



Stormwater System Operation & Maintenance Plan



Natick Avenue Solar

Located in Cranston, Rhode Island

Applicant: Ronald Rossi

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Operation & Maintenance Plan Overview

An essential component of a successful Stormwater System (SS) is the ongoing Operation and Maintenance (O&M) of the various components of the stormwater drainage, control, and conveyance systems. These components include swales, pipes, catch basins, and treatment/ control devices are commonly referred to as Best Management Practices (BMPs). Failure to provide effective maintenance can reduce the hydraulic capacity and the pollutant removal efficiency of stormwater practices.

Many people expect that stormwater facilities will continue to function correctly forever. However, it is inevitable that deterioration of the stormwater system will occur once it becomes operational. The question is not whether stormwater system maintenance is necessary but how often.

This plan has been developed to proactively address operations and maintenance to minimize potential problems and maximize potential stormwater runoff treatment and management. Ongoing inspections and maintenance will extend the service life of the Best Management Practices.

This plan addresses;

1. Stormwater management system(s) owners;
2. The party or parties responsible for operation and maintenance, including how future property owners will be notified of the presence of the stormwater management system and the requirement for proper operation and maintenance;
3. A description and delineation of public safety features;
4. The routine (scheduled) and non-routine (corrective) maintenance tasks for each BMP to be undertaken after construction is complete and a schedule for implementing those tasks;
5. A plan that is drawn to scale and shows the location of all stormwater BMPs in each treatment train along with the discharge point;
6. An estimated operation and maintenance budget; and
7. Funding source for operation and maintenance activities and equipment.

A major contributor to unmaintained stormwater facilities is a lack of clear ownership and responsibility definition. In order for an inspection and maintenance program to be effective, the roles for each responsibility must be clearly defined prior to construction of a system. This can be accomplished with a maintenance agreement between the site owners and the responsible authority.

This report is suitable for recording as an attachment to a maintenance agreement between the site owner and the responsible authority. A copy of a sample agreement prepared by RIDEM is attached to this report as Appendix B.

Stormwater System Owner / Party Responsible for O&M

Stormwater BMPs are maintained during construction by the site contractor as identified in the Soil Erosion and Sediment Control Plan (SESC) for the site. A copy of the SESC is required to be kept on site during construction. The SESC requires maintenance and inspection of the BMPs during the construction phase of project and requires a log be kept of these activities. Once construction is complete and the contractor's warranty period is elapsed, the contractor must obtain the signature of the stormwater system's owner releasing the contractor from his maintenance and inspection responsibilities. A copy of this release of contractor's responsibility shall be attached to this document.

The property owner will also be the owner of the stormwater system. Upon completion of construction, the owner of the property along with mailing and emergency contact information must be added below.

Owner _____

Mailing Address _____

Emergency Contact Name _____

Phone _____

Transfer of Ownership

In the event that the owner of the property changes, the current owner (grantor) must provide a copy of this document to the new owner (grantee). The new owner must notify the Rhode Island Department of Environmental Management of the change of ownership and provide a signed updated Operations and Maintenance Plan to the Rhode Island Department of Environmental Management.

The Stormwater System Owner is the Party Responsible for the ongoing O&M of the system.

The two key components to adequately maintain the stormwater infrastructure are:

1. Performance of periodic and scheduled inspections
2. Performance of scheduled maintenance

The actual operation and maintenance of the system may be performed by a third party designated by the owner. If the owner contracts with a third party for O&M the name, address, and emergency contact information must be added below and updated if the third party designee changes.

Name _____

Mailing Address _____

Emergency Contact Name _____

Phone _____

Public Safety

Public safety was a critical factor in designing the stormwater system. Public safety features included in this design are:

- Accessibility to Stormwater BMPs
- 6' high security fence

Accessibility to Stormwater BMPs

As shown on the site plans, a permeable access road is proposed, which will allow access to the stormwater BMPs for maintenance.

Winter Maintenance

The following tasks shall be performed to protect the public safety during the winter season:

- Inspect and maintain stone access and drainage structures post storm event to alleviate any signs of icing or damming.

