FINAL REPORT - Draft

McDougle Middle School Bioretention Area and Cistern Installation

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Introduction

Faculty, staff, and students associated with the North Carolina State University (NCSU) Department of Biological and Agricultural Engineering worked with the Town of Carrboro (Town) to implement watershed restoration practices and water quality monitoring as a component of an EPA 319 project in the Bolin Creek Watershed. The purpose was to improve ecosystem health and water quality by restoring natural stream functions and implementing stormwater best management practices (BMPs) demonstration sites to treat runoff in degraded areas in the watershed. This report outlines Task 1 of the approved scope of work between NCSU and the Town: McDougle Middle School Bioretention Area and Cistern Installation.

Background

During a rainstorm, stormwater runoff travels across a surface and picks up pollutants such as sediment, nutrients, metals, and bacteria. In traditional developments, polluted runoff would discharge directly to storm inlets and flow rapidly into receiving creeks, eroding streambanks and adversely impacting downstream water quality.

One solution to mitigate urban runoff pollution is to install stormwater BMPs to treat and slow down runoff at the source. A bioretention area captures runoff from an impervious surface and allows that water to infiltrate through the soil media. As the water infiltrates, pollutants are removed through a variety of mechanisms including adsorption, microbial activity, plant uptake, sedimentation, and filtration. Some of the incoming runoff is temporarily held by the soil of the bioretention area and later "leaves" the system by way of evapotranspiration, exfiltration to the ground water, or discharge from the underdrains.

Cisterns are another stormwater BMP that can be used to reduce runoff volumes and pollutant loads. Cisterns are large storage tanks (greater than 500-gallons) that are typically connected to the downspout of a large impervious roof. Captured stormwater runoff can be used in place of a municipal water supply for irrigation, toilet flushing, or vehicle washing. For this project, the cistern will be used to irrigate the adjacent bioretention area and surrounding landscape.

The McDougle bioretention area was installed in a grassed courtyard adjacent to the school gymnasium. This highly visible area made for an effective demonstration and education site. A permanent educational sign was installed adjacent to the garden to educate students, teachers, and parents about the impacts of stormwater pollution and how bioretention areas can improve water quality (Appendix A). Prior to this project, runoff from adjacent roofs, sidewalks, and a brick courtyard discharged directly to a drop inlet, which eventually discharged to a tributary to Bolin Creek (Photograph 1).

Photograph 1: Stormwater drop inlet prior to bioretention area construction

Project Summary

A 1,280- square foot bioretention area was installed at the McDougle Middle School in Carrboro, North Carolina. The area was designed by NCSU and constructed in August 2010 by Wright Contracting, LLC. It was designed to capture and treat the runoff produced from a one-inch rainfall event, also referred to as the first flush. This represents the most polluted portion of runoff during an event. An overflow device was utilized to safely route larger storms through the bioretention area. The design calculations are included with this report in Appendix B. Specific project components included:

Excavation of Existing Clay Soils

The onsite clay soil was not suitable to infiltrate runoff for the bioretention area. Therefore, the clay soil was excavated and hauled off site to make room for an engineered sandy bioretention media (photographs 2 &3).

Photograph 2. Before construction.

Photograph 3: Bioretention area excavation.

The white pipe in photograph 3 was an existing storm pipe that discharges to the drop inlet. This pipe was carefully avoided during the excavation.

Bioretention Liner and Underdrains

The excavation was lined with a permeable geotextile fabric to allow water to infiltrate while keeping fine soil particles out of the gravel underdrain and sandy media layers (photograph 4). Two four-inch perforated plastic pipes were installed for the underdrains. The underdrains were embedded in a six-inch layer of washed gravel (photograph 5). Two cleanouts were installed in case the underdrains ever get clogged. The underdrains were connected to the drop inlet structure in the middle of the bioretention area.

Photograph 4: Liner installation.


Photograph 5: Underdrain and gravel installation.

Engineered Bioretention Media

The next step was to backfill the area with the bioretention media to the specified design elevation (photographs 6, 7, & 8). The contractor carefully installed the media to avoid compaction and keep the surrounding soil out of the bioretention mix. The media consisted of approximately 85 – 88 percent sand, 8 – 12 percent fines, and 3 – 5 percent organic matter. The specified media should result in an infiltration rate of approximately 1 – 2 inches per hour.

