Cleaning Up The Bays

Managing Stormwater in the Three Bays

APCC Association to Preserve Cape Cod
Preserving the Very Nature of Cape Cod

United States Environmental Protection Agency

Seal of the Town of Barnstable, Mass. 1639. Adopted May 4, 1989

Barnstable Land Trust

Cotuit 1874 the heart of the village Library

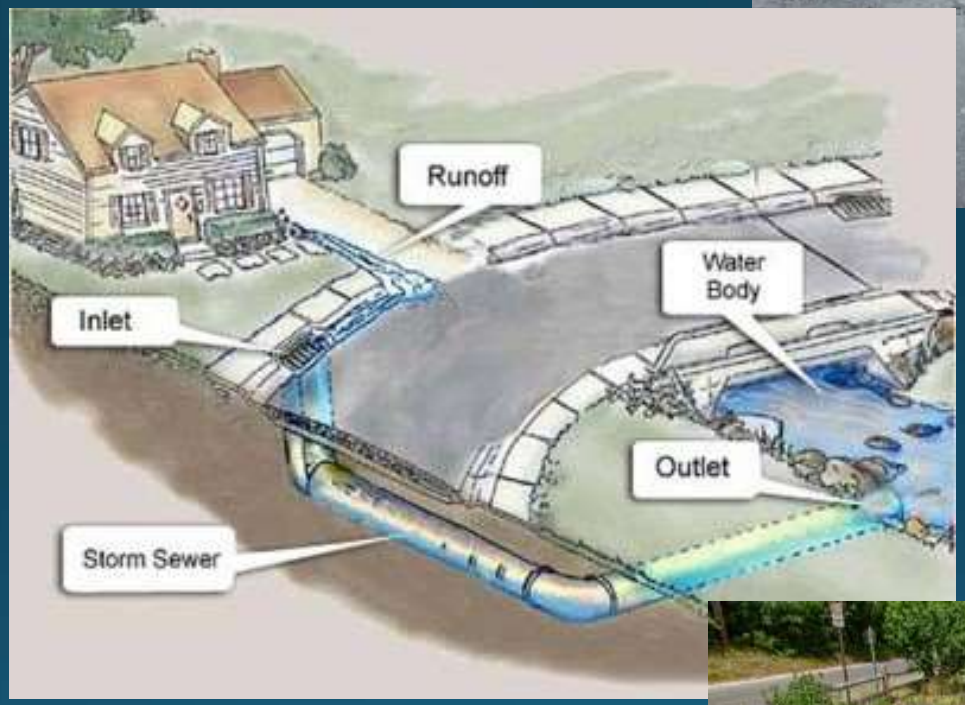
Horsley Witten Group

Barnstable Clean Water Coalition

SNEP Southeast New England Program

Stormwater 101

rain



impervious surfaces

runoff

Negative Effects on the Environment and Community

Project Overview

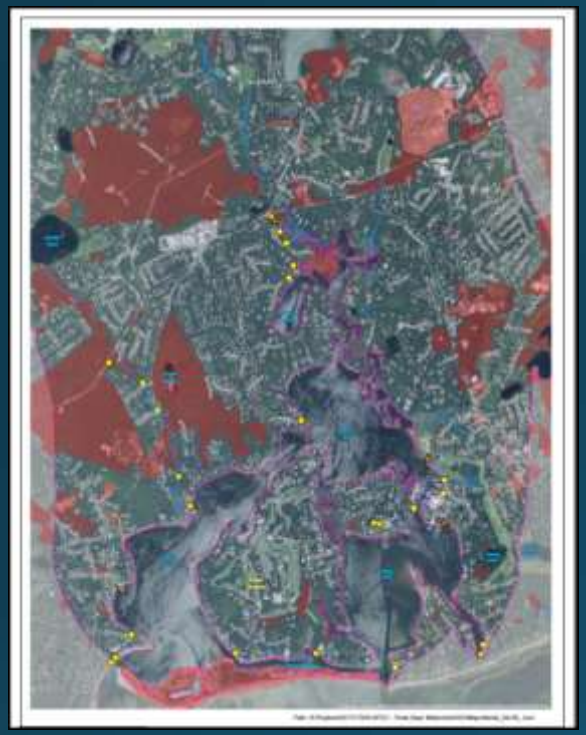
5 Year Project

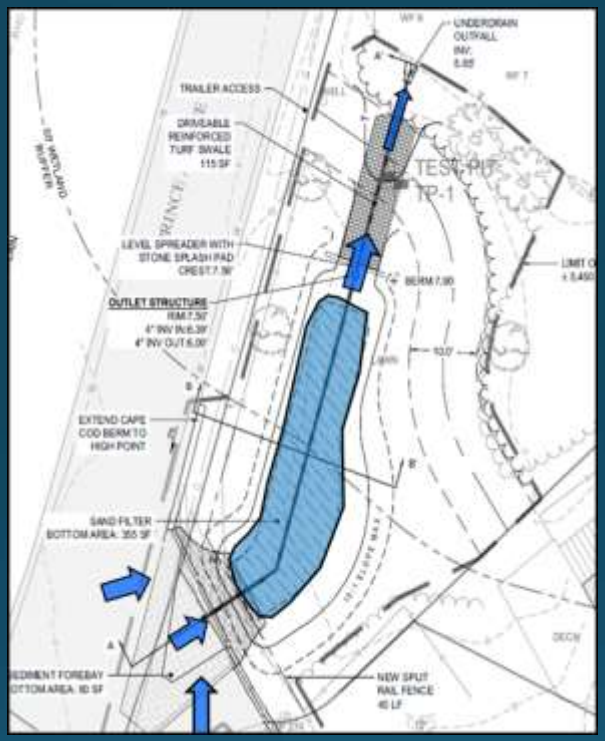
Total Cost: $2 million

$1.7 million from state and federal grants

$300,000 from project team match

Approach





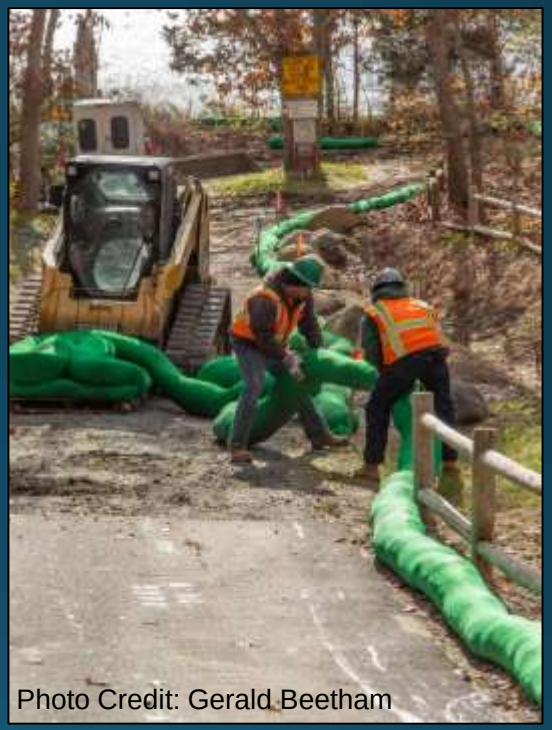


Photo Credit: Gerald Beetham

Assessment and Prioritization

