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SOUTH BRUNSWICK TOWNSHIP OF

Index DEED BOOK

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Instrument DEED W/O ABSTRA

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COUNTY CLERK

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COUNTY OF MIDDLESEX

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TWO-PARTY DETENTION BASIN MAINTENANCE AGREEMENT

THIS AGREEMENT made as of the day 5 of April, 2016, by and between the TOWNSHIP OF SOUTH BRUNSWICK, a municipal corporation of the State of New Jersey, having its principal offices at the Municipal Building, Monmouth Junction, New Jersey 08852 (hereinafter referred to as the "Township"), and THE TRUSTEES OF PRINCETON UNIVERSITY, with offices at 1 Nassau Hall, Princeton, New Jersey (hereinafter referred to as the "Developer").

W I T N E S S E T H :

WHEREAS, Developer is developing a real estate project known as Interim Basin 6 Construction pursuant to land use approvals granted by the Planning Board of the Township; and

WHEREAS, the ordinances of the Township require that a soil erosion and sedimentation control maintenance agreement be entered into as part of any application for development; and

WHEREAS, the ordinances of the Township require that a surface run-off control maintenance agreement be entered into as part of any application for development; and

WHEREAS, the Developer acknowledges that a copy of the form of this agreement has been supplied to said Developer during the processing leading to approval; and

WHEREAS, the Developer has reviewed the form of this agreement during the process leading to approval and has acknowledged its responsibilities hereunder;

NOW THEREFORE, in consideration of the mutual covenants contained herein and for other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties hereto agree as follows:

FIRST: Developer acknowledges receipt of a copy of the "Soil Erosion and Sediment Control Act" of the State of New Jersey (CH 251, P.L. 1975) as it may be amended and a copy of all applicable ordinances of the Township relating to soil erosion and sediment control including, but not by way of limitation, the "Municipal Land Use Ordinance of the Township of South Brunswick" and by reference agrees to be bound by all duties and obligations imposed upon a developer by said law or ordinances.

84929203.3

SECOND: Developer agrees both during and subsequent to the completion of the proposed development to maintain the surface water run-off control plan and the soil erosion and sedimentation control plan and will follow the measures, devices and methods as shown on plans submitted by Developer to the Township and as approved or subject to approval of the appropriate Township boards and/or officials as by ordinance in such case made and provided.

THIRD: That all soil erosion and sedimentation control plans and drawings as approved and all surface water run-off control plans and drawings as approved, shall be consistent with and conform to the standards established by the hereinabove set forth Act of the State of New Jersey and the Ordinance of the Township and that Developer shall faithfully perform to those standards and specifications.

FOURTH: Unless otherwise specifically directed in writing by the Township, all temporary soil erosion and sedimentation control and surface run-off control measures and devices shall remain in place until such time as the areas thereby affected shall have been stabilized, as certified to the Township by the Township Engineer.

FIFTH: Developer shall be responsible for the continual maintenance of the permanent surface run-off control measures and sediment control and storm water management structures shown on its plans and specifications submitted to the Township, until completion of development and certification of stabilization and termination of the need for such measure or measures and device or devices by the Township Engineer. Thereafter, for a period not to exceed 2 years from the date of final acceptance by the Township, such improvements shall be incorporated as part of the maintenance bond as required by the Municipal Land Use Ordinance.

SIXTH: Should it be determined that there exists a conflict between the standards set forth in statute or ordinance and the various plans and drawings submitted by the Developer and approved by the Township, then, in that even, those standards deemed more stringent on the Developer by the Township Engineer shall control and Developer acknowledges that Developer was neither improperly induced no coerced into presenting plans or drawings more stringent than required by such statute or ordinance.

SEVENTH: The within agreement is intended to be executed in recordable form and to be recorded in the Office of the Clerk of the County of Middlesex. However, it is expressly understood and agreed that, when the terms and conditions of this agreement have been met and completed by Developer, as evidenced by a certificate of the Township Engineer being submitted to the Township confirming completion and compliance by Developer with the requirements of this agreement, as well as with the applicable statutes and ordinances, such certificate shall, upon request, be submitted to Developer in a form acceptable for recording with said Clerk of the County of Middlesex.

EIGHTH: Developer acknowledges that, in whole or in part, the surface water run-off control plan consists of a certain retention and/or detention area(s) or other control device(s) located either on the site of the development or off said site but, due to its nature or by agreement of the Developer, to be maintained by Developer. Developer further acknowledges that said area(s) or device(s) is to be permanently and perpetually maintained by Developer, Developer's heirs, assigns or successors in title and that said maintenance shall conform to reasonable standards required by the Township Engineer. Any deed or conveyance of the property in question shall contain or, by virtue of the recording of this agreement to be deemed to be a provision respecting the maintenance of said area(s).

NINTH: Notwithstanding the provisions of paragraph Seventh above, no certificate of completion or compliance by the Township Engineer shall be deemed or construed to release Developer, Developer's heirs, assigns or successors in title, from the obligation to maintain any detention or retention area(s) herein set forth. Further, the covenant respecting such maintenance is not personal and shall run with the land.

TENTH: Upon the release of the Maintenance Bond as provided for in paragraph Fifth, the Developer shall be released from the condition imposed herein and all obligations hereunder shall be binding upon the then owners, their heirs, assigns or successors in title, or the property described herein and such obligation shall be in perpetuity. The Developer shall cause this instrument to be recorded with the Clerk of the County of Middlesex, State of New Jersey.

