OPERATION AND MAINTENANCE PLAN COTUIT LIBRARY (CO-2) STORMWATER

RETROFIT



Prepared for:

BARNSTABLE PUBLIC WORKS DEPARTMENT 382 FALMOUTH ROAD HYANNIS, MA 02601

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Operation & Maintenance Plan

Green Stormwater Infrastructure Cotuit Library (CO-2)

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- A. Bioretention Area Inspection Report
- B. Plantings Maintenance Checklist
- C. Planting Plan

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1.0 INTRODUCTION

This document provides a general description along with the operation and maintenance requirements for the Cotuit Library Stormwater Retrofit project at 871 Main Street in Cotuit, MA. The responsible parties are required to inspect and maintain all measures as outlined in this maintenance guide throughout the year. Site maintenance is divided into three categories as outlined below.

- 1. Green Stormwater Infrastructure
 - Structural Components
 - Structural Maintenance Schedule
 - Planting
 - Plantings Maintenance Schedule
 - Weed Guide
- 2. General Site Maintenance
 - Trash & Debris
 - Pet Waste
 - Pavement Sweeping
 - Contributing Drainage Areas
 - Snow Removal
 - De-icing
- 3. Long-Term Pollution Prevention Measures

2.0 **RESPONSIBLE PARTIES**

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3.0 GREEN STORMWATER INFRASTRUCTURE

3.1 How Does Green Infrastructure Work?

Green Stormwater Infrastructure (GSI) is a nature-based approach to stormwater treatment and management. These stormwater practices or "treatment areas" are designed to mimic nature and use the natural filtration properties of soil and plants to remove pollutants from stormwater runoff prior to discharging to the municipal drainage system or waterbodies.

GSI relies on the following basic steps to function properly. Structural components of the practices facilitate the functioning of the steps. If one of these steps, or components, does not work properly, the entire system can be compromised and the GSI practice itself could be contributing to maintenance problems. This can lead to landscape nuisances, more frequent maintenance and costly repairs/improvement.

- 1. Collect (Inlets)
- 2. Move Water (Conveyance) if needed, can come after capturing sediment
- 3. Capture Sediment (Pretreatment)
- 4. Treat and Manage (Filter, Infiltrate and/or Store)
- 5. **Overflow** (Structures and Spillways)

3.2 What is required for Maintenance?

As these are nature-based systems that often rely on plant upkeep, the maintenance for GSI typically falls under landscape and general site maintenance services. Proper operation and maintenance (O&M) are vital to its long-term viability. Regularly scheduled maintenance can prevent system failures due to sediment build-up, damage, or deterioration. The maintenance requirements, outlined in this guide, are critical to ensure proper treatment, maintain storage capacity and preserve the visual integrity.

3.3 **Bioretention Areas**

Bioretention areas are types of GSI that have a proven track record of better pollutant removal capabilities than more conventional drainage systems. Bioretention areas reduce stormwater runoff and use both a designed soil media and vegetation to remove nitrogen and bacteria, as well as other stormwater pollutants.

The maintenance for the bioretention area is divided into two categories:

- a. The Structural Components that make up the basic steps of a functioning system
- b. Plantings, the landscape and filtration element

BIORETENTION: STRUCTURAL COMPONENTS



3.4 Structural Components

- 1. **Collect**: Runoff is directed overland from the parking lot to a cobbled inlet where stormwater enters the system.
- 2. *Capture Sediment*: Sand and debris settle out in the sediment forebay and "foxhole" structure.
- 3. *Move Water:* Stormwater exits the forebay flowing over two log check dams to enter the three bioretention cells.
- 4. *Treat and Manage*: Plants slow the water down, and the soil media and plant roots filter the runoff, removing nitrogen and bacteria. The treated water from the 1" storm event then infiltrates into the soil below or is directed to the Outlet Structure via a perforated underdrain.

5. Overflow:

- a. Outlet Structure: Runoff from the underdrain and from rain events that exceed the 1" design storm enter the Outlet Structure, which then directs flow into two dry well structures for storage and infiltration.
- Emergency Spillway: Runoff from extreme storms (>25 year) will safely flow over the granite emergency spillway to the back of the property.







