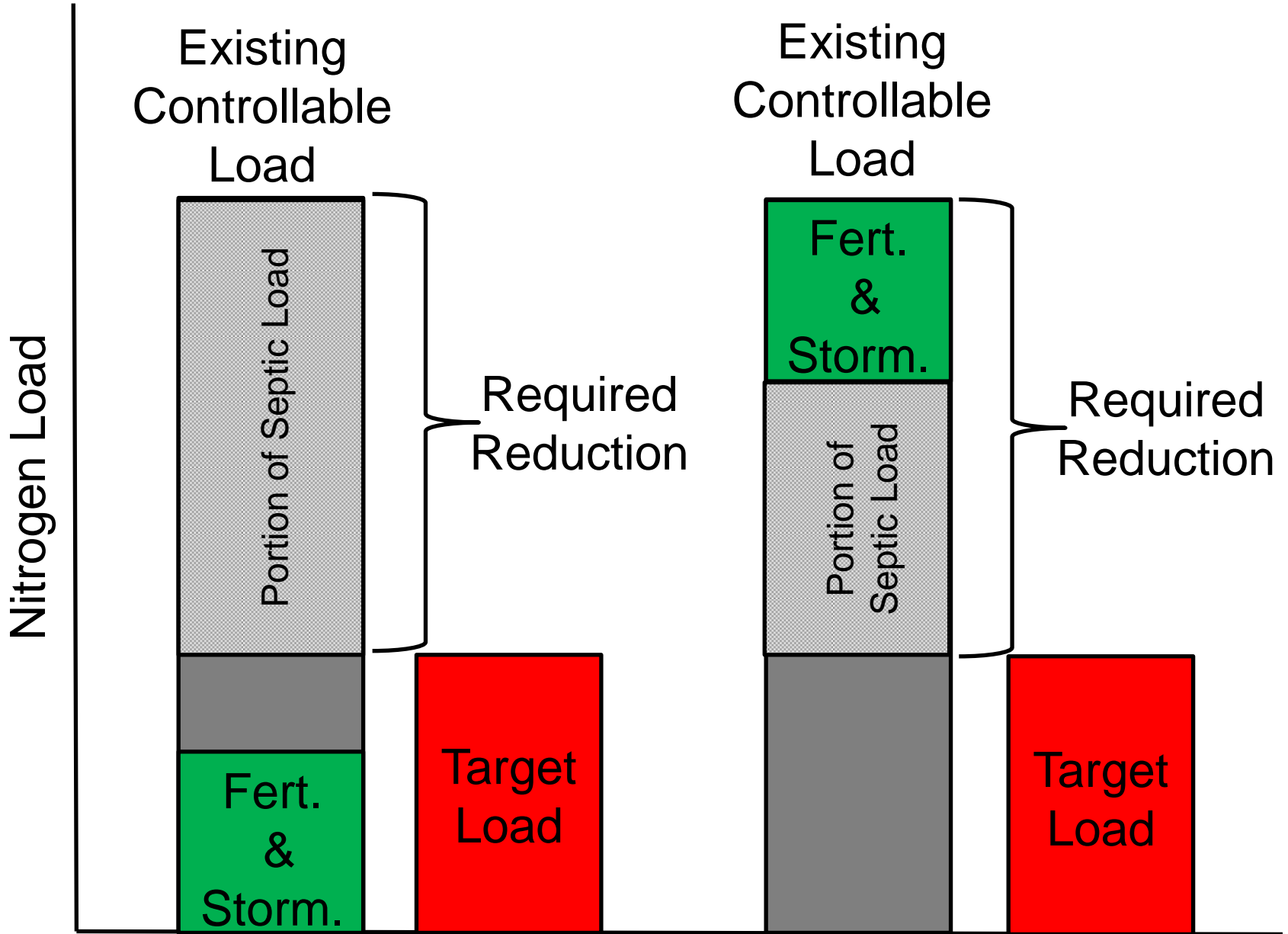


Septic Nitrogen Percent Removal to meet Total Maximum Daily Load



- 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 %





Problem Solving Approach

1
2
3
4
5
6
7



Wastewater



Existing Water Bodies



Regulatory

Targets/Reduction Goals

Present Load:

X kg/day

—

Target:

Y kg/day

=

Reduction Required:

N kg/day

Other Wastewater Management Needs

- A. Title 5 Problem Areas
- B. Pond Recharge Areas

- C. Growth Management

Low Barrier to Implementation

- A. Fertilizer Management
- B. Stormwater Mitigation



Watershed/Embayment Options

- A. Permeable Reactive Barriers
- B. Inlet/Culvert Openings

- C. Constructed Wetlands
- D. Aquaculture



Alternative On-Site Options

- A. Eco-toilets (UD & Compost)
- B. I/A Technologies

- C. Enhanced I/A Technologies
- D. Shared Systems



Priority Collection/High-Density Areas

- A. Greater Than 1 Dwelling Unit/acre
- B. Village Centers

- C. Economic Centers
- D. Growth Incentive Zones



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

DRAFT

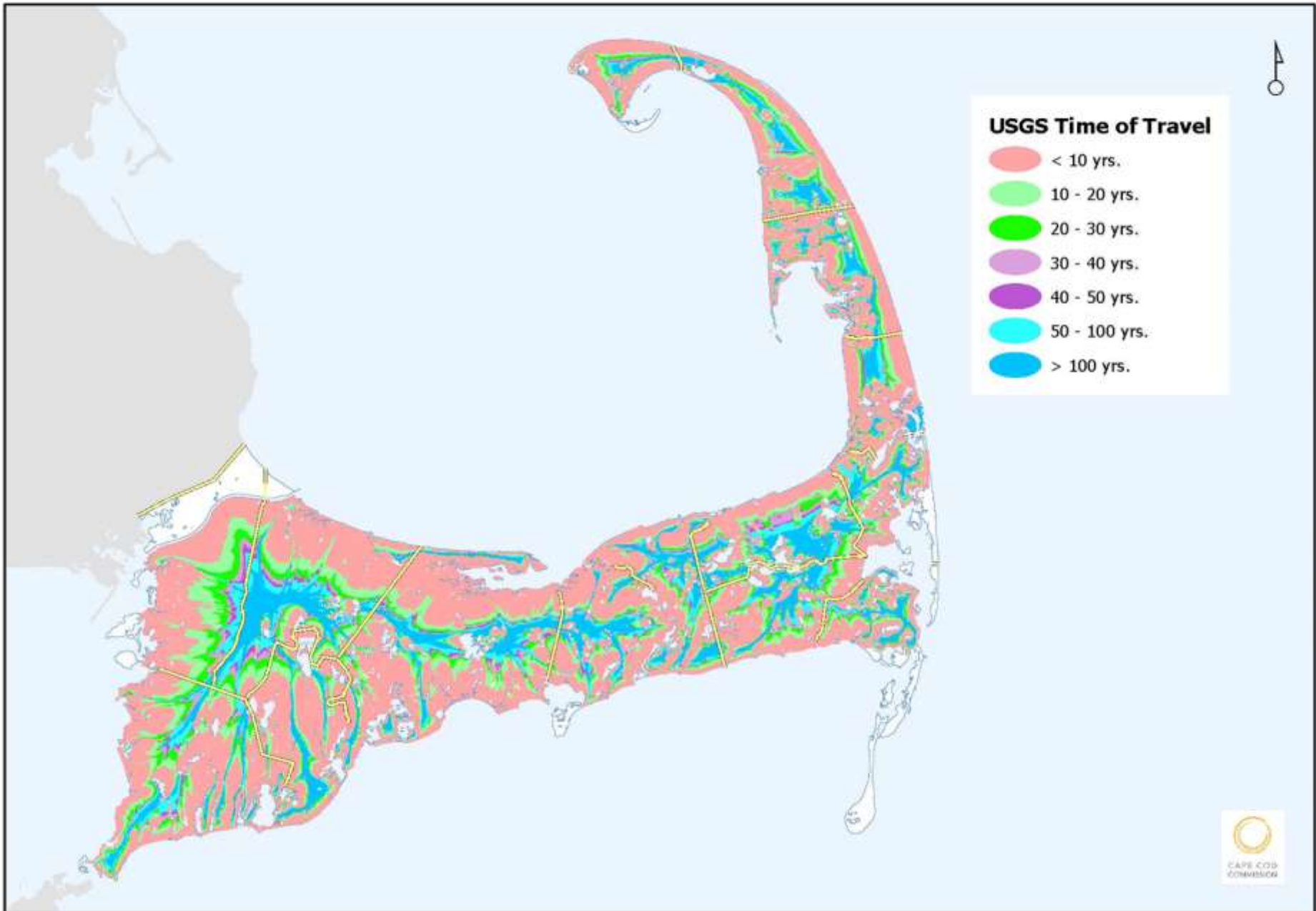


Embayment TMDL Status Map



Legend

Rivers	Subwatersheds with TMDL
Ponds	0.1 - 9 %
Embayment Boundary	9.1 - 26 %
On Land	26.1 - 40 %
On Sea	40.1 - 55 %
Pending	55.1 - 69 %
To Be Addressed	69.1 - 75 %
	75.1 - 86 %
	86.1 - 100 %



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*