(SIGNATURES ON NEXT PAGE)

IN WITNESS WHEREOF, the parties have set their hands and seals the day and year first written above.

ATTEST:

Name:

THE TRUSTEES OF PRINCETON UNIVERSITY

By: _____
Michael McKay, Vice President for Facilities

ATTEST:

Name:

TOWNSHIP OF SOUTH BRUNSWICK

By: _____
Bernard P. Hvozdovic, Jr., Township Manager

84929203.3

STATE OF NEW JERSEY :
: SS:
COUNTY OF MIDDLESEX :

BE IT REMEMBERED that on this 5 day of April, 2016, before me, the subscriber, Barbara Nyitrai, personally appeared Bernard P. Hvozdovic, Jr. who, being by me duly sworn on his oath, deposes and makes proof to my satisfaction, that he is the Manager of the Township of South Brunswick, the Township named in the within Instrument; that the execution, as well as the making of this Instrument, has been duly authorized by a proper Resolution of the Governing Body of the said Township; that deponent well knows the Seal of said Township; and that the Seal affixed to this Instrument is the proper Township Seal and was hereto affixed and said Instrument signed and delivered by said Township, as and for the voluntary act and deed of said Township, in the presence of deponent, who hereupon subscribed his/her name hereto as attesting witness.

Barbara Nyitrai
Barbara Nyitrai
Township Clerk

Sworn to and subscribed before me,
The date foresaid

DONALD J. SEARS
AN ATTORNEY AT LAW
IN THE STATE OF NJ

STATE OF NEW JERSEY :
: SS:
COUNTY OF Mercer :

BE IT REMEMBERED that on this 1st day of April, 2016, before me, the subscriber, Laura I. Darrell, personally appeared Michael McKay, who, being by me duly sworn on his/her oath, deposes and makes proof to my satisfaction, that (s)he is the Vice President/Trustee of Princeton University, the Developer named in the within Instrument; that the execution, as well as the making of this Instrument, has been duly authorized by a proper Resolution of the _____; that deponent well knows the Seal of said Corporation; and that the Seal affixed to this Instrument signed and delivered by said Corporation, as and for the voluntary act and deed of said Corporation, in the presence of deponent, who hereupon subscribed his/her name hereto as attesting witness.

Laura I. Darrell

Sworn to and subscribed before me,
The date aforesaid.

Laura I. Darrell

LAURA I. DARRELL
NOTARY PUBLIC OF NEW JERSEY
ID # 50018350
My Commission Expires 6/26/2020

84929203.3

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- Since 1894 -

van note - harvey associates, pc

STORMWATER MANAGEMENT MAINTENANCE PLAN

NURSERY ROAD, SEMINARY DRIVE AND COLLEGE ROAD WEST ROADWAY IMPROVEMENTS AND INTERSECTION IMPROVEMENTS INTERIM BASIN 6 CONSTRUCTION

Block 99, Lots 3.213 & 14

South Brunswick Township, Middlesex County

Prepared For:
Princeton Forrestal Center
105 College Road East
Princeton, New Jersey 08540

VNHA #41839-462-21
March 22, 2016

103 College Road East, 3rd Floor, Princeton, NJ 08540
(609) 987-2323 • Fax (609) 987-0005
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I. MAINTENANCE

Effective stormwater management system performance requires regular and effective maintenance. The following section provides information and requirements necessary to keep the systems at the Princeton Forrestal Center Development functioning properly:

A. Responsibilities

The following individual or organization is responsible for maintenance of stormwater management system at the Princeton Forrestal Center Development:

Name: Curt Emmich

Affiliation: Princeton Forrestal Center

Address 1 105 College Road East

Address 2 Princeton, New Jersey 08540

Telephone Number: 609-452-7720

NOTES:

1. If the party named above is not the owner or developer, (i.e., a homeowners' association or public entity), a copy of the party's written agreement to assume this responsibility must be included. This agreement must include a copy of any ordinance or regulation that requires the owner or developer to dedicate the stormwater management measure and/or its maintenance to the party.
2. The person responsible for maintenance shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan as needed. This maintenance plan and any future revisions shall be included upon the deed of record for the property.
3. This party shall retain and make the maintenance plan available upon request by any public entity with administrative, health, environmental or safety authority over the site.

B. Schedules

Maintenance should be completed on a routine basis along with required inspections as outlined later in this manual. Specific tasks have been outlined in the following sections and should be closely followed to ensure the effectiveness and longevity of the stormwater management systems and avoid costly repairs.

C. Access

All of the stormwater management facilities must be accessible for inspection and maintenance. Access routes and easements have been provided in the overall design of the site, and these areas need to be kept clear and free of obstructions so that equipment

and personnel can complete work in a timely fashion. No physical structures should be placed in access easements, and all trees, shrubs, and underbrush must be pruned or trimmed as necessary to maintain this access.

D. Safety

Standard safety precautions should be taken when maintaining the stormwater facilities. The primary concern for these systems is related to standing water remaining in the systems for more than 48 hours. While the systems, during smaller storm events (1-year storm), are designed to temporarily hold no more than one foot of standing water in its lower region, extreme caution should be used when entering any areas of standing water.