Non-Winter Maintenance

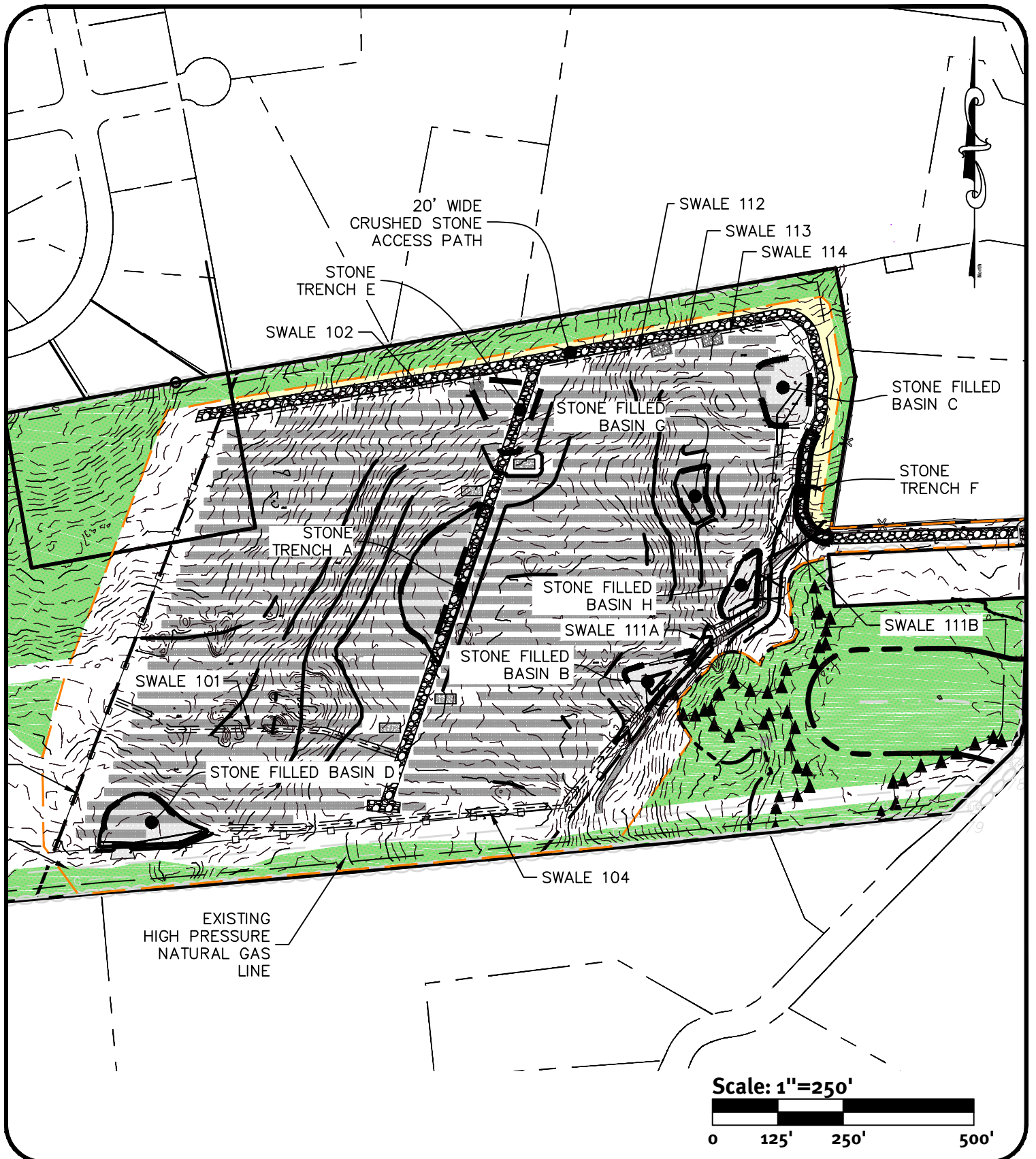
The following tasks shall be performed to protect public safety during the non-winter seasons:

- The site does not contain any impervious roadways which will need to be swept.
- The contractor will inspect and maintain the storm water management systems in accordance with the enclosed Operations & Maintenance Plan
- Periodic rejuvenation of stone infiltration areas may be required to maintain a rapidly permeable surface

Particular care must be taken in the operation and maintenance of these features.

Stormwater System Plan

A plan identifying each component of the stormwater system is included on the following page.



