

STORMWATER MANAGEMENT OPERATION AND MAINTENANCE REPORT

for

**Ster Developers, LLC
Proposed Multi-Family Mixed Use Building**

**1102 9th Avenue, 105 8th Avenue & Memorial Drive
Block 405, Lots 5, 6, & 7
Township of Neptune
Monmouth County, NJ**

Prepared by:



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A handwritten signature in black ink, appearing to read 'Steven R. Cattani', is positioned above a horizontal line.

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I. INTRODUCTION AND DESCRIPTION OF FACILITIES

The project site consists of Block 405, Lots 5-7, located at the intersection of 9th Ave, Memorial Drive, and 8th Ave. in Neptune Township, Monmouth County, New Jersey. Currently, the site is mostly open with wooded areas towards the central portion of the combined lots. In addition, the site currently has two single-family homes located on existing lot 7. The subject site is 79,034 square feet (1.81 acres). The site is bordered to the north by 9th Ave; to the east Memorial Drive; to the south 8th Ave, and the west by residential uses. The project consists of developing the parcel with a proposed 38,875 square foot multi-family mixed use building, which includes 78 units, 936 SF of retail, one hundred and fifty-seven (157) total passenger vehicle parking, driveways, landscaping and other related site improvements.

The existing conditions of the tract have been verified by the Alta/ NSPS Land Title Survey, prepared by Dynamic Survey, LLC, dated 3/30/2022.

This manual shall run with the property and be recorded as part of the deed.

II. PROJECT CONTACTS

Responsibility for operation, maintenance, repair and safety of stormwater management facilities, including periodic removal and disposal of accumulated particulate material and debris, shall remain with the property owner or designated tenant and all successors in title unless assumed by a governmental agency. The requirements of this section do not apply to stormwater management facilities that are dedicated to and accepted by the municipality or another governmental agency.

In the event that the stormwater management facilities become a danger to public safety or public health, or if it is in need of maintenance, the municipality shall so notify the responsible person in writing. Upon receipt of that notice, the responsible person shall have fourteen (14) days to provide maintenance and repair of the facility in a manner that is approved by the municipal engineer or a designee. If for reasons of safety there is need for immediate action, the responsible person shall act forthwith to remove the danger. If the responsible person fails or refuses to perform such maintenance and repair, the municipality may immediately proceed to do so and shall be reimbursed for the cost thereof by the responsible person or entity.

Applicant
Ster Developers LLC 811 Amboy Ave, Second Floor Edison, NJ 08837
Owner
JJPP CO and JCR Enterprise Inc. 621 Shrewsbury Ave Shrewsbury, NJ
Municipal Engineer
Neptune Township Department of Engineering 2201 Heck Avenue First Floor West Entrance Neptune, NJ 07756
Design Engineer
Dynamic Engineering Consultants, P.C. 826 Newtown Yardley Road, Suite 201 Newtown, PA 18940 Attn: Steven R. Cattani, PE, CFM, CME (267) 685-0276
Party Responsible for Maintaining Stormwater Management Facility
Ster Developers LLC 811 Amboy Ave, Second Floor Edison, NJ 08837 Or Current Owner

III. POROUS PAVING SYSTEM WITH UNDERGROUND STORAGE

A. INSPECTION OF UNDERGROUND STORAGE SYSTEM

A consulting professional engineer should inspect the stormwater facility annually to ensure that the BMP system consisting of sub-surface underground storage is operating as designed. The inspection shall reveal whether or not there are accumulated sediments within the manhole structures or the associated pipe network. An inspection report should be provided to the owner with recommendations on whether or not sediment removal is required. Debris and other general nuisance materials should also be removed at this time.

Property Owners/Tenants or their maintenance designee should also inspect the underground facility components after considerable storm events to remove accumulated floating debris and to ensure proper functioning of the outlet orifice configuration. If removal of accumulated debris is necessary, it shall be accomplished at this time.