Photograph 6: Media installation.

Photograph 7: Media installation.

Photograph 8: Media installation complete

Overflow Device

The existing drop inlet structure was raised to create an eight-inch ponding depth in the bioretention area (photograph 9). This depth allowed sufficient storage capacity to capture the runoff associated with a one-inch storm (photograph 10). Runoff from storms greater than one-inch can safely bypass the area through the top of the drop inlet without creating additional flooding or negatively impacting the bioretention area.

Photograph 9: Overflow structure

Photograph 10: After runoff event

Site Stabilization

Silt fence was installed around the perimeter of the bioretention area to prevent sediment from the surrounding disturbed area from clogging up the imported bioretention media. Additional, the disturbed areas outside the bioretention area were stabilized with permanent grass seed and straw mulch (photograph 11).

Photograph 11: Post Construction

Hardwood Mulch and Bioretention Plants

In October 2010, NCSU staff, Town staff, Friends of Bolin Creek volunteers, a documentary film crew, teachers and school staff, and five 8th grade science classes planted and mulched the garden (photographs 12 & 13). Native plants that can tolerate extremely dry and wet conditions were chosen for the garden. For the October 2010 planting, the following species were planted: Asclepias tuberosa "Butterfly weed", Echinacea purpurea "Cone flower", Iris virginica "Southern blue flag", Rudbeckia hirta "Black-eyed Susan", Vernonia noveboracensis "Iron Weed", Panicum virgatum "Switchgrass", Muhlenbergia capillaris "Sweet grass", Clethara alnifolia "Sweet pepperbush", and Itea virginica "Virginai willow".

The following website outlines plants that are suitable for bioretention areas in the piedmont of North Carolina.
http://www.bae.ncsu.edu/topic/bioretention/PiedmontPlants_list.pdf

For each class throughout the day, the students rotated between different learning and work stations. They learned about the water cycle and basic stormwater hydrology, bioretention area design and function, how to install plants in a garden, and how to install a cistern. This was all captured by a local documentary film crew. The final video can be found at:
http://www.youtube.com/watch?v=N17ClREiegc

An additional planting occurred in December 2012 to fill in areas where the previous vegetation did not survive. The following species were planted: Trees: Nyssa sylvatica "Black Gum". Shrubs: Aronia arbutifolia "Red Chokeberry", Callicarpa americana "American beautyberry", Ceanothus americanus "New Jersey Tea", Ilex glabra "Inkberry Holly", Ilex verticillata "Winterberry", Spirea tomentosa "Hardback spirea", Viburnum nudum "Possumhaw virburnum". Perennials: Amsonia hubrectii "Willowleaf blue star", Asclepias incarnata "Pink swamp milkweed", Baptisia alba "White false indigo", Baptisia australis "False indigo", Boltonia asteroids "White Boltonia", Eryngium yuccifolium "Rattlesnake master", Eupatorium coelestinum "Hardy ageratum", Eupatorium dubium "Eastern Joe-Pye Weed", Eupatorium maculatum "Spotted Joe-Pye Weed", Gaillardia grandiflora "Blanketflower", Iris virginica "Southern blue flag", Monarda didyma "Bee balm", Penstemon digitalis "Beard Tonque", Salvia lyrata "Lyre-leaf sage", Salvia nemorosa "Bog salvia", Stokesia laevis "Stoke's aster", Vernonia lettermanii "Dwarf Ironweed"

Photograph 12: Plant installation

Photograph 13: Initial planting and mulch complete

Cistern Installation

The students also helped NCSU staff install the 1,550-gallon cistern (photograph 14). The cistern was connected to an existing downspout off the gymnasium roof. Runoff collected in the cistern can be used to irrigate the bioretention area and the surrounding landscape. This will reduce municipal water use and the volume of runoff leaving the site. Experience with the cistern during the project period suggests that adding a pump to increase pressure would benefit irrigation by increasing the pressure. However, this would require extending electrical service, which is not currently available in proximity to the cistern. It is also worth noting that the site is well suited for the addition of two more cisterns if additional funds become available. Given interest in additional educational gardens, additional capacity could be both an environmentally and financially beneficial undertaking.

Photograph 14: Cistern installation

Project Monitoring

Runoff to the bioretention area consists of sheet flow from adjacent roofs and brick patio area. There were no point sources (e.g., pipes or roof gutter downspouts) to collect inflow samples. Therefore, it was not feasible to compare inflow water quality to outflow water quality.