Phase 1: March – Aug. 2017

Phase 2: 2018 – 2019

Design and Permitting

Phase 1: 2017 – 2018

Phase 2: 2019

Installation

Phase 1: Fall 2018 - Spring 2019

Phase 2: 2020 and 2021

Project Summary

Watershed Plan

71 ranked and prioritized sites

Completed Sites

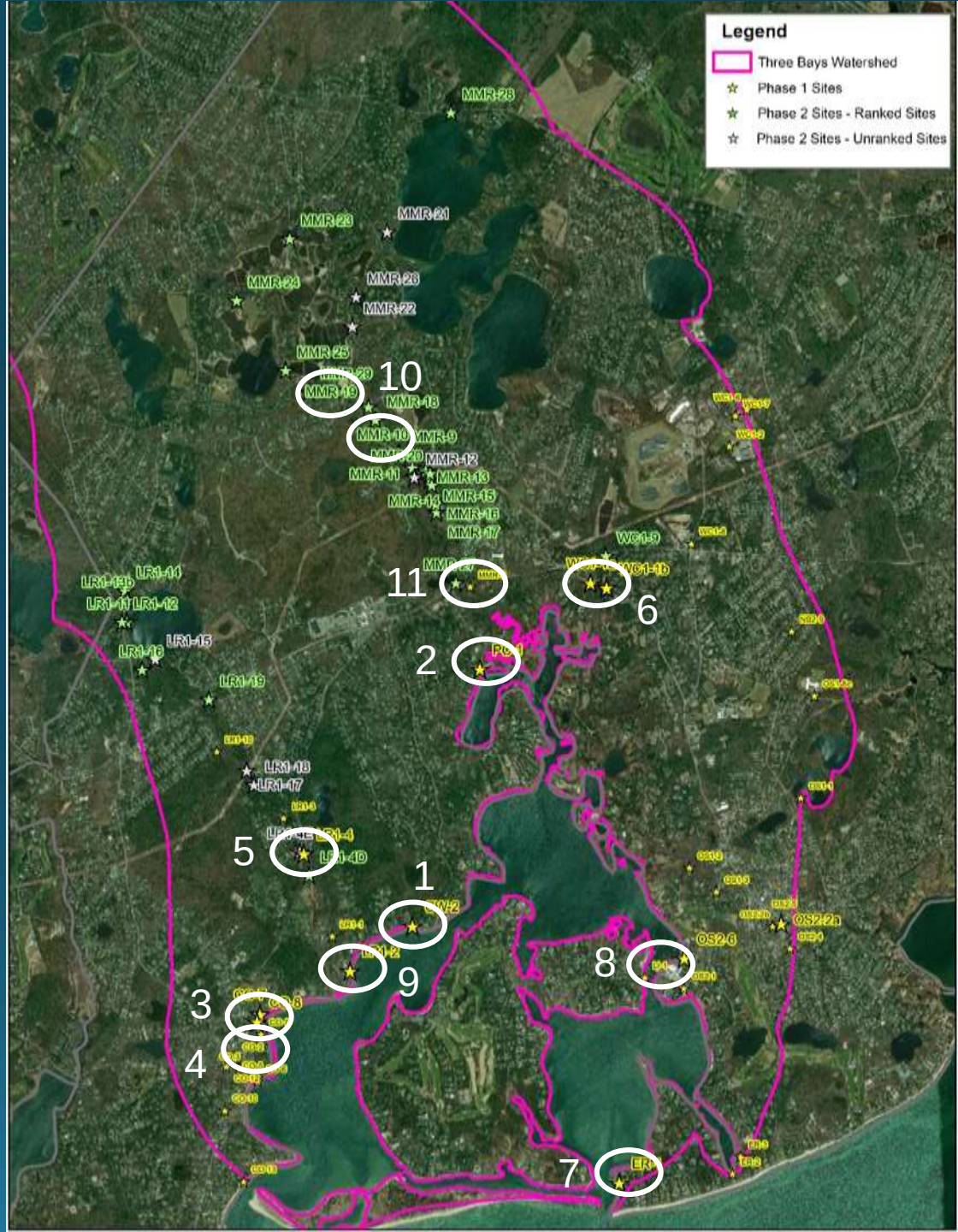
1. Cordwood Landing
2. Prince Cove
3. Ropes Beach
4. Cotuit Library
5. Putnam Avenue
6. South County Rd*

Design and Permitting

7. Eel River
8. Bridge Street
9. Little River
10. River Road

Maintenance Plan

11. Rt 149 System



Site 1: Cordwood Landing

Existing System Improvements

Photo Credits: Gerald Beetham

Site 1 New Bioretention System – End of Cordwood Landing

Photo Credits: Gerald Beetham

Site 2: Prince Cove Sand Filter

Photo Credits: Gerald Beetham

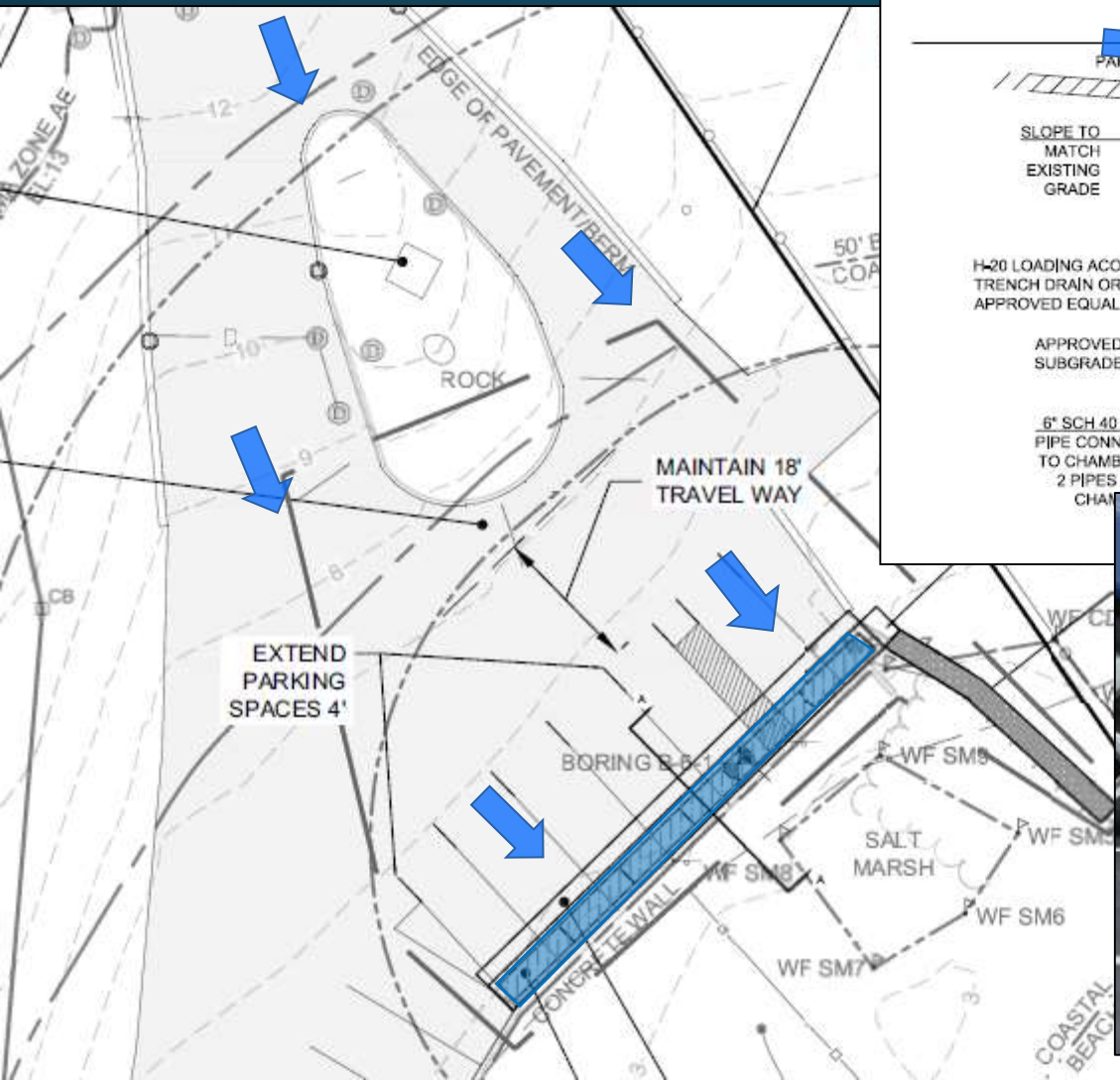
Site 3: Ropes Beach, Maintenance of Existing Systems