Responsibility for operation, maintenance, repair and safety of stormwater management facilities, including periodic removal and disposal of accumulated particulate material and debris, shall

remain with the property owner or designated tenant and all successors in title unless assumed by a governmental agency.

In the event that the stormwater management facility becomes a danger to public safety or public health, or if it is in need of maintenance, the municipality shall so notify the responsible person in writing. Upon receipt of that notice the responsible person shall have fourteen (14) days to effect maintenance and repair of the facility in a manner that is approved by the municipal engineer or a designee. If for reasons of safety there is need for immediate action, the responsible person shall act forthwith to remove the danger. If the responsible person fails or refuses to perform such maintenance and repair, the municipality may immediately proceed to do so and shall be reimbursed for the cost thereof by the responsible person or entity.

B. MAINTENANCE AND REPAIR OF PERVIOUS PAVEMENT

Maintenance of Pervious Pavement

The primary goal of porous pavement maintenance is to prevent the pavement surface and/or the underlying storage from being clogged with fine sediments. To keep the system clean throughout the year and prolong its lifespan, the pavement surface should be vacuum swept at least four times a year. Should the porous paving system's storage area not drain within 72 hours, the various system components and groundwater levels must be evaluated and appropriate measures taken to comply with the maximum drain time requirements and maintain the proper functioning of the system.

Planted areas adjacent to porous pavement should be well maintained to prevent soil washout onto the pavement. If any washout does occur it should be cleaned off the pavement immediately to prevent further clogging of the pores. Furthermore, if any bare spots or eroded areas are observed within the planted areas, they should be replanted and/or stabilized at once. Superficial dirt does not necessarily clog the pavement voids; however, dirt that is ground in repeatedly by tires can lead to clogging. Therefore, trucks or other heavy vehicles should be prevented from tracking or spilling dirt onto the pavement. Furthermore, all construction or hazardous materials carriers should be prohibited from entering a porous pavement lot.

- **Vacuuming**

It is recommended to vacuum porous asphalt and concrete pavement with a vacuum sweeper at least four times a year. This should be followed by a high-pressure hosing. All dislodged sediment and other particulate matter must be removed and properly disposed.

Acceptable types of vacuum sweepers include the Elgin Whirlwind and the Allianz Model 650. Though much less effective than “pure” vacuum sweepers, regenerative air sweepers, such as the Tymco Model 210, Schwarze 348, Victory, and others, are sometimes used. These units contain a blower system that generates a high velocity air column, which forces the air against the pavement at an angle, creating a 'peeling' or 'knifing' effect. The high-volume air blast loosens the debris from the pavement surface, then transports it across the width of the sweeping head and lifts it into the containment hopper via a suction tube. Thus, sediment and debris are loosened from the pavement and sucked into the unit. (Note: simple broom sweepers are not recommended for porous pavement maintenance.) If the pavement surface has become significantly clogged such that routine vacuum sweeping does not restore permeability, then a more intensive level of treatment may be required. Recent studies have revealed the usefulness of washing porous pavements with clean, low pressure water, followed by immediate vacuuming. Combinations of washing and vacuuming techniques have proved effective in cleaning both organic clogging as well as sandy clogging.

Maintenance crews are encouraged to determine the most effective strategy of cleaning their porous installations.

For smaller installations, such as sidewalks, plazas, or small parking lots, “walk behind” vacuum units may prove most effective. Though these units can be loud and somewhat messy to the operator due to the lack of dust suppression, they are also relatively easy to operate and inexpensive. Examples of acceptable “walk behind” units include the Billy Goat models, the 5700 industrial-strength Scrubber by Tennant, and the sidewalk class vacuum sweepers made by Nilfisk, Advance and Hako. If “walk behind” units are used, it is recommended that the scrub pressure be kept relatively low. The dirtiest areas may need to be power washed after scrubbing to get out the dirt that has been deeply ground in.