A manual rain gauge was installed at the site so students can determine the volume of runoff treated by the bioretention area.

Precipitation data was obtained from the State Climate Office of North Carolina to determine the percentage of rain captured by the bioretention area for a given year. The weather station name and ID were Chapel Hill 2W and 311677, respectively. The total precipitation at this station from October 30, 2011 to October 30, 2012 was 45.9 – inches. The total portion of precipitation that was less than one-inch for a given storm was 37.7 – inches. Therefore, it is assumed that the McDougle bioretention area captured and treated at least 82% of the runoff produced during this period.

Bioretention Maintenance

During the project period, NCSU, Town and school staff and Friends of Bolin Creek volunteers pursued maintenance activities including mulching, weeding, and watering. Some plant mortality and suboptimal growth was observed, and diagnosed as being associated with drought, deer grazing pressure, and low soil fertility. To address plant loss and stress, replanting and soil amendment was pursued.

For the longer term, it is recommended that the maintenance be pursued in accordance with Carrboro's general bioretention maintenance schedule (Appendix C). The following maintenance activities are highlighted for the bioretention area.

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- Mulch removal: 1 time/-3 years – Mulch accumulation reduces available water storage volume. Remove accumulated mulch in the late fall every 3 years. Apply fresh mulch in the spring using shredded hardwood mulch or leaf mulch.
- Watering: As needed to establish plants or during drought conditions.
- Ferlization: 1 time initially. One time spot fertilization for "first year" vegetation.
- Remove and replace dead plants: 1 time per year
- Miscellaneous upkeep: Monthly. Tasks include trash collection, spot weeding, and removing mulch from overflow device.
- Weeding, especially of bermuda grass during the period of plant establishment, will be beneficial to minimizing its profusion in the garden.

Educational Component

The project team integrated educational activities on an ongoing basis, and put elements in place to facilitate future educational opportunities. Major educational components are outlined below.

- Installation included 8th grade science classes participation. Over 150 students from 6 classes participated in the installation on a day dedicated to completing the installation and involving the students. A professional quality video was produced of the event with support from the Friends of Bolin Creek, and posted on the Friends of Bolin Creek website at this **link** (http://bolincreek.org/blog/actions/rain-gardens/video-stories/), and distributed electronically.
- Town staff provided a public presentation on the project at a Board of Aldermen meeting (June 2011; http://www.townofcarrboro.org/BoA/Agendas/2011/06_21_2011.htm [item 2]) and at a well attended symposium on creek stewardship at the North Carolina Botanical Gardens (February, 2012; http://bolincreek.org/blog/symposium-2/presentations/).
- The Friends of Bolin Creek and Town and NCSU staff organized a tour of watershed friendly sites (April,2011) and included the McDougle site on the tour
- An 8th grade science teacher has included the bioretention in her hydrology section curriculum. Friends of Bolin Creek and school staff continue to explore ways to further integrate the rain garden into educational activities, including planning for a more extensive outdoor education area adjacent to the rain garden.
- The Friends of Bolin Creek installed a weather proof kiosk for posting of environmental educational materials adjacent to the bioretention site
- NCSU worked with a sign manufacturer to create a high quality, durable educational sign (Appendix A) that was installed adjacent to the bioretention site.
- While outside the scope of the 319 grant, NCSU, Friends of Bolin Creek, and Chapel Hill School staff collaborated on the installation of a rain garden in the Bolin Creek watershed in a courtyard at a Chapel Hill High School (November, 2012). The McDougle project provided a platform and context for this effort by educating school staff, students, and the community at large. Students districted to McDougle are also districted to Chapel Hill High. Similarly, the site has heightened interest in further outdoor education at McDougle including additional outdoor gardens.