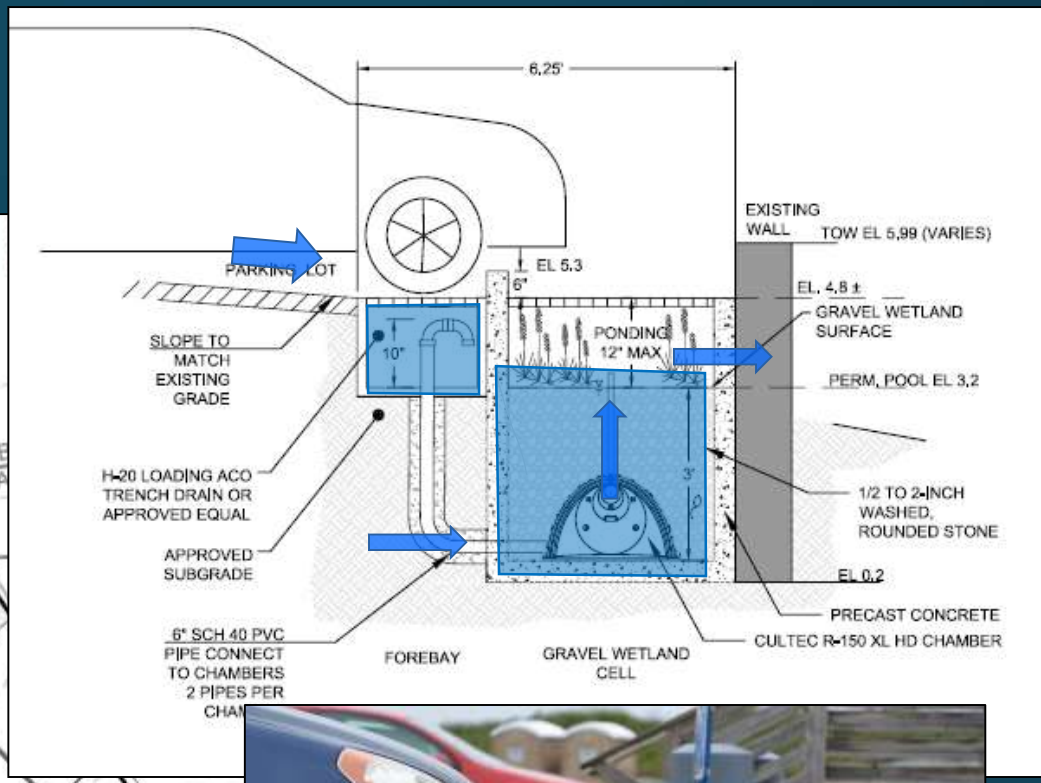
Fixed pipes and flushing underdrains of existing system

Site 3: Ropes Beach Linear Gravel Wetland

Photo Credits: Gerald Beetham

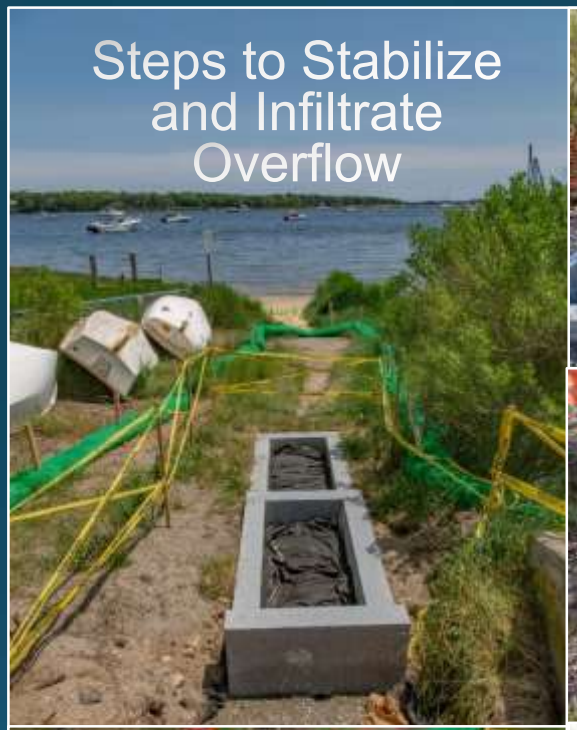
Ropes Beach: Gravel Wetland Design





Ropes Beach Gravel Wetland Infiltrating Steps/Outlet

Photo Credits: Gerald Beetham

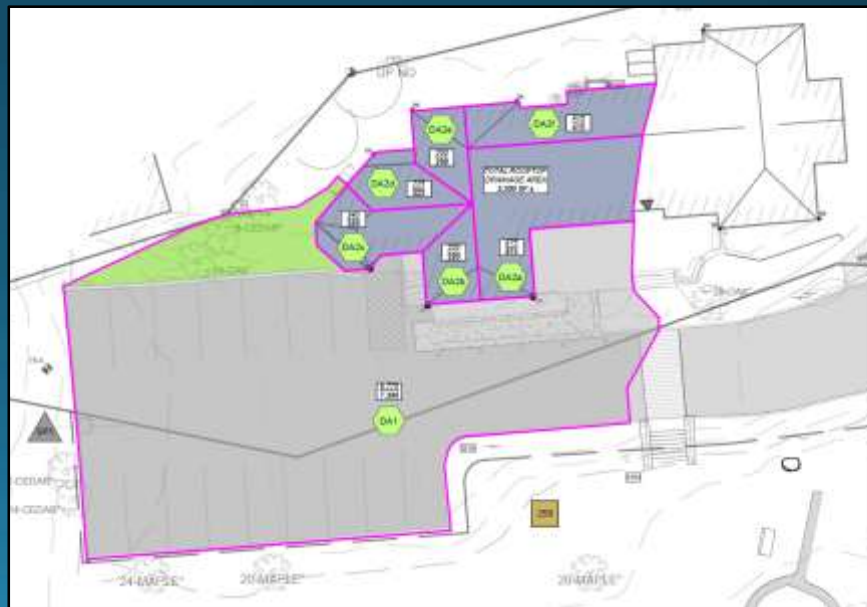


Site 3: Ropes Beach Linear Gravel Wetland

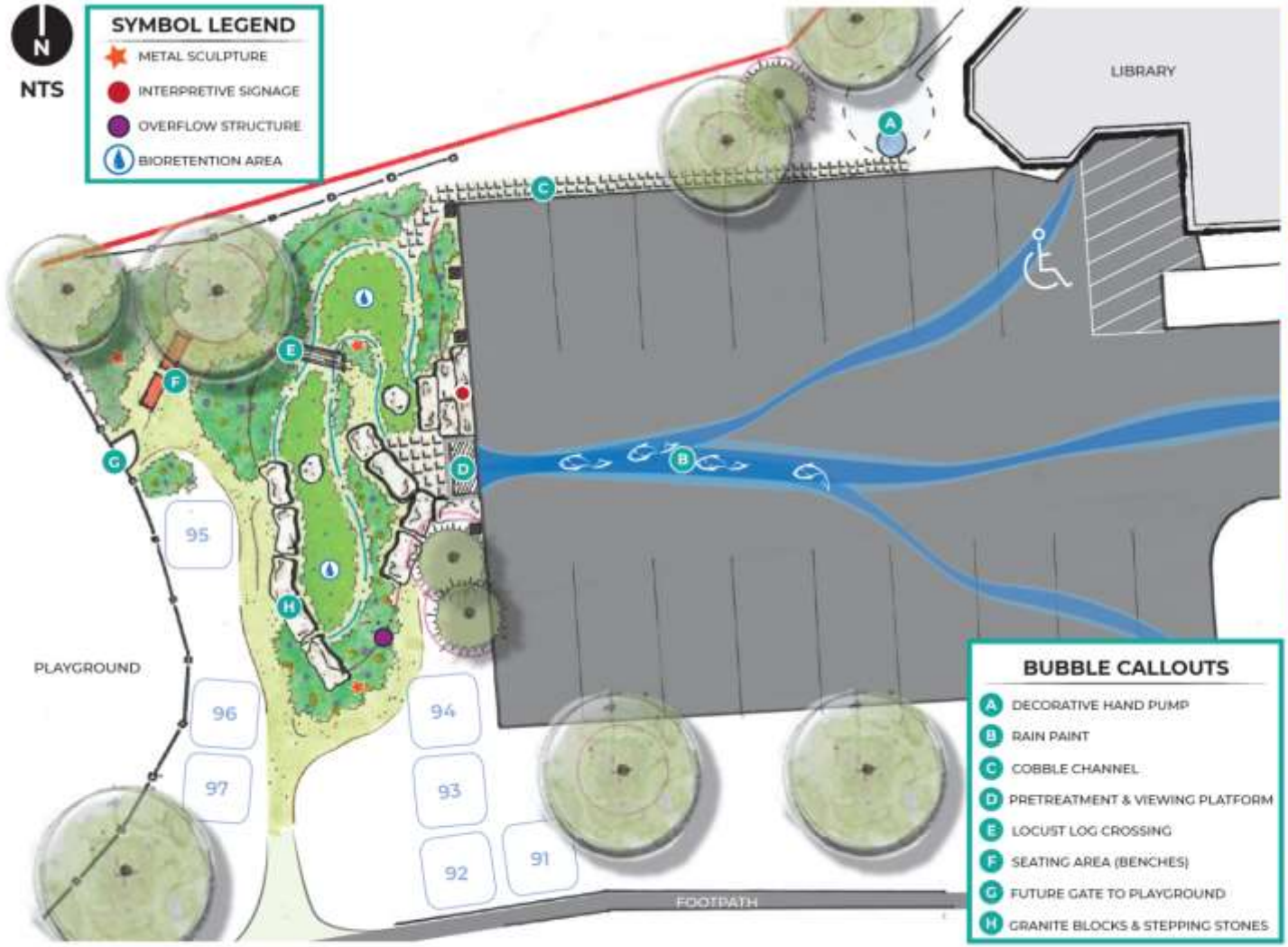
System flush to parking lot with plantings below grate to allow view, parking and beach access