SHEET
1
OF 1

O&M Plan

Natick Avenue Solar

Cranston, RI

Date:
11-5-2020



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Boston • Providence • Newport

Inspections & Maintenance

Inspections shall be performed on a regular basis and scheduled based on the BMP type and configuration. It is not mandatory that all inspectors be trained engineers, but they shall have some knowledge or experience with stormwater systems and in general, trained stormwater engineers should direct the inspectors. Follow-up inspections by registered professional engineers shall be performed where a routine inspection has revealed a question of structural or hydraulic integrity affecting public safety.

Not all inspections can be conducted by direct human observation. For subsurface systems, video equipment may be required. There may be cases where other specialized equipment is necessary. The inspection program shall be tailored to address the operational characteristics of the system.

The inspection process shall document observations made in the field and shall cover structural conditions, hydraulic operational conditions, evidence of vandalism, condition of vegetation, occurrence of obstructions, unsafe conditions, and build-up of trash, sediments and pollutants.

Maintenance of the stormwater management system is essential and can be divided into two types, scheduled and corrective.

Scheduled maintenance tasks are those that are typically accomplished on a regular basis and can generally be scheduled without referencing inspection reports. These items consist of such things as vegetation maintenance (such as mowing) and trash and debris removal. These tasks are required at well-defined time intervals and are a requirement for all stormwater structural facilities.

Corrective maintenance tasks consist of items such as sediment removal, stream bank stabilization, and outlet structure repairs that are done on an as-needed basis. These tasks are typically scheduled based on inspection results or in response to complaints.

Since specialized equipment may be required, some maintenance tasks can be effectively handled on a contract basis with an outside entity specializing in that field. In addition, some maintenance may also require a formal design and bid process to accomplish the work.

Appendix A provides an "Inspection Schedule & Maintenance Checklist" for the stormwater system components on this site. Completed checklists shall be maintained as an ongoing record of inspections for each component of the stormwater system.

In addition to the maintenance of the stormwater system, maintenance of other site improvements can significantly enhance the ability for the BMPs to function as designed. We have identified several of these below, along with the suggested maintenance.

Lawn, Garden and Landscape Management

- Lawns shall be cut no shorter than 1-1/2" in the spring and fall to stimulate root growth, and no shorter than 2 to 3 inches throughout the summer.
- No fertilizer shall be used onsite.
- Weeds should be dug or pulled out. Large area of weeds can be removed by covering with large plastic sheet for a few days

-
- No chemical pesticides shall be used onsite within the limits of the lease area.
 - Irrigation should be minimal if required at all. The natural seed mix provided by the landscape architect will not require substantial watering and will become dormant during dry periods.
 - Established lawns require no more than one inch of water per week.
 - Areas should be watered before 9am to avoid evaporation.

Road and Parking Area Management

Street and Parking Lot Sweeping

- There are no streets on site therefore, no street sweeping is needed.
- Periodic rejuvenation of the permeable access drive surface will be performed as needed to maintain a rapidly permeable surface. The rejuvenation will occur in compliance with RIDEM standard practices.

Deicing:

- No deicing shall occur onsite

Sealants:

- No coal-tar based asphalt sealants shall be used onsite.

Snow Removal:

- No snow removal is proposed.

Solid Waste Containment

- The site will not be accessed by the public and will not contain trash and recycling receptacles.

***Reference;** Additional information relating to operation and maintenance of specific BMPs can be found in the Rhode Island Stormwater Design and Installation Standards Manual.*

www.dem.ri.gov/pubs/regs/regs/water/swmanual.pdf

Drip Edge of Solar Panels

- Drip edge along panels shall be inspected on an annual basis.
- If evidence of gullying is found, the owner shall install turf reinforcement mats in the locations noted on the Soil Erosion & Sediment Control Plan.

Estimated Inspections & Maintenance Budget

It is important to be able to budget for the O&M costs associated with the stormwater system. To assist the owner in budgeting, we have developed an estimate of the costs that may be incurred in maintaining the system. The costs have been estimated on a yearly basis.

Periodic inspections, if performed by an outside entity will cost approximately \$23,307 /yr.

Extended Detention Pond:

For a 25-year finance period, detention structures cost approximately \$268.59 per acre of tributary area per year. The site contains approximately 26 acres of area flowing to detention ponds. This equates to an approximate cost of \$7,983 per year to maintain the detention ponds.