E. Equipment, Tools, and Supplies

No specialized equipment, tools, or supplies are needed to maintain the stormwater management facilities; however, the following is a list of recommended materials and equipment that should accompany any inspector:

Stormwater Management Recommended Inspection Equipment/Materials	Quantity	Required for:
Public Communications Materials		
Jurisdiction Permission Letter (for 3rd party inspectors)	multiple	All Stormwater Management Facilities (SWFs)
Jurisdiction contact list	multiple	All SWFs
SWF-Specific Information		
Blank inspection checklists	multiple	All SWFs
Site plans/as-built drawings	per facility	All SWFs
Facility type and outfall pipe size	per facility	All SWFs
Facility location	per facility	All SWFs
Previous inspection results (Reports, redlines and photos)	per facility	All SWFs
Confined Space Entry permit (as required)	per facility	Underground/Confined Space Entry (CSE)
Inspection Equipment		
Clipboard w/Forms, Pencil and Compass	1	All SWFs
Area Map	1	All SWFs
Mobile Telephone	1	All SWFs
Two-Way Radio w/charged batteries	2	All SWFs
100' Measuring Tape	1	All SWFs
25' Retractable Scale	1	All SWFs
Bolt Cutters	1	All SWFs

Cans of Orange Spray Paint	2	All SWFs
Crow Bar	1	All SWFs
Digital Camera	1	All SWFs
First Aid Kit	1	All SWFs
Flashlight w/charged batteries	1	All SWFs
Goggles or Safety Glasses	2	All SWFs
Hardhats	2	All SWFs
Leather Gloves	2	All SWFs
Manhole Cover Tool / Puller	1	All SWFs
Pair of Hard Sole Boots (wear)	2	All SWFs
Pair of Rubber Boots (as-needed)	2	All SWFs
Roll of Orange Tie-off Tape	1	All SWFs
Std. Size Bolt Locks and Keys (for pond gates)	2	All SWFs
Waterproof Carrying Bag	1	All SWFs
Machete or Pruning Sheers	1	Above ground
Monkey Wrench	1	Above ground
Standard Shovel	1	Above ground
Observation Well Cap Wrenches	1/Size	Infiltration facilities only
Small Size Bolt Lock and Key (for well caps)	1	Infiltration facilities only
100' Rope	1	Underground CSE
Air Monitor/Meter w/charged batteries	1	Underground CSE
Orange Pylons/Traffic Cones	4	Underground CSE
Spot light	1	Underground CSE
5 Minute Air Supply	1	Underground CSE (as-needed)
Full Face Respirator	1	Underground CSE (as-needed)
Recalibration Kit	1	Underground CSE (as-needed)
Ventilation/Forced Air Blower	1	Underground CSE (as-needed)

Care must be taken to avoid having large equipment operate from the basin floor causing compaction and reducing the effectiveness of infiltration areas. All work done by machinery should be completed from the perimeter of the basin.

F. Bioretention Basin

A bioretention basin is a BMP that functions as a stormwater runoff management and infiltration system.

Preventitive Measures:
The pretreatment of a bioretention basin can reduce the incoming velocities of stormwater runoff and capture larger sediments, which will extend the life of the system. Per this project's basin design, interim basin on the site will include a sediment forebay at the inflow points to the bioretention system to capture coarse sediments, trash, and debris, which can simplify and reduce the frequency of system maintenance.

Interim Bioretention Basin 6 Benchmarks

Basin	Water Surface Elevation (100-Yr Storm Event)	Proposed Basin Water Depth (100-Yr Storm Event)	Approximate Time to Drain (Based on1.25" Rainfall)
6	92.68 Ft.	3.68 Ft.	71 Hrs.

G. Cleaning of Inlet and Outfall Structures

Regular removal of sediment and debris accumulated in inlet and outlet structures is the best method to preventing clogging of the infiltration areas and avoiding costly repairs. Sediment removal should take place when the basin is thoroughly dry. Disposal of debris and trash should be done at suitable disposal/recycling sites and in compliance with all applicable local, state, and federal waste regulations.

H. Landscape Care

Maintenance of the property should emphasize the following landscape conservation and maintenance techniques to prolong the longevity and effectiveness of the stormwater management systems.

1. Mowing

The bioretention basins should be maintained as meadows, not as turfgrass or manicured lawn. This means that the grass is not to be mowed on a weekly basis. Mowing is necessary to define the "edge" of the systems and provide a maintained look to the landscape. A clear boundary should be established. All areas of the systems should be mowed or cut no shorter than 6 to 8 inches in height at a maximum frequency of once a month during the growing season, if desired for aesthetic reasons. At a minimum, all meadow areas should be mowed once a year to keep woody vegetation from becoming established.

2. Removal of Invasive Vegetation

If inspection deems that invasive vegetation has become established, removal of the invasive vegetation by weeding or herbicide application shall be conducted. Several invasive plant species can become established in these systems. Of these species, some need to be removed entirely from the site, while others need to be closely monitored and, if they become a nuisance, removed or cut back. Those species that should be removed as soon as they appear include: purple loosestrife, phragmites, Japanese knotweed, multiflora rose, tree-of-heaven, and honeysuckle. Establishment of invasive species such as reed canary grass and cattail needs to be closely monitored and removed from the basin if they colonize and cover an area larger than 100 square feet (approximately 10 ft. x 10 ft. in area).

It is recommended that invasive plant species be removed by hand weeding if at all possible. If sufficient manual labor cannot be employed or is not successful after initial efforts, an herbicide application can be used. An appropriate herbicide for treating invasive exotics in this type of environment is Rodeo, manufactured by Monsanto. The herbicide must be applied by a licensed applicator, per the manufacturer's specifications and local rules and regulations.