Photo Credits: Gerald Beetham

Site 4: Cotuit Library Bioretention



Cotuit Library Concept Design



BUBBLE CALLOUTS

- A DECORATIVE HAND PUMP
- B RAIN PAINT
- C COBBLE CHANNEL
- D PRETREATMENT & VIEWING PLATFORM
- E LOCUST LOG CROSSING
- F SEATING AREA (BENCHES)
- G FUTURE GATE TO PLAYGROUND
- H GRANITE BLOCKS & STEPPING STONES

IMMERSIVE GREEN INFRASTRUCTURE AT THE COTUIT LIBRARY

AUGUST, 2019

APCC Association to Preserve Cape Cod

Horsley Witten Group
Sustainable Environmental Solutions

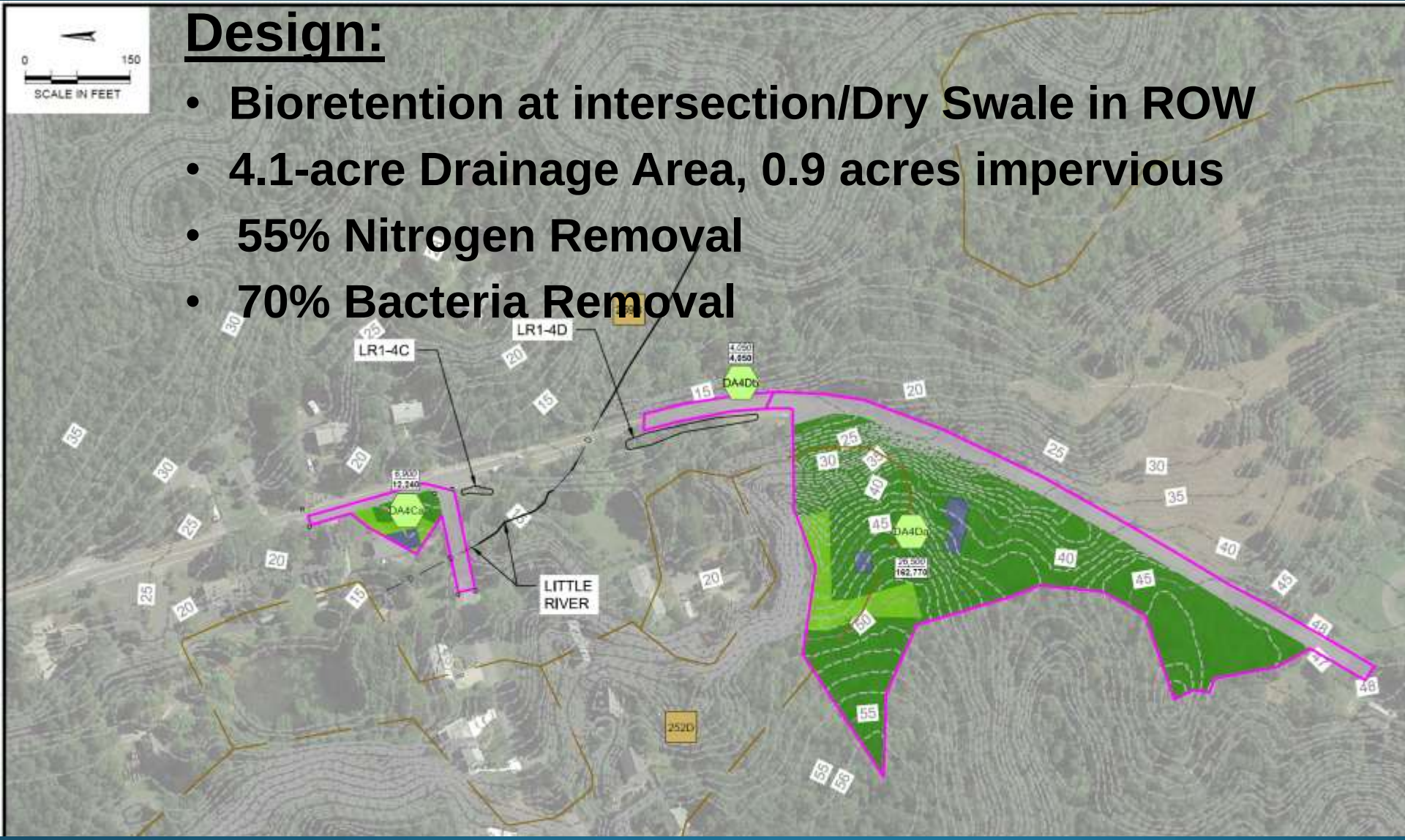
Site 4: Cotuit Library Bioretention

Cotuit Library Programming

LSTA Grant

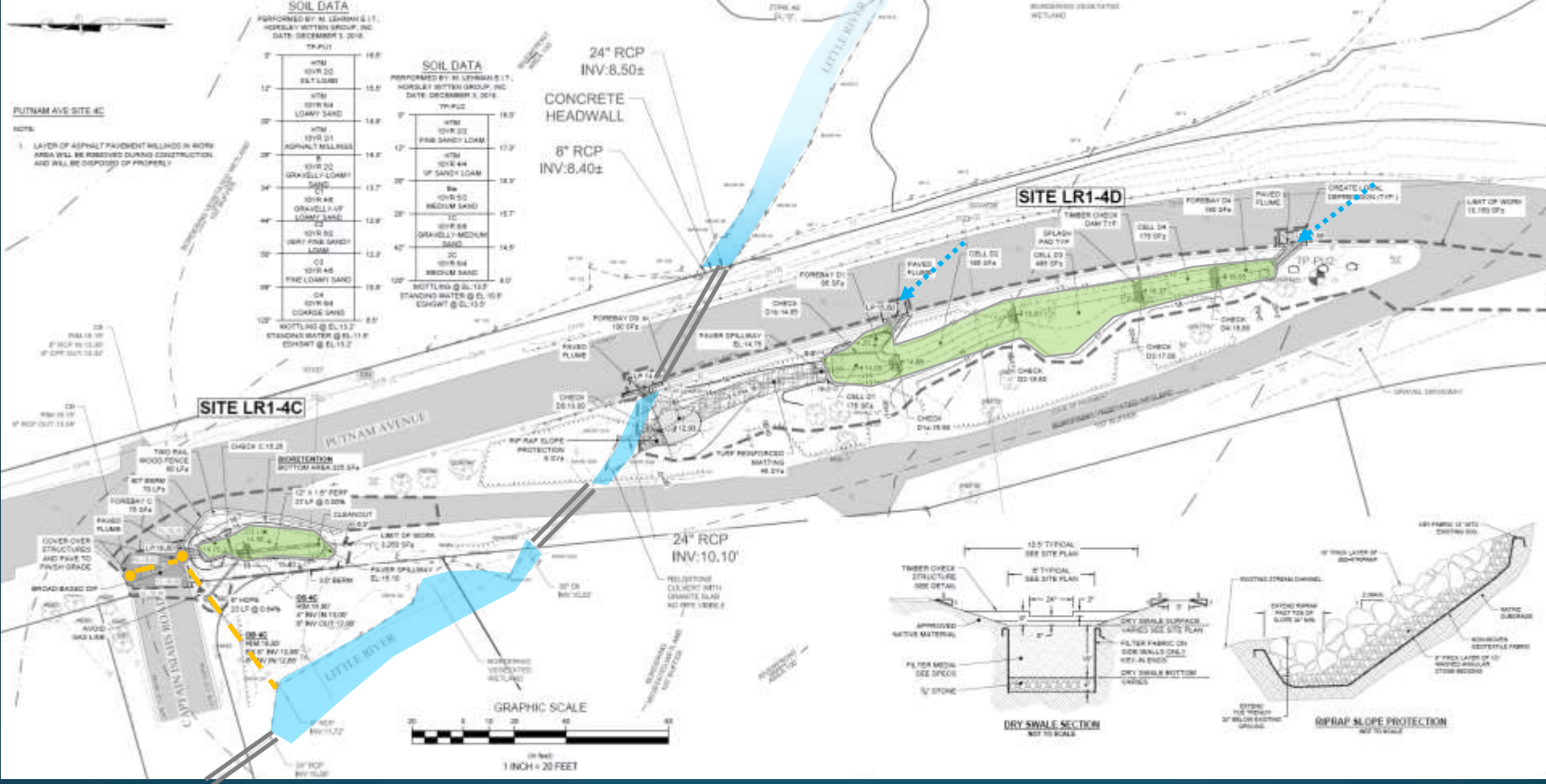