Infiltration Structure:

For a 25-year finance period, Infiltration Structures cost approximately \$1,277.77 per acre of tributary area per year. The site contains approximately 12 acres of area flowing to infiltration ponds. This equates to an approximate cost of \$15,324 per year to maintain the infiltration trenches.

Based on the costs outlined above, the stormwater system will cost approximately \$23,307 per year to maintain. This is only an estimate and costs may vary.

These costs are the responsibility of the stormwater system owner. Funding for the costs will be provided by the site owner.

Reference; *Maintenance costs are based on information provided by Horsely Witten during the January 19, 2011 Stormwater Manual Training.*

<http://www.dem.ri.gov/programs/benviron/water/permits/ripdes/stwater/t4guide/slides/sess210.ppt>

Appendix A – Inspection Schedule & Maintenance Checklists

**Stone Infiltration Trench
Operation, Maintenance, and Management
Inspection Checklist**

Project:

Date:

Location:

Time:

Site Status:

Inspector:

Notes:

- **Beyond inspection frequency noted, inspections shall be completed after storms equal to or greater than the 1-year 24-hour Type III storm event (2.7" of rain fall)**
- **All Checklist Maintenance items are MANDATORY.**
- **During inspections, if maintenance items are found not to be applicable, note as N/A in comments**
- **All removed sediments shall be disposed at an approved and permitted location.**
- **All hazardous debris removed shall be disposed of in accordance with state and federal regulations by a properly licensed contractor**

MAINTENANCE ITEM	SATISFACTORY (YES/NO)	COMMENTS
Monthly inspect for trash and debris and remove if present.		
Monthly inspect for erosion and evidence of channelized flows. Erosion and channels must be corrected immediately by re-establishing original grade by raking existing stone or applying new stone as necessary.		
Semi-Annually inspect for excessive sediments and remove sediments if present. If sediment source is observed, eliminate source.		
Every 5 years, remove and wash pea stone layer or replace with new pea stone.		

**Stone Infiltration Trench
Operation, Maintenance, and Management
Inspection Checklist**

Project:

Date:

Location:

Time:

Site Status:

Inspector:

COMMENTS:

ACTIONS TO BE TAKEN:

**Detention / Infiltration Pond
Operation, Maintenance, and Management
Inspection Checklist**

Project:

Date:

Location:

Time:

Site Status:

Inspector:

Notes:

- Beyond inspection frequency noted in parenthesis, i.e. (quarterly), inspections shall be completed after storms equal to or greater than the 1-year 24-hour Type III storm event (2.7" of rain fall)
- All Checklist Maintenance items are MANDATORY.
- During inspections, if maintenance items are found not to be applicable, note as N/A in comments
- All removed sediments shall be disposed at an approved and permitted location.
- All hazardous debris removed shall be disposed of in accordance with state and federal regulations by a properly licensed contractor
- Sediment shall be removed from stormwater basins when the sediment volume exceeds 10% of the total basin volume. Sediment shall be disposed of in an acceptable manner at an approved and permitted location.
- Infiltration Ponds Only: When infiltration rates decrease below design infiltration rates, remove accumulated surface sediments and rototill pond bottom. Revegetate bottom of infiltration pond as needed

MAINTENANCE ITEM	SATISFACTORY (YES/NO)	COMMENTS
1. Embankment and Emergency Spillway (Annual)		
Vegetation and Ground Cover Adequate		
Embankment Erosion		
Animal Burrows		
Unauthorized Planting		
Cracking, bulging or sliding of dam		
<ul style="list-style-type: none"> • Upstream face 		
<ul style="list-style-type: none"> • Downstream face 		

Detention / Infiltration Pond Operation, Maintenance, and Management Inspection Checklist

Project:

Date:

Location:

Time:

Site Status:

Inspector:

<ul style="list-style-type: none"> At or beyond toe 		
<ul style="list-style-type: none"> Downstream 		
<ul style="list-style-type: none"> Upstream 		
<ul style="list-style-type: none"> Emergency Spillway 		
Basin, toe & chimney drains clear and functioning		
Seeps/leaks on downstream face		
Slope protection or riprap failure		
Vertical/horizontal alignment of top of dam "As-Built"		
Emergency Spillway clear of obstructions and debris		
2. Riser and Principal Spillway (Annual)		
Type: Reinforced Concrete____ Corrugated Pipe_____ Masonry_____		
Low-flow orifice obstructed		
Low-flow trash rack <ul style="list-style-type: none"> Debris removal necessary 		
<ul style="list-style-type: none"> Corrosion control 		
Weir trash rack maintenance <ul style="list-style-type: none"> Debris removal necessary 		
<ul style="list-style-type: none"> Corrosion control 		
Excessive Sediment accumulation inside riser		
Concrete/Masonry condition riser and barrels <ul style="list-style-type: none"> cracks or displacement 		
<ul style="list-style-type: none"> Minor spalling (<1") 		

Detention / Infiltration Pond Operation, Maintenance, and Management Inspection Checklist

Project:

Date:

Location:

Time:

Site Status:

Inspector:

<ul style="list-style-type: none"> Major spalling (rebars exposed) 		
<ul style="list-style-type: none"> Joint failures 		
<ul style="list-style-type: none"> Water tightness 		
Metal pipe Condition		
Control Valve <ul style="list-style-type: none"> Operational/ Exercised 		
<ul style="list-style-type: none"> Chained and Locked 		
Basin Drain Valve <ul style="list-style-type: none"> Operational/ Exercised 		
Outfall channels functioning		
3. Dry Basin Areas (Annual)		
Vegetation adequate		
Undesirable vegetative growth		
Undesirable woody vegetation		
Low-flow channels clear of obstructions		
Standing water or wet spots		
Annual mowing of vegetation along the maintenance access roads.		
Annual inspection of vegetation within basin.		
Prune all dead or dying vegetation within the extents of the basin or WVTS.		
Sediment and/or trash accumulation *		

**Detention / Infiltration Pond
Operation, Maintenance, and Management
Inspection Checklist**

Project:

Date:

Location:

Time:

Site Status:

Inspector:

Remove all herbaceous vegetation root stock when overcrowding of the maintenance access to the facility, remove any vegetation that has a negative impact on stormwater flowage through facility, and trim any overgrown vegetation within the basin.		
Replace any/all original vegetation that has died off or has not fully established, as determined at the time of the inspection.		
WVTS vegetation should be reinforced to its original design standards if less than 50% of the original vegetation is established after two years.		
Any invasive vegetation encroaching upon the perimeter of the facility should be pruned or removed if it is prohibiting access to the facility, compromising sight visibility and/or compromising original design vegetation.		
4. Condition of Outfalls (Annual)		
Riprap Failures		
Slope erosion		
Storm drain pipes		
Endwalls/ Headwalls		
Other (specify)		
1. Emergent Vegetation (Annual)		
Annual mowing of vegetation: Annual mowing of the basin setback is only required along maintenance rights-of-way and the embankment. The remaining setback can be managed as rangeland (mowing every other year) or forest		
Vegetation healthy and growing WVTS maintaining 50% surface area coverage of		

**Detention / Infiltration Pond
Operation, Maintenance, and Management
Inspection Checklist**

Project:

Date:

Location:

Time:

Site Status:

Inspector:

emergent plants after the second growing season (If unsatisfactory, reinforcement plantings needed)		
Dominant emergent plants: Survival of desired emergent plant species. Distribution according to planting plan?		
Evidence of invasive species		
Maintenance of adequate water depths for desired emergent plant species		
Harvesting of emergent plantings needed		
Have sediment accumulations reduced pool volume significantly or are plants "choked" with sediment		
Eutrophication level of the WVTS		

Appendix B – RIDEM Sample Stormwater Facility Maintenance Agreement

****A site specific Stormwater Facility Maintenance Agreement between the Owner and RIDEM shall be developed prior to construction****

Sample Stormwater Facility Maintenance Agreement

THIS AGREEMENT, made and entered into this ___ day of _____, 20___, by and between (Insert Full Name of Owner)

_____ hereinafter called the "Landowner", and the [Local Jurisdiction], hereinafter called the "[Town/City]".

WITNESSETH, that WHEREAS, the Landowner is the owner of certain real property described as (Tax Map/Parcel Identification Number) _____ as recorded by deed in the land records of [Local Jurisdiction] Deed Book _____ Page _____, hereinafter called the "Property".