BIORETENTION: STRUCTURAL COMPONENTS













STRUCTURAL COMPONENTS MAINTENANCE SCHEDULE: BIORETENTION

A site inspection of the bioretention components shall be conducted at least twice a year in the Spring and Fall, and after major storm events (2" of rain or greater). Debris and trash should be removed monthly as needed and sediment removal should occur during the two, bi-annual site inspections and during the monthly debris and trash inspections as needed. See the calendar below and the Inspection Report in Appendix A for more information.

Bioretention General Maintenance Schedule												
	Jan	Feb	Mar	Apr	Мау	Jun	July	Aug	Sep	Oct	Nov	Dec
Task		Frequency & Time of the Year										
Site Inspection				x	x x							
Debris & Trash Removal				Х	x	х	х	х	х	х	х	
Sediment Removal				х	x	x	х	х	х	х	х	

should **also** be completed after major storm events.

- **X** required inspection
- x as needed
- When removing trash and debris during monthly inspections look for:
 - If sediment is > 2" in cobble sediment forebay or within the bottom of the "foxhole" structure. Ensure sediment does not cause blockage of inlet. If it is, remove sediment with a flat shovel. See Inspection Report for more information.
 - If standing water does not drain after 48 hours.
 See Inspection Report for action items.

- After rain event look for:
 - o If standing water does not drain after 48 hrs.
 - Side slope erosion and gullying.
 - Surface erosion and plant root exposure.
 - See Inspection Report for action items.

See section below for information on plantings maintenance of the bioretention area. Use the plantings maintenance calendar to combine maintenance efforts.

PLANTINGS

3.5 Plantings

The planting design for the bioretention area consists of four landscape maintenance areas:



Landscape maintenance of "mowed" areas includes the following:

Seed

Loam and reseed bare spots with the specified seed mix as shown on the Planting Plan.

Mowing/Weed Whacking

Mow or weed whack (with string trimmer) at the same frequency as adjacent park areas – roughly once a month during the growing season. Mowing can be done with a mulching mower, with material left on site. When weed whacking, material may be substantial (long grasses) that could clog the bioretention, so bag and remove from site as necessary. Maintain a cutting height of 3" or more. Leave the grass taller during hot, summer months, and cut shorter during cooler periods of the growing season. Trim edges when necessary. Remove and properly dispose litter from all grass areas prior to mowing or trimming.

Watering

Water only during drought conditions or during reseeding establishment period.

Fertilizing

No fertilizer shall be used on the grass areas.

Weeding

Weeding should be limited to invasive and exotic species. Non-chemical methods (hand pulling and hoeing) are required; chemical herbicides are not allowed.

Properly remove and dispose off site all invasive species as to prevent colonization elsewhere, this includes disposal on land beyond the project area.



PLANT MAINTENANCE: NO "MOW" AREA – BIORETENTION

By design, plants in bioretention areas are meant to flourish throughout the growing season leaving dry standing stalks during the dormant months. Plants do not require fertilizers and/or watering. This area is designated as No "Mow" - frequent mowing would eliminate selected species, may promote the growth of undesirable plants, and require additional maintenance and watering. It is recommended this area be cut back no more than one time per year. Remove and replace vegetation as necessary, see replacement section below.

Specific maintenance activities of the bioretention no mow area include the following:

Cutting Back/Spring Cleanup

Recommend cutting with shears a maximum of once a year in early spring if necessary. Otherwise, allow areas to grow to their natural heights. Do NOT cut area lower than 6" – consider adding a visual indicator, such as wooden stakes on site at 6" height, to provide visual cues during cutting. Use a leaf blower to move leaves and cuttings onto lawn or pavement for easy removal. Collect and compost the clippings and leaves. If composting is not an option, bag and remove the clippings and leaves from the site so they do not clog the bioretention area.

Fall Cleanup

Collect all leaf litter that accumulates within the bioretention and pretreatment areas. Mulch collected leaf litter and spread evenly across the planted areas. Do not smother plants or leave piles of mulched leaf litter. Mulched leaf litter is intended to act as natural fertilizer.

Watering

Water only during drought conditions or during re-establishment period as needed.

Fertilizing

No fertilizer shall be used.