- Storywalk
- Storyhour and Craft Sessions
- Rain Fairy Gardens
- Pamphlets and Signage
- Children's Ecology Workshops
- Parking lot painted river
- Bioretention demonstration models
- Interpretive Sign
- Lecture and workshop series

Site 5: Putnam Avenue



Design:

- Bioretention at intersection/Dry Swale in ROW
- 4.1-acre Drainage Area, 0.9 acres impervious
- 55% Nitrogen Removal
- 70% Bacteria Removal

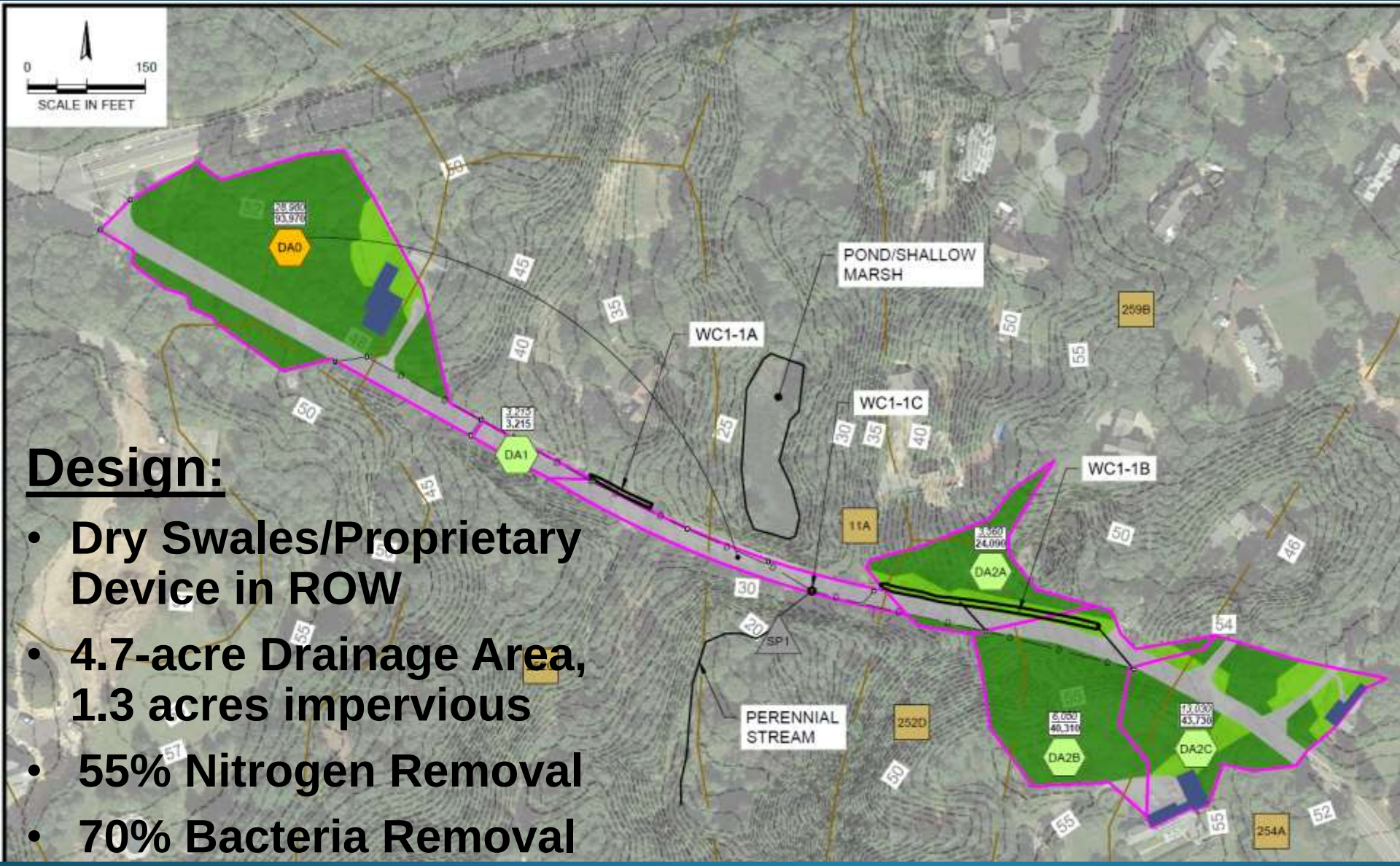

SOIL DATA
SOIL DATA
24" RCP
INV:8.50±
CONCRETE
HEADWALL
8" RCP
INV:8.40±
SITE LR1-4D
SITE LR1-4C
PUTNAM AVENUE
LITTLE RIVER
24" RCP
INV:10.10'
GRAPHIC SCALE
1 INCH = 20 FEET
DRY SWALE SECTION
RIPRAP SLOPE PROTECTION