3. Replacement of Vegetation

The Contractor should provide a guarantee on all vegetation for a minimum of one year after installation. If any vegetation needs to be replaced during this period, the Contractor will be responsible for its replacement. After this period regular inspections should note any plant loss, and replacement should occur as needed. A minimum of 100% vegetative coverage is required after two years. If 100% coverage is not achieved, vegetation shall be installed using recommended species under the direction a Landscape Architect

4. General Herbaceous Care

The herbaceous vegetation is planted to achieve between 80-100% coverage within a two-year period. Apart from the removal of invasive vegetation as discussed above, regular maintenance of the herbaceous vegetation is not required.

5. General Shrub Care

Proper maintenance is important for most shrubs and will result in beautiful plants year after year. General maintenance considerations include watering thoroughly during the first year, if necessary, and inspecting shrubs closely to discover and control pests or diseases in their early stages. The only other maintenance requirement is occasional pruning. The Contractor will be responsible for watering all vegetation during construction. After construction, rainfall and the associated ponding in the bioretention basin(s) will supply water for the shrubs.

No fertilization is necessary. The topsoil specifications provide enough organic material to adequately supply nutrients from natural cycling. The primary function of the bioretention system is to improve water quality. Adding fertilizers defeats or, at a minimum, impedes this goal. If shrubs are climatically adapted to the area in which they are planted, they rarely need protection from weather extremes. Since all shrubs specified for this project are native and should be purchased from local nurseries, climate protection will not be required for any of these shrubs.

6. General Tree Care

Trees require virtually the same maintenance as shrubs (i.e., watering, pruning, and inspecting for diseases). One additional maintenance procedure is staking. During installation, the Contractor will stake all trees. The stakes shall be removed as soon as the trees are able to stand on their own. Stakes are usually only needed through the first season.

7. On-Site Fertilizer and Pesticide Use

Providing nutrients is essential to maintaining a healthy landscape. Most native trees and shrubs do not require fertilizer to thrive. Overfertilizing and exceeding application rates may promote excessive top growth and a shallow root system to plants and can become a major source of pollution in nearby streams. Fertilizer shall be applied with care to keep fertilizer off parking and driveway areas where it can wash into the storm drainage system. Applications that could carry nutrients away before they are absorbed into the soil should not be done when severe weather is imminent.

Pesticides should be used with care and only applied to address specific problems. Again, avoid spraying pesticide onto paved surfaces where it could be washed into the storm drainage system. No excess liquids should be dumped down storm drains, and applications during wet or rainy conditions should be avoided.

8. Wildlife Management

A low-maintenance landscape that minimizes mowing and allows for taller grasses and herbaceous plant materials will discourage waterfowl, especially non-migratory Canada Geese. During the establishment period, it is important to deter waterfowl from taking up temporary residence in these areas.

If deer browsing becomes a major problem during landscape establishment, Benner's Gardens (6974 Upper York Rd., New Hope, PA 18938, 1-800-753-4660) distributes a "Virtually Invisible Deer Fencing" that is low cost,

easy to install and maintain, and useful for temporary protection of young plantings during the critical establishment period.

I. Maintenance Costs

Maintenance of the stormwater management system is required to ensure effective operation, longevity, and aesthetic functioning of the facilities. As outlined above, the site stormwater management facilities require different types of maintenance activities, and costs vary with type and size. Attachment 1 lists a wide range of commonly required maintenance activities and associated unit costs. Also listed in Attachment 1 are recommended maintenance intervals for the varying activities.

II. INSPECTIONS

While the bioretention basins are designed to simulate some of the functions of a natural ecological community, the facilities are located in a suburban commercial setting and will be exposed to an array of extreme conditions that will tend to inhibit the effectiveness of the systems. The systems should function as designed and maintain an aesthetic appeal. To ensure that maintenance is completed and that the systems are functioning properly, regular inspections of the BMPs are required. A standard inspection form has been provided in Attachment 2 for use at these facilities. Copies of the complete inspection forms are to be kept in an Inspection Log. When concerns or issues are noted during inspection, immediate action should be taken to prevent any permanent damage or costly repairs to the system. A detailed, written log of all preventive and corrective measures performed at the stormwater management facilities must be kept, including a copy of maintenance-related work orders.

Some problems that may occur include erosion or wash out of areas near inlet structures, ponding for extended periods of time, plant fatality, and debris collecting near the inlet or outlet structures. Loss of vegetation may also be a problem due to local wildlife (i.e. goose or deer damage), extreme storm events, or extended periods of drought.

Special attention should be given to the removal of floating debris (leaves, paper, trash, branches, etc.), which can clog outlet structures. Debris removal on a routine basis is critical to:

Reduce the chance of clogging outlet structures
Prevent damage to vegetation
Reduce potential mosquito-breeding habitat areas
Improve aesthetic appearance

All components expected to receive and/or trap debris and sediment must be inspected for clogging and excessive debris and sediment accumulation at least four times annually, as well as after every storm exceeding 1 inch or rainfall. Such components may include trash racks, low flow channels, outlet structures, riprap or gabion aprons, and inlets.

A. Responsibilities

The following individual or organization is responsible for inspections of the stormwater management facilities at the Princeton Forrestal Center Development:

Name: Curt Emmich

Affiliation: Princeton Forrestal Center

Address 1 105 College Road East

Address 2 Princeton, New Jersey 08540

Telephone Number: 609-452-7720

NOTE: If the party named above is not the owner or developer, (i.e., a homeowners' association or public entity), a copy of the party's written agreement to assume this responsibility must be included. This agreement must include a copy of any ordinance or regulation that requires the owner or developer to dedicate the stormwater management measure and/or its maintenance to the party.