Weeding

Weeding should be limited to invasive and weedy species (see weed list below and Weed Guide at <u>https://web.uri.edu/riss/files/In-the-Weeds.pdf</u>). Non-chemical methods (hand pulling and hoeing) are required; chemical herbicides are not allowed. Properly remove and dispose off site all invasive species as to prevent colonization elsewhere; this includes disposal on land beyond the project area.

Monitoring

When weeding, monitor the site for potential invasive species, bare spots and identify potential pest or plant diseases.

Debris & Trash

Remove and properly dispose litter from all areas.

Plant Identification

Photos of some of the bioretention plants are included below for help with identification.



Viola walterii 'Silver Gem' - Violet



Eupatorium dubium 'Little Joe' – Joe Pye Weed

PLANT MAINTENANCE: NO "MOW" AREA – BIORETENTION



Aster novae-angliae - New England Aster



Iris versicolor – Blue Flag Iris



Astilbe chinensis 'Visions' - Astilbe



Waldsteinia fragarioides – Barren Strawberry

PLANT MAINTENANCE: NO "MOW" AREA - BIORETENTION



Anemone canadensis - Windflower



Polystichum arcostichoides – Christmas Dagger Fern

PLANT MAINTENANCE: NO "MOW" AREA - BIORETENTION



Porteranthus trifoliatus - Bowman's Root



Carex amphibola – Creek Sedge

PLANT MAINTENANCE: INFORMAL WALKING TRAILS

Maintenance of informal walking trails areas includes the following:

Woodchips

Natural, organic woodchips with no dye should be replaced every other year if needed. Spread woodchips to a minimum depth of 2" across the site where informal walking trails are intended. Adjust woodchips to prevent them from entering the bioretention area as visitors are walking through the area or during rain events. See color coded plan.

Weeding

Weeding should occur to remove all plants from within the informal walking trails. Non-chemical methods (hand pulling and hoeing) are required; chemical herbicides should be avoided. Properly remove and dispose all invasive species as to prevent colonization elsewhere, this includes disposal on land beyond the project area.



PLANT MAINTENANCE: UPLAND PLANTINGS

Maintenance of the upland plantings along the perimeter of the bioretention area includes the following:

Cutting Back

Recommend cutting with shears a maximum of once a year in early spring. Otherwise, allow areas to grow to natural height. Do NOT cut area lower than 6" – consider adding a visual indicator, such as wooden stakes on site at 6" height, to provide visual cues during cutting. Depending on height of grasses and the time of year, grass cuttings/stalks may need to be raked, bagged, and removed from the site so as not to clog the bioretention.

Watering

Allow these areas to "brown." Water only during drought conditions or during reseeding establishment period.

Fertilizing No fertilizer shall be used.

Weeding

Weeding should be limited to invasive and weedy species (see weed list below and Weed Guide at <u>https://web.uri.edu/riss/files/In-the-Weeds.pdf</u>). Non-chemical methods (hand pulling and hoeing) are required; chemical herbicides are not allowed. Properly remove and dispose off site all invasive species as to prevent colonization elsewhere; this includes disposal on land beyond the project area.

Monitoring

When weeding, monitor the site for potential invasive species, bare spots and identify potential pest or plant diseases.



Plant Replacements

Replace all dead or dying plants with the species as shown on the Planting Plan as updated in June 2021 (see updated list in Appendix C) when some plants were replaced.

The plants that thrive in bioretention areas are typically quite drought tolerant due to the filter profile having a top layer of planting soil and sandy soil media below. They need to be able to withstand periods of inundation after storm events; however, when it doesn't rain, there will be less water held naturally in the sand than in other soil types for the plants to use so they need to withstand these dry periods as well.

Specifying plants native to the area increases the ecosystem benefits by helping to support native wildlife like pollinators.

The best time to plant is in early to mid-fall or early to mid-spring. If replacements are needed, use the planting plan and updated list as a guide (see Appendix C). However, if all of the plants of a certain species have not done well in the bioretention area, do not replace with that same species. Rather, replant with one or more of the other species that has thrived under the bioretention area conditions or have a plant professional choose a different species based on current photos of the site and the following site-specific considerations.