Site 5: Putnam Avenue

Bioretention

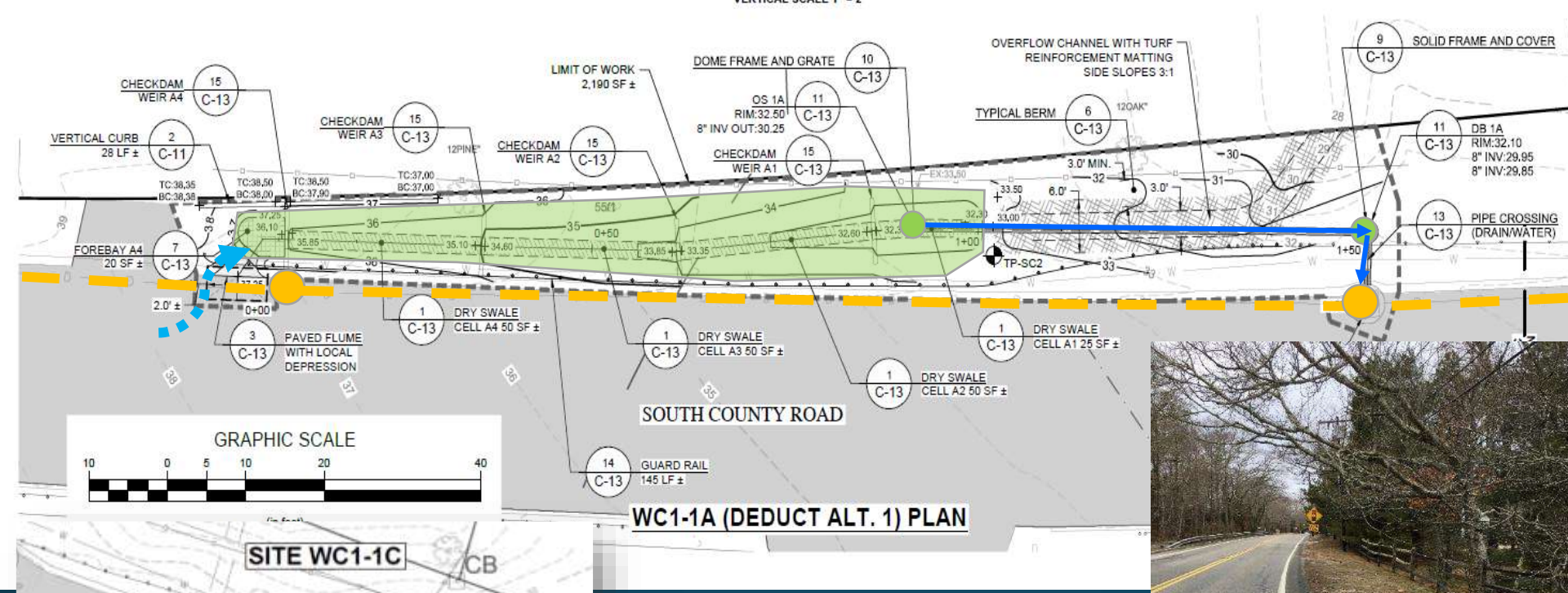
Swale

Site 6: South County Road



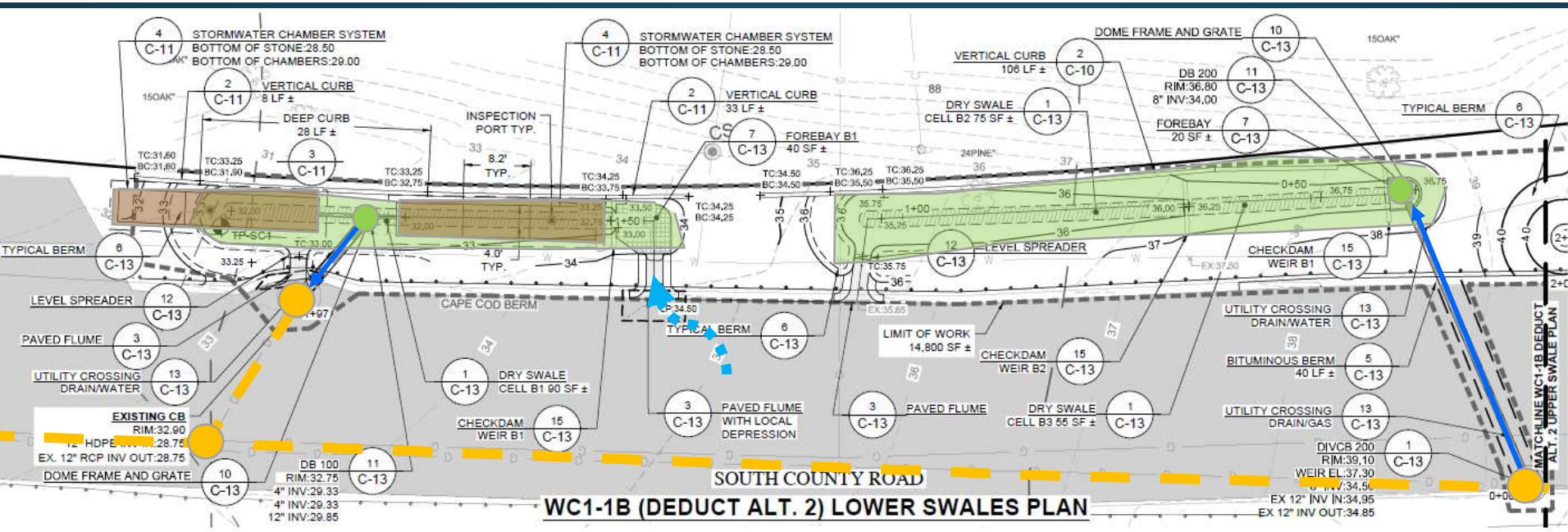
Design:

- Dry Swales/Proprietary Device in ROW
- 4.7-acre Drainage Area, 1.3 acres impervious
- 55% Nitrogen Removal
- 70% Bacteria Removal