B. Schedules

During the site construction, and for one year following the completion of all construction, all systems shall be inspected monthly, after each rainfall event (i.e., events of one inch of rainfall per 24 hours or greater), and during an extended period of drought.

Following the one-year establishment period, inspections shall occur quarterly and after each substantial rainfall event (i.e., storms producing one inch or more rainfall in 24 hours).

C. Inspection List

Erosion and Sedimentation: Avoiding erosion during the establishment period and beyond is critical to ensuring integrity of the visible banks, slopes, and basin floors. Healthy herbaceous vegetation must be maintained on all soil areas. Any bare areas should be reseeded and stabilized as quickly as possible. Seeding, along with the use of an erosion control blanket, may be necessary on slopes or embankments. Specific details on vegetation care and maintenance are outlined in this manual.

Sediment removal should take place when the basin is thoroughly dry. Disposal of debris and trash should be done at suitable disposal/recycling sites and in compliance with all applicable local, state, and federal waste regulations.

Structural Components: The inlet and outlet structures as well as all components of all bioretention basins shall be inspected quarterly and cleaned and maintained as necessary, based on these inspections. All structural components should be inspected for cracking, subsidence, spalling, erosion, and deterioration. Sediment

deposited in the scourholes and forebays will need to be removed after it has accumulated in sufficient quantities to impede flow of stormwater into the basin. Evidence of too much sediment includes ponding near the headwall of the inlet, or the pipe, and bare deposits of sand with little or no vegetation. Sediment removal should take place when the basin is thoroughly dry. Disposal of debris and trash should be done at suitable disposal/recycling sites and in compliance with all applicable local, state, and federal waste regulations.

If standing water remains in the systems for more than 48 hours, this is a sign that outlets may be clogged and cleaning of the structures may be needed, or that the soil bed or underdrain system has become clogged. If inspection deems this to be the case, immediate action should be taken, as ponded water in the basin floor will destroy the vegetation and could provide mosquito breeding habitat. Regular removal of sediment and debris accumulated in the systems is the best method of preventing this from happening and avoiding costly repairs. If significant increases or decreases in the normal drain time are observed, or if the 72-hour maximum is exceeded, a qualified designer/engineer familiar with BMPs should be consulted to evaluate the system's soil bed, underdrain system, and both groundwater and tailwater level, and to test permeability rates and identify appropriate corrective measures to restore the functions of the system.

Vegetation: Vegetated areas should be checked for the following invasive vegetation: purple loosestife, reed canary grass, phragmites, water primrose, and cattails. If any of these species are noted, they must be removed.

After the Contractor guarantee period, regular inspections should note any plant loss and replacement should occur as needed. Vegetation shall be installed using recommended species under the direction of a Landscape Architect.

D. Emergency Plan

If the basin does not drain within 72 hours, the emergency outlet should be opened and the basin drained of all standing water. Each basin outlet structure contains an emergency 6-inch gate valve that shall remain closed during normal operation. If standing water remains in the system, the valve can be opened and the water drained, so that vegetation is not destroyed and an assessment of the system can be completed (see Inspection of Structural Components).

Attachment 1

Unit Costs for Stormwater Maintenance Activities

UNIT COSTS FOR STORMWATER TREATMENT PRACTICE MAINTENANCE - DRAFT[1]

Maintenance Item	Unit Price ($)	Unit	Mobilization Cost ($)[2]	Typical Applicability	Maintenance Interval (yrs)[3]
Dam/ Embankment					
unclog internal drains for embankments	10	lf	1500	dry pond or infiltration basin	R (10)
low spots in dam or berm	170	cy	1500	ponds, wetlands, infiltration basins and some filters	R (5)
Sediment/ Debris Removal					
debris removal (preventative)	350	event	0	all surface practices	0.25-1
clear outfall channel of sediment	130	cy	0	all practices that outfall to a channel	5-15
clogged low flow	750	event	800	all practices except bioretention, and infiltration practices	0.25-1
dredge wet ponds (jobs larger than 1000 cy) haul offsite	60	cy	>2500	wet ponds and wetlands	5-15
dry pond sediment removal	7,600	event	0	dry pond or infiltration basin	15-25
dewater pond	900	event	0	wet ponds and wetlands	15-25
muck out undergrounds	390	cy	0	underground proprietary filter systems	0.5-1
dewater and remove sludge from underground facilities	1	gal	0	all underground facilities	0.25-1
typical sediment dump fee (not including trucking)	66	ton	0	all practices	NA
truck day for landfill to transport underground dredge materials (minimum, assume 2 to 4 trips in one day)	800	trip-day	0	all underground facilities	NA

1) These costs were largely derived from data from the Maryland region, based on bid proposal and actual project data.
2) Cost at four levels: $0 for no mobilization; $800 for minimal mobilization; $1,500 for small project mobilization; >$2,500 for large project mobilization. Note that these are approximations. For items with no mobilization cost, it is assumed that the mobilization cost is incorporated into the overall unit cost, or that the maintenance can be completed during inspection.
3) Bottom number in range represents ideal maintenance interval. Top number represents maximum interval between maintenance activities. R indicates repair items, whose frequency is somewhat unpredictable. The frequencies sometimes reported in parentheses represent an estimate of typical repair frequency.