Project Timeline

June 2010: Site topographic survey
July/August 2010: Bioretention design and review
August 2010: Bioretention construction completed
October 2010: Planting day with NCSU, Town staff, Friends of Bolin Creek volunteers, a documentary film crew, teachers, and five 8th grade science classes throughout the day.
October 2010: 1,550-gallon cistern installation
March 2011: Drip irrigation lines from cistern to bioretention area installed.
April 2011: Creek Action Tour and video release
June 2011: Board of Aldermen presentation
August 2011: Educational Kiosk installed
July 2012: Permanent educational sign installed with a rain gage.
November 2012: Chapel Hill High rain garden installed
December 2012: Bioretention maintenance and additional planting
Ongoing: project site visits and informal tours, and maintenance

Appendix A:

McDougle Educational Sign

RAIN GARDEN
McDougle Middle School

- **Captures runoff** from portions of surrounding roofs and courtyard.
- **Slows and filters stormwater** runoff naturally, using plants, microbes, and soil.
- Utilizes **native plants** that can tolerate both wet and dry conditions.

Before Construction: Runoff discharged directly to drop inlet and storm sewer.

Students, teachers, and volunteers installed native rain garden plants.

1,000-gallon cistern installed to collect roof runoff and irrigate the rain garden during dry periods while the plants become established.

Construction: Rain garden was excavated, lined with geotextile fabric, a gravel underdrain, and 3-feet of engineered sandy soil.

View of rain garden after a large rain event. Water ponded up to the outlet rim before infiltrating into the garden.

After the initial planting was complete, McDougle students, staff, and volunteers celebrate this project's achievement.

The Problem: During a rainstorm, urban runoff travels across the landscape and picks up pollutants such as sediment, bacteria, metals, and nutrients. Without treatment, polluted water will flow rapidly into creeks, eroding stream channels and failing to recharge aquifers. Pollutants end up in Jordan Lake, a major drinking water supply.

A Solution: Rain gardens are a sustainable way to treat runoff before it is discharged to streams. As water slowly infiltrates through a rain garden, pollutants are filtered and removed, stream channels are better protected, and water quality improved.

Try it: Build a rain garden to enhance your landscape and improve water quality. To find out more about rain gardens, contact your local Cooperative Extension office or visit: www.bae.ncsu.edu/stormwater or bolincreek.org

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Appendix B:

McDougle Bioretention Design Calculations

McDougle Bioretention Area

Objective: Design a bioretention cell for McDougle Elementary/Middle School in a courtyard adjacent to the gymnasium.

Background:
A bioretention area captures runoff from an impervious surface and allows that water to infiltrate through the soil media. As the water infiltrates, pollutants are removed from the stormwater runoff through a variety of mechanisms including adsorption, microbial activity, plant uptake, sedimentation, and filtration. Some of the incoming runoff is temporarily held by the soil of the bioretention area and later "leaves" the system by way of evapotranspiration, exfiltration to the ground water, or discharge from the underdrains. The construction of a bioretention system in clay type soils involves importing a sand/compost mixture (1 – 2 in/hr infiltration rate) and installing perforated underdrains.

Site Suitability
Overall, the site appears to be conducive for a bioretention area.

Terrain: A small grassed area on the northwest side of the gymnasium has been chosen for the proposed bioretention area. The proposed area is in a slight depressional area with an existing outlet structure. Runoff from adjacent roofs and a brick courtyard drain to the area. The existing outlet elevation will likely need to be raised to create a temporary ponding area.

Existing Vegetation: The proposed bioretention cell site is currently open with a grass cover and a few shrubs.

Water Table: It appears that the seasonally high water table is greater than five feet below ground surface.

Soil Type: According to soil maps, the site soil types are from the Helena soil series (HSG C) and are likely highly compacted. The in situ soil has a hydraulic conductivity well below 1 inch per hour. As a result, the rain garden will likely require excavation and placement of imported soil. While this will affect cost, it is typical of sites in this area.

McDougle Bioretention Area

Maintenance/Access: Maintenance will be a crucial part of the overall effectiveness of the rain garden. As part of the school system, site maintenance should be available. Additionally, access for educational purposes and outdoor classroom activities is excellent. Access for construction equipment also appears to be acceptable.

Design Summary

The design of the bioretention area at the site consists of the following general steps, which are detailed in the subsequent section.

1. Determine watershed size and characteristic
2. Determine volume of runoff to catch
3. Determine size of bioretention area
4. Set bio-retention area depth and soil type
5. Size underdrain and gravel envelope
6. Choose vegetation and a planting plan (to be completed during planting season in late fall)

Design Procedure and Results

Determine watershed size and characteristic

Based on a site survey and measurements off Google Earth, the watershed draining to the proposed bio-retention area is approximately 27,700 square feet (0.64 acres). The drainage area consists of approximately 41% impervious (i.e roof, sidewalk, and brick courtyard) and 59% pervious area (i.e, grassed areas). It is assumed that the pervious area is located on a SCS hydrologic soil group C.