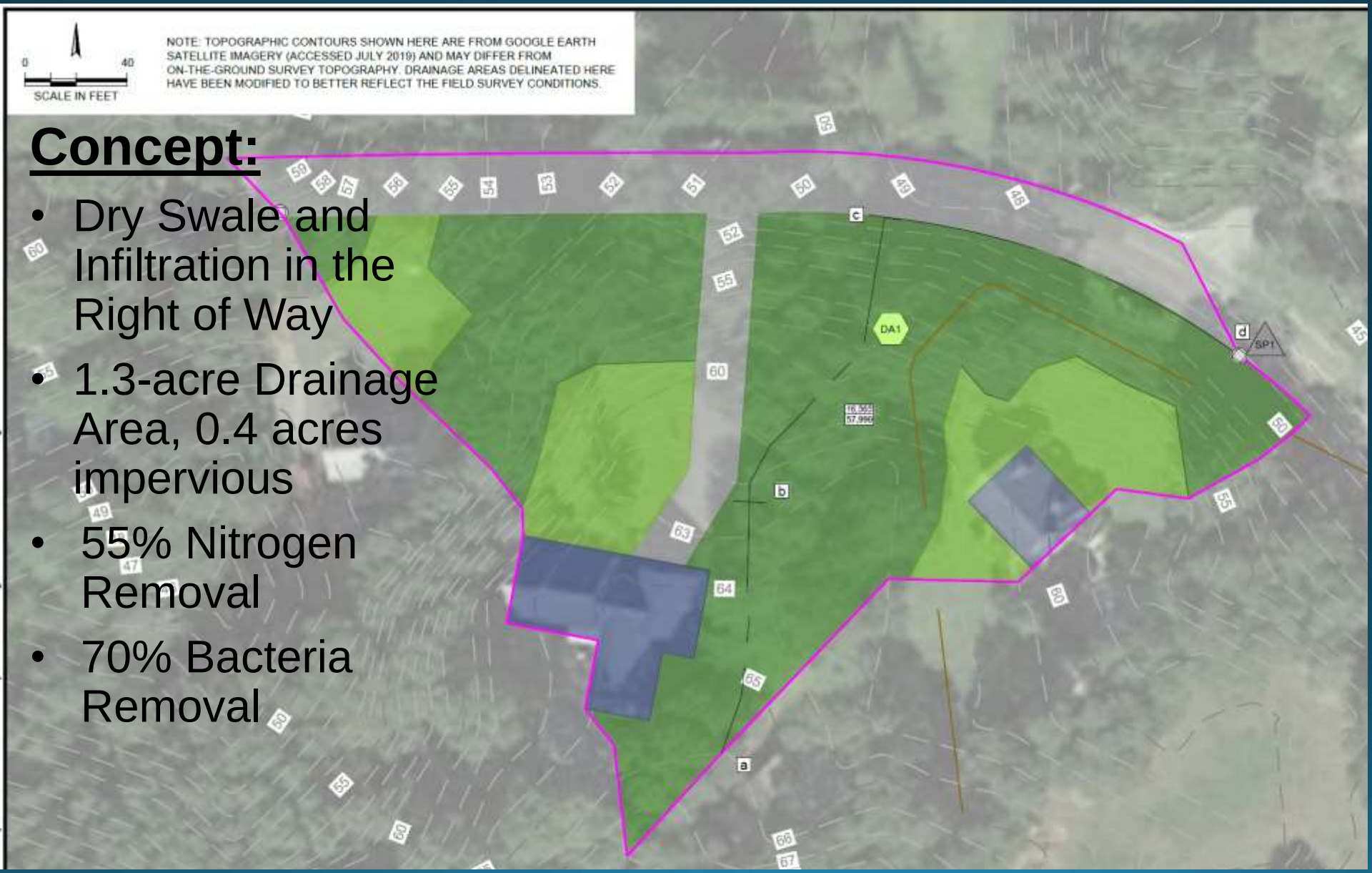

CHECKDAM WEIR A4 15 C-13
VERTICAL CURB 28 LF ± 2 C-11
CHECKDAM WEIR A3 15 C-13
CHECKDAM WEIR A2 15 C-13
LIMIT OF WORK 2,190 SF ±
DOME FRAME AND GRATE 10 C-13
OS 1A RIM:32.50 8" INV OUT:30.25 11 C-13
CHECKDAM WEIR A1 15 C-13
OVERFLOW CHANNEL WITH TURF REINFORCEMENT MATTING SIDE SLOPES 3:1
TYPICAL BERM 6 C-13
9 C-13 SOLID FRAME AND COVER
11 C-13 DB 1A RIM:32.10 8" INV:29.95 8" INV:29.85
13 C-13 PIPE CROSSING (DRAIN/WATER)
FOREBAY A4 20 SF ± 7 C-13
3 C-13 PAVED FLUME WITH LOCAL DEPRESSION
1 C-13 DRY SWALE CELL A4 50 SF ±
1 C-13 DRY SWALE CELL A3 50 SF ±
1 C-13 DRY SWALE CELL A2 50 SF ±
1 C-13 DRY SWALE CELL A1 25 SF ±
14 C-13 GUARD RAIL 145 LF ±
TP-SC2
SOUTH COUNTY ROAD
GRAPHIC SCALE
10 0 5 10 20 40
WC1-1A (DEDUCT ALT. 1) PLAN


SITE WC1-1C
CB
DMH RIM:32.14' UNABLE TO OPEN
WATER QUALITY TREATMENT UNIT

12 C-13 LEVEL SPREADER
CHECKDAM WEIR B4 15 C-13
CHECKDAM WEIR B5 15 C-13
CHECKDAM WEIR B6 15 C-13
CHECKDAM WEIR B7 15 C-13
CHECKDAM WEIR B8 15 C-13
7 C-13 FOREBAY 40 SF ±
11 C-13
10 C-13
3 C-13 PAVED FLUME
GUARDRAIL 320 LF ± 14 C-13
1 C-13 DRY SWALE CELL B4 55 SF ±
1 C-13 DRY SWALE CELL B5 45 SF ±
1 C-13 DRY SWALE CELL B6 45 SF ±
1 C-13 DRY SWALE CELL B7 110 SF ±
1 C-13 DRY SWALE CELL B8 125 SF ±
MATCHLINE WC1-1B DEDUCT ALT. 2 LOWER SWALES PLAN
SOUTH COUNTY ROAD
VERTICAL GRANITE CURB
8" INV:42.00
EX 12" INV OUT:43.30
WC1-1B (DEDUCT ALT. 2) UPPER SWALE PLAN


4 C-11 STORMWATER CHAMBER SYSTEM
BOTTOM OF STONE:28.50
BOTTOM OF CHAMBERS:29.00
2 C-11 VERTICAL CURB 8 LF ±
DEEP CURB 28 LF ±
3 C-11
INSPECTION PORT TYP.
8.2' TYP.
4.0' TYP.
TP-SC1
TYPICAL BERM 6 C-13
LEVEL SPREADER 12 C-13
PAVED FLUME 3 C-13
UTILITY CROSSING DRAIN/WATER 13 C-13
EXISTING CB
RIM:32.90
EX. 12" RCP INV OUT:28.75
DOME FRAME AND GRATE 10 C-13
DB 100 RIM:32.75 4" INV:29.33 4" INV:29.33 12" INV:29.85 11 C-13
CAPE COD BERM
1 C-13 DRY SWALE CELL B1 90 SF ±
CHECKDAM WEIR B1 15 C-13
3 C-13 PAVED FLUME WITH LOCAL DEPRESSION
2 C-11 VERTICAL CURB 33 LF ±
7 C-13 FOREBAY B1 40 SF ±
LIMIT OF WORK 14,800 SF ±
3 C-13 PAVED FLUME
VERTICAL CURB 106 LF ± 2 C-10
DOME FRAME AND GRATE 10 C-13
DB 200 RIM:36.80 8" INV:34.00 11 C-13
DRY SWALE CELL B2 75 SF ± 1 C-13
FOREBAY 20 SF ± 7 C-13
TYPICAL BERM 6 C-13
12 C-13 LEVEL SPREADER
CHECKDAM WEIR B1 15 C-13
CHECKDAM WEIR B2 15 C-13
DRY SWALE CELL B3 55 SF ± 1 C-13
UTILITY CROSSING DRAIN/WATER 13 C-13
BITUMINOUS BERM 40 LF ± 5 C-13
UTILITY CROSSING DRAIN/GAS 13 C-13
DIVCB 200 RIM:39.10 WEIR EL:37.30 1 C-13
EX 12" INV IN:34.95
EX 12" INV OUT:34.85
MATCHLINE WC1-1B DEDUCT ALT. 2 UPPER SWALE PLAN
SOUTH COUNTY ROAD
WC1-1B (DEDUCT ALT. 2) LOWER SWALES PLAN