UNIT COSTS FOR STORMWATER TREATMENT PRACTICE MAINTENANCE - DRAFT[1]

Maintenance Item	Unit Price ($)	Unit	Mobilization Cost ($)[2]	Typical Applicability	Maintenance Interval (yrs)[3]
Restore/Replace Filtering Media Permeability					
fill low spots in bottom of infiltration or dry pond	25	sy	1500	dry pond or infiltration basin	R (2-5)
replace sand filter media surface	2,200	event	0	all sand filters	3-5
replace sand filter media (surface)	300	cy	0	surface sand filters	15-25
replace sand media (underground)	390	cy	0	underground sand filters	15-25
Structural - Riser and Barrel					
re-tar CMP barrel	11	sf	800	ponds, wetlands and infiltration basins	15-20
repair CMP barrel joint leak	530	ea	800	ponds, wetlands, infiltration basins	R (3-5)
repair leaking concrete principal spillway joint	1,200	ea	0	ponds, wetlands, infiltration basins	R (5-10)
replace riser (CMP)	12,000	ea	>2500	ponds, wetlands, infiltration basins	R (25)
replace riser (concrete)	20,000	ea	>2500	ponds, wetlands, infiltration basins	R (50)
replace barrel	1000	lf	>2500	ponds, wetlands and infiltration basins	R (25-50)

1) These costs were largely derived from data from the Maryland region, based on bid proposal and actual project data.
2) Cost at four levels: $0 for no mobilization; $800 for minimal mobilization; $1,500 for small project mobilization; >$2,500 for large project mobilization. Note that these are approximations. For items with no mobilization cost, it is assumed that the mobilization cost is incorporated into the overall unit cost, or that the maintenance can be completed during inspection.
3) Bottom number in range represents ideal maintenance interval. Top number represents maximum interval between maintenance activities. R indicates repair items, whose frequency is somewhat unpredictable. The frequencies sometimes reported in parentheses represent an estimate of typical repair frequency.

UNIT COSTS FOR STORMWATER TREATMENT PRACTICE MAINTENANCE - DRAFT[1]

Maintenance Item	Unit Price ($)	Unit	Mobilization Cost ($)[2]	Typical Applicability	Maintenance Interval (yrs)[3]
Structural - Pipes and Valves					
remove old valve	300	ea	800	all practices designed with valves	R (10)
replace existing underground elbow	1,600	ea	800	oil/grit separators and some underground filters	R (10)
slip line failing pipes	90	lf	>2500	all practices that receive flow from or outfall to a pipe	R
install new valve (< 24 inches)	3,100	ea	1500	ponds, wetlands, infiltration basins	R
install new valve (<11 inches)	1,300	ea	1500	ponds, wetlands, infiltration basins	R
install new valve (<36 inches)	4,600	ea	1500	ponds, wetlands, infiltration basins	R
install new valve (<7 inches)	460	ea	800	ponds, wetlands, infiltration basins	R
replace end sections <36"	600	ea	1500	ponds, wetlands, infiltration basins, surface filters	R
remote control TV video pipes	1	lf	800	all practices that receive flow through pipes	5-25
lubricate valves (same price for first four)	300	ea	0	Ponds, wetlands and infiltration basins	1-2

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2) Cost at four levels: $0 for no mobilization; $800 for minimal mobilization; $1,500 for small project mobilization; >$2,500 for large project mobilization. Note that these are approximations. For items with no mobilization cost, it is assumed that the mobilization cost is incorporated into the overall unit cost, or that the maintenance can be completed during inspection.
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UNIT COSTS FOR STORMWATER TREATMENT PRACTICE MAINTENANCE - DRAFT[1]

Maintenance Item	Unit Price ($)	Unit	Mobilization Cost ($)[2]	Typical Applicability	Maintenance Interval (yrs)[3]
Special Structures: Underdrains, Trash Racks, Observation Wells					
jet observation well	10	lf	800	infiltration and filtering practices	R (3-5)
underdrain jetting not including disposal (25' an hour)	200	hr	800	filtering practices	R (3-5)
replace broken observation well in asphalt parking lot	1,200	ea	0	infiltration and filtering practices	R
replace broken observation wells (not located in pavement or underground)	300	ea	0	infiltration and filtering practices	R
replace observation well cap (each additional cap is $20)	50	ea	800	infiltration and filtering practices	R
install underground half shell trash rack (4' to 6') (2 pieces is extra $120)	1,300	ea	0	underground practices	R
repair high stage trash racks (weld new rebar, etc.)	430	event	0	ponds, wetlands, infiltration basins	R (10-20)
new low flow trash rack (surface facilities)	1,700	ea	800	all surface practices except bioretention, infiltration practices, and open channel practices	R (5-10)
install high stage trash rack 4'x2'	1,100	ea	1500	ponds, wetlands, infiltration basins	R (20+)
replace CMP anti-vortex device <48"	1,500	ea	1500	ponds, wetlands, infiltration basins	R (10-15)
replace CMP anti-vortex device >48"	4,600	ea	1500	ponds, wetlands, infiltration basins	R (10-15)

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UNIT COSTS FOR STORMWATER TREATMENT PRACTICE MAINTENANCE - DRAFT[1]