WHEREAS, the Landowner is proceeding to build on and develop the property; and WHEREAS, the Site Plan/Subdivision Plan known as _____, (Name of Plan/Development) hereinafter called the "Plan", which is expressly made a part hereof, as approved or to be approved by the [Town/City], provides for detention of stormwater within the confines of the property; and

WHEREAS, the [Town/City] and the Landowner, its successors and assigns, including any homeowners association, agree that the health, safety, and welfare of the residents of [Local Jurisdiction] require that on-site stormwater management facilities be constructed and maintained on the Property; and

WHEREAS, the [Town/City] requires that on-site stormwater management facilities as shown on the Plan be constructed and adequately maintained by the Landowner, its successors and assigns, including any homeowners association.

NOW, THEREFORE, in consideration of the foregoing premises, the mutual covenants contained herein, and the following terms and conditions, the parties hereto agree as follows:

1. The on-site stormwater management facilities shall be constructed by the Landowner, its successors and assigns, in accordance with the plans and specifications identified in the Plan.
2. The Landowner, its successors and assigns, including any homeowners association, shall adequately maintain the stormwater management facilities in accordance with the required Operation and Maintenance Plan. This includes all pipes, channels or other conveyances built to convey stormwater to the facility, as well as all structures, improvements, and vegetation provided to control the quantity and quality of the stormwater. Adequate maintenance is herein defined as good working condition so that these facilities are performing their design functions. The Stormwater Best Management Practices Operation, Maintenance and Management Checklists are to be used to establish what good working condition is acceptable to the [Town/City].

-
3. The Landowner, its successors and assigns, shall inspect the stormwater management facility and submit an inspection report annually. The purpose of the inspection is to assure safe and proper functioning of the facilities. The inspection shall cover the entire facilities, berms, outlet structure, basin areas, access roads, etc. Deficiencies shall be noted in the inspection report.
 4. The Landowner, its successors and assigns, hereby grant permission to the [Town/City], its authorized agents and employees, to enter upon the Property and to inspect the stormwater management facilities whenever the [Town/City] deems necessary. The purpose of inspection is to follow-up on reported deficiencies and/or to respond to citizen complaints. The [Town/City] shall provide the Landowner, its successors and assigns, copies of the inspection findings and a directive to commence with the repairs if necessary.
 5. In the event the Landowner, its successors and assigns, fails to maintain the stormwater management facilities in good working condition acceptable to the [Town/City], the [Town/City] may enter upon the Property and take whatever steps necessary to correct deficiencies identified in the inspection report and to charge the costs of such repairs to the Landowner, its successors and assigns. This provision shall not be construed to allow the [Town/City] to erect any structure of permanent nature on the land of the Landowner outside of the easement for the stormwater management facilities. It is expressly understood and agreed that the [Town/City] is under no obligation to routinely maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the [Town/City].
 6. The Landowner, its successors and assigns, will perform the work necessary to keep these facilities in good working order as appropriate. In the event a maintenance schedule for the stormwater management facilities (including sediment removal) is outlined on the approved plans, the schedule will be followed.
 7. In the event the [Town/City] pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like, the Landowner, its successors and assigns, shall reimburse the [Town/City] upon demand, within thirty (30) days of receipt thereof for all actual costs incurred by the [Town/City] hereunder.
 8. This Agreement imposes no liability of any kind whatsoever on the [Town/City] and the Landowner agrees to hold the [Town/City] harmless from any liability in the event the stormwater management facilities fail to operate properly.
 9. This Agreement shall be recorded among the land records of [Local Jurisdiction] and shall constitute a covenant running with the land, and shall be binding on the Landowner, its administrators, executors, assigns, heirs and any other successors in interests, including any homeowners association.

WITNESS the following signatures and seals:

Company/Corporation/Partnership Name (Seal)

By: _____

(Type Name and Title)

The foregoing Agreement was acknowledged before me this ____ day of _____, 20____, by

_____.

NOTARY PUBLIC

My Commission Expires: _____

By: _____

(Type Name and Title)

The foregoing Agreement was acknowledged before me this ____ day of _____, 20____, by

_____.

NOTARY PUBLIC

My Commission Expires: _____

Approved as to Form:

[Town/City] Attorney Date