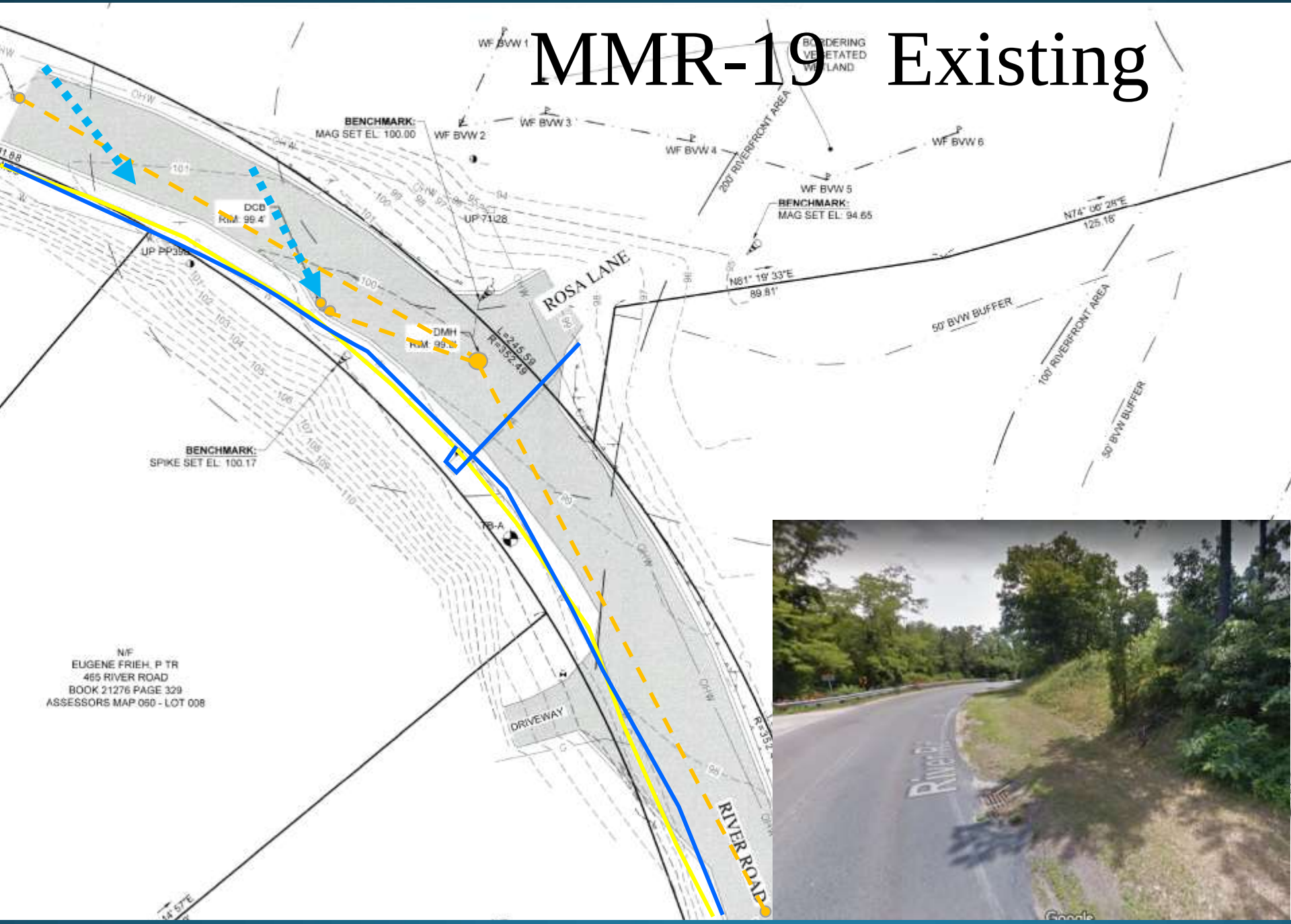
Site 10: River Road Dry Swale



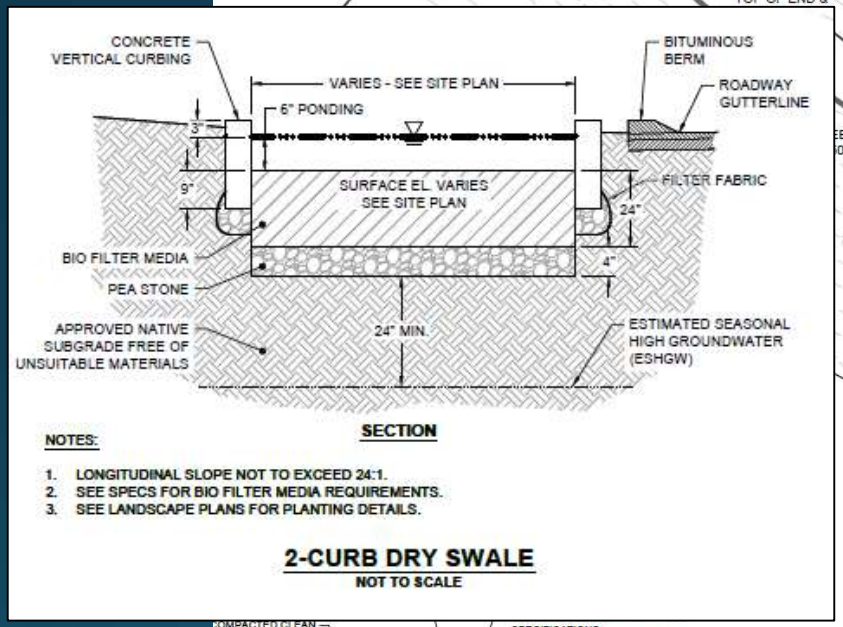
Concept:

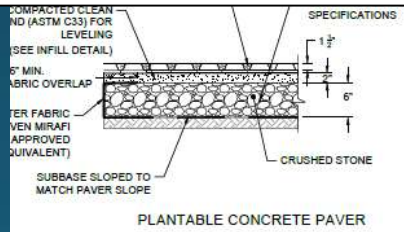
- Dry Swale and Infiltration in the Right of Way
- 1.3-acre Drainage Area, 0.4 acres impervious
- 55% Nitrogen Removal
- 70% Bacteria Removal

MMR-19 Existing

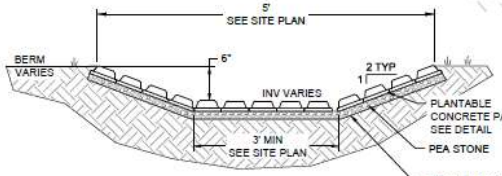


Curbed Dry Swale with Infiltration



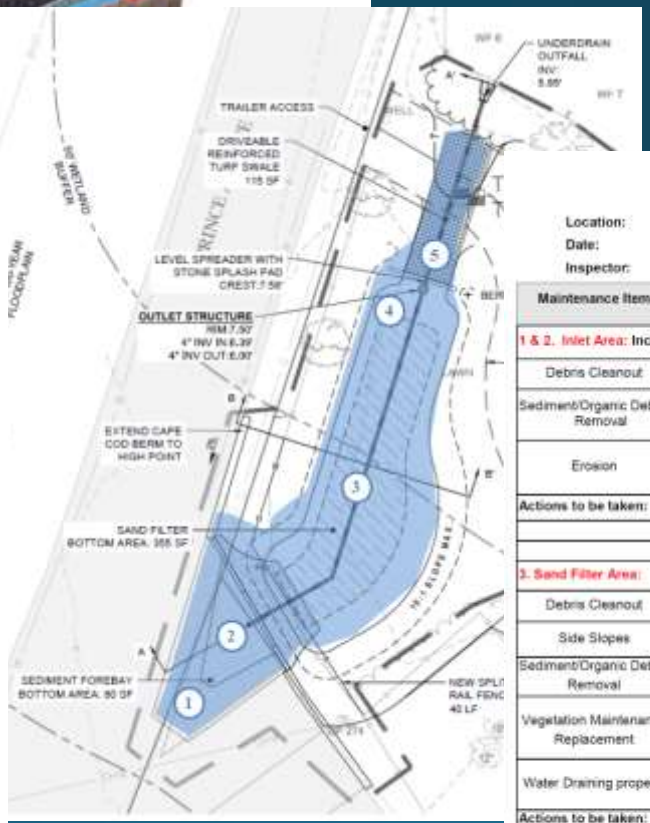


PLANTABLE CONCRETE PAVER



NOTES:
1. SUBGRADE SHALL BE UNIFORM AND SMOOTH. REMOVE ALL ROCKS, CLODS, VEGETATION OR OTHER OBJECTS.
2. BOTTOM AND SIDE SLOPES WITHIN THE EMERGENCY OVERFLOW SHALL BE

Operation & Maintenance Plans



SAND FILTER AREA INSPECTION REPORT

Location:
Date:
Inspector:

Maintenance Item	Description	Maintenance (Y/N)
1 & 2. Inlet Area: Includes: Sediment Forebay		
Debris Cleanout	Remove all trash and debris from the forebay.	
Sediment/Organic Debris Removal	Remove and properly dispose of when build-up is greater than or equal to 3 inches.* Remove any vegetation that sprouts through voids in stone, pavement, or pavers.	
Erosion	Check for areas of erosion in the forebay, particularly along side slopes and perimeter. Repair as necessary.	
Actions to be taken:		
3. Sand Filter Area:		
Debris Cleanout	Remove trash and debris from the surface.	
Side Slopes	Signs of erosion gullies, animal burrowing, overtopping or slumping are observed. Repair as necessary.	
Sediment/Organic Debris Removal	Remove sediment accumulation and properly dispose when accumulation is greater than or equal to 3 inches.*	
Vegetation Maintenance Replacement	Mow vegetation at least twice per year but not more than four times per year. Remove and replace vegetation as necessary using the appropriate species as designated on plans (see Appendix B).	
Water Draining properly	If standing water is observed for more than 48 hours after a storm event, rototil or aerate the bottom 6 inches to breakup any hard-packed sediment.*	
Actions to be taken:		
4. Overflow Structures/Spillways: Includes: Sand filter outlet structures and level spreaders/overflow spillways		
Emergency Spillways	Check for settling, gullying, erosion damage, & clogging. Repair as necessary and return to design grades.	

Total Impact of 2017-2020 Work

- Watershed Stormwater Management Plan
- Maintenance and improvement of 2 existing systems (Cordwood and Ropes)
- Installation of SIX new systems! (+2 in 2021)
- Total of ~17 Acres of Drainage Addressed
- 55% or greater Nitrogen Removal
- 70% Bacteria Removal
- Maintenance trainings: 2017, 2019, 2020 (2021)




Photo Credits: Barnstable Clean Water Coalition and APCC