Plants for this bioretention area should be:

- Preferably native
- Drought tolerant
- Tolerant of inundation for 24 hours
- Size constraints:
 - taller perennials at the bottom of the practice
 - shorter perennials on the side slopes
 - desired mix: 80% groundcovers: 20% flowering perennials
- Shade tolerant
- Type of plants: cold and warm season grasses, perennials, groundcovers

PLANTINGS: MAINTENANCE SCHEDULE

By design, plants in the bioretention area are meant to help filter the stormwater as it passes through and flourish throughout the growing season. The plants do not require fertilizers or mulch, and, after establishment, only need water during periods of drought. Remove and replace vegetation as necessary, using the appropriate species as discussed in the page above.

Weeding should occur quarterly during the growing season as well as monitoring for invasive species. An annual spring or fall "clean up" includes cutting last season's growth of the perennials as needed. See the calendar below, the Plantings Maintenance Checklist in **Appendix B** and the Weed Identification Guide at <u>https://web.uri.edu/riss/files/In-the-Weeds.pdf</u> for more information.

Bioretention Landscape Maintenance Schedule												
	Jan	Feb	Mar	Apr	Мау	Jun	July	Aug	Sep	Oct	Nov	Dec
Task				F	reque	ncy & ⊺	Гime of	the Ye	ar			
Cutting/Cleanup				х							х	
Mowing					x				х			
Weeding				x		X		Х			х	
Monitoring				x		Х		Х			х	
Watering						x	х	х	x			
Seeding				x	x				x :	x		
Plant Replacement				х	х				x :	x		



"Mowed" Areas No "Mow" Areas (Bioretention & Upland Plantings) All areas

X required

x as needed

• Trash and debris are removed during monthly structural component inspections but can also be completed during landscape maintenance visits for weeding and monitoring.





Redroot Pigweed- (Amaranthus retroflexus)



Smartweed (Polygonum lapathifolium)







Fireweed (Erechtites hieracifolia)

Spotted Spurge (Euphorbia maculata)



Crabgrass (Digitaria ischaemum)



Crabgrass with seedheads









Ragweed (Ambrosia artemisiifolia)



Oriential Bittersweet (Celastrus orbiculatus)



Green Foxtail (Setaria viridis)

Norway Maple Tree Seedling (Acer platanoides)



Catalpa Tree Seedling (Catalpa speciosa)



Purple Loosetrife (Lythrum salicaria)



Field Bindweed (Convolvulus arvensis)



4.0 GENERAL SITE MAINTENANCE

General site maintenance includes the following requirements:

Trash & Debris

Remove and properly dispose of all trash and debris.

Pet Waste

Residents are encouraged to pick up after their pets. Remove and properly dispose of all pet waste left behind. Pet waste should be picked up and disposed of properly to reduce bacteria and nutrient levels in stormwater.

Pavement Sweeping

The parking area should be mechanically swept, at a minimum, once per year in early spring to remove accumulated sand and sediment debris.

Contributing Drainage Areas

Check for sources of sediment in forebay/foxhole structure from the contributing drainage area. Follow-up with library stakeholder(s) as necessary to reduce sources and minimize maintenance needs.

Snow Removal

Plowed or shoveled snow piles should not block inlet structures and are not to be placed in the stormwater management areas. Due to the potential for plant damage, snow piling and or removal is NOT recommended in the bioretention area.

De-Icing

When de-icing compounds are necessary for areas draining to the green stormwater infrastructure (such as the parking lot), the least harmful chemicals should be used. Excessive salting should be avoided. Use of large amounts of sand should also be avoided, since it may obstruct the conveyance system. Ice removal is NOT recommended in the bioretention area.

5.0 LONG-TERM POLLUTION PREVENTION MEASURES

Long-term pollution prevention measures implemented at the site reduce pollutants in stormwater discharges. The following precautions will be employed on an on-going basis.

Spill Prevention & Control Measures

To minimize the risk of spills or other accidental exposure of materials and substances to stormwater runoff, the following material management is to be used when working on site.