A curve number of 98 is appropriate for the impervious portion of the watershed and a curve number of 79 is appropriate for the pervious portion of the watershed (open space, fair condition, soil group C – NRCS TR-55).

Determine volume of runoff to catch*:* Given the goal of improving water quality, the first flush rainfall depth, or one inch, is chosen as the design storm. Using a curve number of 98 and a precipitation depth (P) of 1.0 inches, the runoff can be calculated as $(P - 0.2\ S)^2 \div (P + 0.8\ S)$, where $S=(1000\div CN) - 10$. <u>The resulting runoff depth is 0.80 inches</u>.

Using a curve number of 79 and a P of 1.0 inches, the resulting runoff depth is <u>0.07 inches</u>.

The total volume of runoff is equal to [(0.80 inches) * (27,700 square feet) * 41%] + [(0.07 inches) * (27,700 square feet) * 59%], or 10,230 square foot- inches. Thus, the total volume of runoff to treat is equivalent to 852 cubic feet.

Determine size of the bioretention area:

The required storage volume of the bioretention area will be 10,230 square foot- inches. An initial ponding depth of 6 to 10 inches is typical of those assigned to bioretention areas. An 8-inch ponding depth will be used here. Thus, the required surface area is (10,230 square foot- inches) /

(8 inches), or **1280 square feet** (approximately 5% of the contributing drainage area). A review of the site plan indicates that a rain garden this size can be accommodated.

An 7-inch ponding depth results in a 1,460 square foot bioretention area.

Set bio-retention area depth and soil type

The onsite soil is not suitable for the bioretention cell. Thus, soil will be excavated from the site to the design depth and subsequently backfilled (after the placement of underdrain and gravel envelope) with the recommended mix of 85-88% sand, 8-12% fines, and 3-5% organic matter or a bio-retention mix from a commercial source (e.g., permatill). This soil mix should not be imported from an agricultural site, and should be tested for nutrient concentrations prior to use. Specifically, the P-index for the imported soil should be between 10 and 25. Imported soil should have a permeability of 1-2 inches per hour.

The design depth of the soil media is based on the project goals and the existing outlet depth. Based on the relatively shallow depth of the existing outlet, the recommended media depth shall range from 24 to 30-inches. The majority of water quality benefits generally occur in the top 18-inches of the bioretention area.

The water drawdown rate can be calculated using Darcy's equation, $Q = (2.3 * 10^{-5}) * K * A * \Delta H/\Delta L$, where K is the hydraulic conductivity of the soil, A is the surface area, ΔH represents the driving head of the water, and ΔL represents the fill media depth. K is assumed to be 1 inch per hour, which represents the minimum allowed hydraulic conductivity of the soil; A is 1280 square feet, and $\Delta H/\Delta L$ is set to equal 1 for simplicity. Assuming an initial 8 inch ponded depth of water, the time required to draw water down to two feet below the surface is found in the following manner:

- Find drawdown rate using Darcy's equation: $Q = (2.3*10^{-5})*1*1280*1 = 0.03$ cfs
- Determine ponded volume to drawdown: V = 1,280 sq ft * 0.66 ft = 853 cubic feet
- Find time required to drawdown ponded volume: T = 853 cubic feet / 0.03 cfs = 28,400 sec = 8 hours
- Find volume of water in top two feet of soil (assume soil porosity, n, = 0.45): V = 0.45* 2 feet * 1280 square feet = 1152 cubic feet
- Find time required to drawdown saturated volume: T = 1152 cubic feet / 0.03 cfs = 38,400 sec = 11 hours
- Find total time for drawdown of ponded water to 2 feet below surface: T = 8 hrs + 11 hrs = 19 hrs (***Note:*** This assumes that the surface drawdown and subsurface drawdown occur in discrete time steps. In reality, both will take place simultaneously, resulting in a drawdown time less than 19 hours.)