Maintenance Item	Unit Price ($)	Unit	Mobilization Cost ($)[2]	Typical Applicability	Maintenance Interval (yrs)[3]
Structural - Other Metal					
remove bolts, lift lugs, form nails	80	ea	800	all practices, except infiltration trench and open channels	R
Structural - Other Concrete					
concrete work under ground	600	cy	1500	all underground practices	R
concrete work above ground	450	cy	1500	all surface practices except infiltration trenches and open channel practices	R
grout cracks	50	lf	0	all practices, except infiltration trench and open channels	R
parge minor spalling	25	sf	0	all practices, except infiltration trench and open channels	R
repair gutter spalling	230	event	800	all underground practices	R
parge major spalling	25	sf	0	all practices except open channels and infiltration trenches	R
injection grout concrete leaks	180	lf	800	all practices, except infiltration trench and open channels	R
Erosion/ Channel Maintenance					
establish new riprap pilot channels (8' wide, 1' deep)	38	lf	1500	dry pond or infiltration basin	5-15
remove and replace rip rap or pea gravel	160	sy	1500	all practices designed with riprap	15-25
shoreline protection	50	lf	1500	wet ponds and wetlands	R
new riprap (general)	80	cy	1500	all practices designed with riprap	R (5-10)
erosion repair	1,100	event	0	all surface practices	R (2-5)

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UNIT COSTS FOR STORMWATER TREATMENT PRACTICE MAINTENANCE - DRAFT[1]

Maintenance Item	Unit Price ($)	Unit	Mobilization Cost ($)[2]	Typical Applicability	Maintenance Interval (yrs)[3]
Landscaping/ Vegetation					
sod	3.30	sy	800	all surface practices	1-2
seed and top soil bare areas (3 inch depth)	4.40	sy	800	all surface practices	1-2
plant 1.5 inch tree	84	ea	0	dry pond, infiltration basin, wet ponds, bioretention	R[3]
plant shrub	15	ea	0	dry pond, infiltration basin, wet ponds, bioretention	R
mowing	300	ac	0	Ponds, wetlands and infiltration basins. Some surface filters	0.5-1
clear outfall and channel of trees	5.50	sy	800	all practices that outfall to the surface	0.5-1
clear embankment of small trees by hand	3.30	sy	800	Ponds, wetlands, infiltration basin, and surface filters	0.5-1
clear embankment trees with Ambusher or Brushhog	0.9	sy	800	Ponds, wetlands, infiltration basin, and surface filters	0.5-1
remove live tree (<12 inches)	130	ea	800	all surface practices	R (1-10)
remove live trees larger than 12 inches, <24 inches	250	ea	800	all surface practices	R (10-25)
remove downed timber (up to 40 cy of material)	2,200	event	0	all surface practices	0.25-1
remove dumped vegetative material (up to 40 cy)	2,600	event	0	all surface practices	0.25-1
install wetland plant	6	ea	800	wet ponds and wetlands	R (3-5)
remove invasive wetland vegetation (machine remove phragmites) (up to 40 cy)	3,000	event	0	wet ponds and wetlands	0.5-1
spray for algae (0.25 ac pond)	600	ea	0	wet ponds and wetlands	0.25-0.5
spray for cattails (0.25 ac pond)	330	ea	0	wet ponds and wetlands	0.25-0.5

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UNIT COSTS FOR STORMWATER TREATMENT PRACTICE MAINTENANCE - DRAFT[1]

Maintenance Item	Unit Price ($)	Unit	Mobilization Cost ($)[2]	Typical Applicability	Maintenance Interval (yrs)[3]
Access/ Safety					
fence repair	1,000	event	800	all practices with fences	R
install warning signs	210	ea	0	wet ponds and wetlands	R
manhole riser repair (in asphalt)	1,900	ea	0	all underground practices	R (10)
add manhole steps	100	ea	800	all practices, except infiltration trench, bioretention, and open channels	R
new manhole cover	250	ea	0	all practices, except infiltration trench, bioretention, and open channels	R
create 12' access road (permanent, cut/fill balances)	40	lf	1500	all surface practices	R
create 12' access road (permanent, cut/fill non-balance)	65	lf	1500	all surface practices	R
create 12' access road (temp)	12	lf	1500	all surface practices	R
install chainlink fence	26	lf	800	all surface practices except infiltration trenches and open channel practices	R
install ladder (8 foot)	27.5	ft	800	all underground practices	R
install three rail fence	15	lf	800	all surface practices except infiltration trenches and open channel practices	R
repair asphalt path	26	cy	800	all above ground practices	R
supply lock and chain for first one (additional at $30 apiece)	125	ea	0	Ponds, wetlands, infiltration basin, and surface filters	4-8

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UNIT COSTS FOR STORMWATER TREATMENT PRACTICE MAINTENANCE - DRAFT[1]

Maintenance Item	Unit Price ($)	Unit	Mobilization Cost ($)[2]	Typical Applicability	Maintenance Interval (yrs)[3]
Animals/ Nuisances					
pond/ wetland aeration	560	ea	0	wet ponds and wetlands	1
treat pond for mosquitoes	1,000	acre	0	wet ponds and wetlands	0.25-0.5
kill trap beavers (one week, one location, family of 6)	1,000	event	0	wet ponds and wetlands	0.5-1
fill animal burrows	23	sy	800	ponds, wetlands and infiltration basins	R (5-10)
remove graffiti	310	day	800	Ponds, wetlands, and infiltration basins	1-3