- Any materials stored on-site will be stored in a neat, orderly manner in their appropriate containers.
- Products will be kept in their original containers with the original manufacturer's label.
- Substances will not be mixed with one another unless recommended by the manufacturer.
- Manufacturers' recommendations for proper use and disposal will be followed.
- The contractor's supervisor will be issued this Guide to ensure proper use and disposal of materials.

Materials or substances listed below may be present on-site for maintenance and care should be taken to avoid spills:

• Petroleum Based Products

The following product-specific measures will be followed on-site:

- <u>*Petroleum Products*</u> All on-site vehicles will be monitored for leaks and receive preventative maintenance to reduce the chance of leakage.
- <u>Grass Clipping, Leaf Litter and Plant Debris</u> are to be removed from the property and not disposed on site.

APPENDIX A BIORETENTION AREA INSPECTION REPORT

COTUIT LIBRARY BIORETENTION AREA INSPECTION REPORT

Location:

Date:

Inspector:

Maintenance Item	Description	Maintenance (Y/N)							
1. Collection Inlets: Cobble Inlet									
Surface Debris Cleaning	Remove all trash, leaf litter and inlet clogging.								
Inlet Flume	Check for clogging and sediment accumulation that impacts inflow. If sediment/debris accumulation, remove sediment.								
Actions to be taken:									
2. Sediment Forebay ar	nd "Foxhole" Structure								
Debris Cleanout	Remove trash and debris from the surface.								
Sediment/Organic Debris Removal	Remove sediment accumulation with a flathead shovel and properly dispose of (critical when accumulation is greater than or equal to 2 inches).*								
Foxhole Structure Cleanout	Remove hex bolts securing metal grates using a 9/16 " socket wrench to access sediment and debris. Clean filter screen manually by sweeping or with pressurized water. Remove sediment and debris as noted above.								
Actions to be taken:									
3. Log Check Dams (2)									
Debris Cleanout	Remove trash and debris from the surface.								
Erosion Repairs	Signs of erosion gullies, exposed roots, 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 2 inches.*								
Actions to be taken:									

4. Bioretention Areas (3	separate cells)						
Debris Cleanout	Remove trash and debris from the surface.						
Erosion Repairs	Signs of erosion gullies, exposed roots, 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 2 inches.*						
Vegetation Maintenance	Refer to Plantings Maintenance Checklist						
Water Draining properly	If standing water is observed for more than 48 hours after a storm event, rototill or aerate the bottom 6 inches to breakup any hard-packed sediment.* If standing water does not drain after tilling, replace the soil media and replant.						
Actions to be taken:							
5. Outlet Structure/Dry	Wells and Overflow Spillway						
Outlet Structure	Check for sediment accumulation that impacts pipe flow. If sediment accumulation present, schedule cleaning.* Check for wood chips, leaf litter, debris and inlet clogging.						
Dry Wells	Carefully pop manholes (these are DEEP structures) and check for sediment/debris accumulation/clogging. If accumulation present, schedule cleaning.*						
Overflow Spillway	Check for leaf litter, debris, erosion and spillway clogging.						
Actions to be taken:							
	General Site Maintenance						
Debris Removal	Remove trash from perimeter areas. Correct any areas where wood chips are entering the bioretention rather than staying on path.						
Pet Waste Removal	Remove any pet waste from perimeter areas.						
Pavement Sweeping	Sweep parking lot minimum once a year after spring thaw.						
Snow Removal	Ensure snow piles do no block inlet structures and are not placed in the green stormwater infrastructure.						
De-Icing	Do not remove ice in the bioretention area. If needed, use de- icing compounds with the least harmful chemicals. Avoid excessive salting or large amounts of sand.						
Actions to be taken:							

BIORETENTION: STRUCTURAL COMPONENTS



3.1 Structural Components

- 1. **Collect**: Runoff is directed overland from the parking lot to a cobbled inlet where stormwater enters the system.
- 2. *Capture Sediment*: Sand and debris settle out in the sediment forebay and "foxhole" structure.
- 3. *Move Water:* Stormwater exits the forebay flowing over two log check dams to enter the three bioretention cells.
- 4. Treat and Manage: Plants slow the water down, and the soil media and plant roots filter the runoff, removing nitrogen and bacteria. The treated water from the 1" storm event then infiltrates into the soil below or is directed to the Outlet Structure via a perforated underdrain.