Size underdrain and gravel envelope: A rearranged version of Manning's equation, $N*D = 16 *(Q*n/s^{0.5})^{3/8}$, can be used to determine the required size of the underdrain piping (N = number of pipes and D = diameter of pipe). A safety factor of 10 is applied to the known flow rate. Thus, Q=0.3 cfs for use in underdrain sizing. Let Manning's n=0.015, a representative value for corrugated plastic pipes. Assume an internal slope of 0.5%

Therefore, $N*D = 16*(0.3*0.015/0.005^{0.5})^{3/8}$, or $N*D = 5.6$. Therefore, one 6 inch pipe would be acceptable for the given flowrate. However, given the potential for pipe clogging, two 4 inch slotted pipes should be installed. A cleanout should be installed for each pipe. Additionally, a 6 inch gravel envelope (2 inches above the pipes) should be used.

Assign an overflow device: An existing yard inlet will be utilized as the overflow device. The invert of the inlet will be raised by 0.9-feet to accommodate runoff storage. The new elevation is below the surrounding sidewalk so excess runoff should not back up onto the sidewalk.

Vegetation and Planting Plan

Plant selection should be based on what is readily available in the area and the types of plants that will survive in a bioretetion area. The students and parents should be involved in planting the garden so they can learn about its function and take ownership in the garden.

The following website outlines plants that are suitable for bioretention areas in the piedmont of North Carolina. This document should be a good resource for this site.
http://www.bae.ncsu.edu/topic/bioretention/PiedmontPlants_list.pdf

Additionally, a 2-3 inch layer of triple shredded hardwood mulch should be applied to the bioretention area. The school should avoid using pine bark mulch as it has a tendency to float and clog the outlet.

Appendix C

CARRBORO BIORETENTION MAINTENANCE GUIDELINES AND SCHEDULE

Frequency	Inspection Items	Maintenance Items
One time- After First Year	Ensure that bioretention plants survive.	Replant bioretention vegetation per approved plans. Remove tree support stakes and guy lines
Monthly and After All Storms (>1" Rainfall)	Inspect inlet and outlet structures and other pipes for clogging – Perform every visit. Monitor sedimentation contamination in bioretention soil Inspect principal and emergency spillway for blockage Check for debris and undesirable vegetation. Investigate embankment, dikes, berms and side slopes for erosion. Monitor bioretention plant composition and health. Look for graffiti, broken signs, and/or potentially public hazards. Observe filtration performance Inspect pretreatment areas for buildup of sediment Monitor adjacent surrounding drainage area	Unclog inlet/outlets structures Immediate action required to prevent sediment from contaminating bioretention soil Unblock spillways Stabilize undercut, eroded and bare soil areas using appropriate erosion control measures Remove trash and debris. Repair mechanical/structural components if needed Remove graffiti Spot weeding Corrective measures if filtration drawdown time becomes greater than designed drawdown time (ponding more than 48 hours after rain event) Stabilize bare soil areas, remove excess silt/dirt and trash from pavement
Every six months	Monitor bioretention plant composition and health. Identify invasive plants.	Trash and debris clean-up day. Remove invasive plants Remove dead or diseased vegetation Repair mechanical/structural components if needed. Remove vegetative growth from inlet structure, weir or principal spillway Prune if necessary
Annually	Monitor bioretention plant composition and health.	Trash and debris clean-up day. Remove dead or diseased vegetation and replace with appropriate plant material Repair mechanical/structural components if needed. Replenish mulch to maintain minimum mulch depth
Every 2 years	All routine inspection items above. Inspect inlet for damage. Inspect all pipes. Monitor sediment deposition in facility and forebay.	Conduct soil test Pipe repair as necessary. Forebay maintenance and sediment removal when needed. Flush underdrain pipes Add lime as indicated on soil test – Do not fertilize Every
3 years	Monitor sediment deposition in facility and forebay. Monitor water storage volume	Forebay maintenance and sediment removal when needed. Remove old mulch accumulation if mulch depth exceeds 3 inches to accommodate initial water storage volume.
Every 5 years	Remote television inspection of reverse slope pipes, underdrains, and other hard to access piping. Sediment accumulation in forebay Monitor bioretention plant composition and health.	Pipe replacement if needed. Sediment removal from forebay. Shrubs may need to be replaced or cut back to ground Perennials and grasses may need to be divided

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General Notes:

1. Do not fertilize bioretention area.
2. Prune bioretention vegetation to maintain sight lines, facilitate trash pick up, remove dead/disease vegetation and for public safety concerns.