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Attachment 2

Maintenance Inspection Form

BIORETENTION MAINTENANCE INSPECTION FORM

Facility Number:_____ Date:_____ Time:_____

Subdivision Name:_____ Watershed:_____

Weather:_____ Inspector(s):_____

Date of Last Rainfall:_____ Amount:_____ Inches Streets:_____

Mapbook Location:_____ GPS Coordinates:_____

Property Classification: Residential Government Commercial Other:_____

Confined Unconfined Barrel Size_____ As-built Plan Available? Yes No

Is Facility Inspectable? Yes No Why?_____ Comments Specific Location(s):_____

Scoring Breakdown:

N/A = Not Applicable
N/I = Not Investigated
0 = Not a Problem
1 = Monitor (potential for future problem exists)
2 = Routine Maintenance Required
3 = Immediate Repair Necessary

* Use open space in each section to further explain scoring as needed

1. Outfall Channel(s) from Facility						
Woody growth within 5' of outfall barrel	N/A	N/I	0	1	2	3
Outfall channel functioning	N/A	N/I	0	1	2	3
Manholes, frames and covers	N/A	N/I	0	1	2	3
Released water undercutting outlet	N/A	N/I	0	1	2	3
Erosion	N/A	N/I	0	1	2	3
Displaced rip rap	N/A	N/I	0	1	2	3
Excessive sediment deposits	N/A	N/I	0	1	2	3
Other:	N/A	N/I	0	1	2	3
2. Outlet / Overflow Spillway						
Woody growth or unauthorized plantings	N/A	N/I	0	1	2	3
Erosion or back cutting	N/A	N/I	0	1	2	3
Soft or boggy areas	N/A	N/I	0	1	2	3
Obstructions / debris	N/A	N/I	0	1	2	3
3. Filter						
Existing as required			No		Yes	
Sediment accumulation > 1"			No		Yes	
Ponding more than 2 days after rain			No		Yes	
Vegetation	N/A	N/I	0	1	2	3
Depth & material of layers	Depth:_____		Material:_____			
Sediment accumulation in soil bed	N/A	N/I	0	1	2	3
Oil/ chemical accumulation on soil bed	N/A	N/I	0	1	2	3
Filter fabric	N/A	N/I	0	1	2	3
Other:	N/A	N/I	0	1	2	3

N/A = Not Applicable
N/I = Not Investigated
0 = Not a Problem
1 = Monitor for Future Repairs
2 = Routine Repairs Needed
3 = Immediate Repair Needed

4. Underdrains							
Broken	N/A	N/I	0	1	2	3	
Daylighted	N/A	N/I	0	1	2	3	
Clogging	N/A	N/I	0	1	2	3	
5. Pretreatment							
Maintenance access	N/A	N/I	0	1	2	3	
Pretreatment a practice other than a stone diaphragm and/ or grass filter strip			No		Yes		Of so,_____(code)
Stone diaphragm level	N/A	N/I	0	1	2	3	
Stone diaphragm clogged with sediment/debris	N/A	N/I	0	1	2	3	
Grass filter strip erosion	N/A	N/I	0	1	2	3	
Evidence of short circuiting, rails/ gullies in filter strip			No		Yes		
Level spreader	N/A	N/I	0	1	2	3	
Other:	N/A	N/I	0	1	2	3	
6. Upland Characteristics							
Excessive trash / debris	N/A	N/I	0	1	2	3	
Bare soil present	N/A	N/I	0	1	2	3	
Sand in parking lot	N/A	N/I	0	1	2	3	
7. Inflow Points							
Number of inflow pipes:_____	Direction: N		E		W	S	
Endwalls, headwalls, end sections	N/A	N/I	0	1	2	3	
Inlet/ outflow pipes	N/A	N/I	0	1	2	3	
Discharge undercutting outlet or displacing rip-rap	N/A	N/I	0	1	2	3	
Discharge water is causing outfall to erode	N/A	N/I	0	1	2	3	
Sediment accumulation	N/A	N/I	0	1	2	3	
8. Special Structures							
Manhole access (steps, ladders)	N/A	N/I	0	1	2	3	
Vehicular access	N/A	N/I	0	1	2	3	
Concrete/masonry condition	N/A	N/I	0	1	2	3	
Sediment / trash accumulation	N/A	N/I	0	1	2	3	
Manhole lockable nuts	N/A	N/I	0	1	2	3	
9. Miscellaneous							
Encroachment in facility area and/or easement area by buildings	N/A	N/I	0	1	2	3	
Complaints from local residents	N/A	N/I	0	1	2	3	
Graffiti	N/A	N/I	0	1	2	3	
Public hazards	N/A	N/I	0	1	2	3	
Were any pad locks cut and replaced			No		Yes		How many?_____
Other:	N/A	N/I	0	1	2	3	

N/A = Not Applicable
N/I = Not Investigated
0 = Not a Problem
1 = Monitor for Future Repairs
2 = Routine Repairs Needed
3 = Immediate Repair Needed

Overall Condition of Facility

Total number of concerns receiving a: (1)_____ - Need Monitoring
(2)_____ - Routine Repair
(3)_____ - Immediate Repair Needed

Inspector's Summary

Pictures	Clock/Degrees
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	

N/A = Not Applicable
N/I = Not Investigated
0 = Not a Problem
1 = Monitor for Future Repairs
2 = Routine Repairs Needed
3 = Immediate Repair Needed

Sketches, If Necessary:

N/A = Not Applicable
N/I = Not Investigated
0 = Not a Problem

1 = Monitor for Future Repairs
2 = Routine Repairs Needed
3 = Immediate Repair Needed

Attachment 3

BMP Site Map and Details