5. Overflow:

- a. Outlet Structure: Runoff from the underdrain and from rain events that exceed the 1" design storm enter the Outlet Structure, which then directs flow into two dry well structures for storage and infiltration.
- Emergency Spillway: Runoff from extreme storms (>25 year) will safely flow over the granite emergency spillway to the back of the property.







BIORETENTION: STRUCTURAL COMPONENTS













APPENDIX B

PLANTINGS MAINTENANCE CHECKLIST

BIORETENTION PLANTINGS MAINTENANCE CHECKLIST

Location: _____

Date: _____

Inspector: _____

Task	Description	Complete (Y/N)				
Pruning	 Prune surrounding trees and shrubs to remove deadwood and low hanging branches if needed for visitors to walk around the area. 					
Cutting	 Leave dry standing stalks during the dormant months and remove in the spring. Cut back perennials in early spring. Do NOT cut below 6". 					
Mowing/Weed Whacking	 Mow surrounding lawn areas at least twice a year with a mulching mower. Rake and/or bag and remove grass clippings and dispose of off-site. Do NOT cut lawn grass areas below 3". Do NOT mow or weed-whack the bioretention and upland plantings. Trim edges when necessary. 					
Weeding	 Weeding should be limited to invasive and exotic species, which can overwhelm the desired plant community.* Non-chemical methods including hand pulling and hoeing are recommended. Chemical herbicides should be avoided. 					
Monitoring	 Look for potential invasive species and identify potential disease. Remove and dispose of all invasive species.* (see weeding) 					
Watering	 During establishment or drought conditions, plants should be watered a minimum of once every seven to ten days. 					
Seeding	 Loam and re-seed bare spots with the specified seed mix as shown on the Planting Plan. 					
Plant Thinning	 Separation of herbaceous vegetation rootstock should occur when over-crowding is observed 					
Plant Replacement	 Replace/replant diseases, unhealthy or dead plants to maintain a healthy plant community 					
Fall Cleanup	 Collect all leaf litter that accumulates within the bioretention and pretreatment areas. Either compost or mulch leaf litter and evenly spread organic matter across the upland planting areas. 					
Wood Chips	 Supplement with natural, organic woodchips as needed for path stabilization; no more than once every two years. Ensure woodchips do not enter the bioretention area. 					
Mulch	NONE					
Fertilizing	NONE					
Actions to be taken:						

*Invasive species shall be disposed of offsite in a pre-approved location.



"Mowed" Areas No "Mow" Areas (Bioretention & Upland Plantings) Informal Walking Trails - Woodchips All areas The planting design for the bioretention area consists of four plantings maintenance areas:





FINAL PLANT LIST AFTER REPLACEMENTS – JUNE 2021

Planted in the Cotuit Library bioretention garden are the following plants, selected to thrive in this shady location. Those identified in <u>blue font</u> are additions during the maintenance follow-up one year after construction to supplement and replace the original list as needed. Those crossed out are species that were originally planted in the bioretention but did not survive the conditions and were thus not replanted. See the original planting plan on the following page for general locations.

- Windflower (Anemone canadensis) Native
- Astilbe (Astilbe chinensis) Non-Native
- New England Aster (Aster novae-angliae) Native
- Creek Sedge (Carex amphibola) Native
- Pennsylvania Sedge (*Carex pensylvanica*) Native (replaced violets that did not survive in upper and middle bioretention cells)
- Little Joe Pye Weed (Eupatorium dubium) Native cultivar
- Tea Berry; Wintergreen (Gaultheria procumbens) Native
- Sweet Woodruff (*Galium odoratum*) Naturalized (replaced tea berry that did not survive on slope closest to the playground)
- Japanese Forest Grass (Hakonechloa macra) Non-Native (replaced tea berry that did not survive by sign)
- Blue Flag Iris (Iris versicolor) Native
- Christmas Fern (Polystichum arcostichoides) Native
- Bowman's Root (Gillenia trifoliata) Native
- Silver Gem Violet (Viola walteria 'Silver Gem') Native cultivar
- Barren Strawberry (Waldensteinia fragaroides) Native