- **Winter Maintenance**

Winter maintenance for a porous parking lot may be necessary, but is usually less intensive than that required for a standard asphalt lot. By its very nature, a porous pavement system with subsurface aggregate bed has superior snow melting characteristics than standard pavement. Therefore, ice and light snow accumulation are generally not as problematic. However, snow will accumulate during heavier storms. Abrasives such as sand or cinders should not be applied on or adjacent to the porous pavement. Snow plowing is necessary for significant snow accumulation, but should be done carefully (i.e. by setting the blade slightly higher than usual, about an inch). Standard road salt is acceptable for use as a

deicer on porous pavement, although a non-toxic, organic deicer applied either as a blended, magnesium chloride-based liquid product or as pretreated rock salt, is recommended. Acceptable liquid deicers include Magic-O, Ice B' Gone, Ice Ban, and Geomelt, etc. Magic Salt is an example of an acceptable pretreated salt product. Other acceptable deicer alternatives to standard sodium chloride include calcium chloride, magnesium chloride, potassium chloride, urea, and calcium magnesium acetate. Follow supplier recommendations when applying deicers to pavement.

Repair of Pervious Pavement

Potholes in the porous pavement are extremely unlikely, though settling might occur if a soft spot in the subgrade is not removed during construction. For damaged areas of less than 50 square feet, a declivity could be patched by any means suitable with standard pavement, with the loss of porosity of that area being insignificant. The declivity can also be filled with porous mix. If an area greater than 50 SF is in need of repair, approval of patch type must be sought from either the engineer or owner. Under no circumstance is the pavement surface to ever be seal coated. Any required repair of drainage structures should be done promptly to ensure continued proper functioning of the system.

With minimal maintenance, porous bituminous asphalt can function effectively for well over 20 years. However, in the event that maintenance of the porous pavement is neglected and it becomes clogged over time, the Owner shall vacuum the lot until the original permeability is restored. (If the original permeability of the lot cannot be restored, the pavement should be removed and replaced with a new porous mix.) Recent research has shown that one of the most effective ways of restoring porous pavement is applying a pressurized dose of a non-toxic detergent cleaning solution, allowing adequate soak time, and then vacuuming with a high-performance unit (Elgin Whirlwind and the Allianz Model 650). Once again, it is important to note that high pressure washing may drive contaminants further into the porous surface and even into the underlying aggregate. It is therefore recommended that, prior to vacuum sweeping, a low performance pressure washer is used to get the solution to break the surface tension and reach into the pores.

General Maintenance Summary

- Prevent clogging of pavement surface with sediment.
- Vacuum pavement four times a year.
- Maintain planted areas adjacent to pavement.
- Immediately clean any soil deposited on pavement.
- Do not allow construction staging, soil/mulch storage, etc. on unprotected pavement surface.
- Do not apply abrasives such as sand or cinders on or adjacent to porous pavement.
- Snow plowing is fine but should be done carefully (i.e. set the blade slightly higher than usual).
- Salt application is acceptable, although more environmentally-benign deicers are preferable.
- Surface should never be seal-coated.
- Inspect for pavement rutting/raveling on an annual basis (some minor ruts may occur in the porous pavement from stationary wheel rotation).
- Damaged areas less than 50 square feet can be patched with porous or standard asphalt.
- Larger areas should be patched with an approved porous asphalt.

$$I = (K * M) / (D^2 * t), \text{ where}$$

$K = 126,870 \text{ in-lbs}$

$M = \text{water mass, lbs}$

$D = \text{ring diameter} = 12 \text{ inches}$

$t = \text{time, in seconds}$

Test Methods Per ASTM C1701 or C1781		
Time to Infiltrate the Specified Amount of Water (seconds)	Approximate Surface Infiltration Rate (inches per hour)	
	$M = 8 \text{ lbs}$	$M = 40 \text{ lbs}$
30	235	1175
60	118	587
100	70.5	352
200	35.2	176
350	20.1	100.7
360	19.6	97.9
380	18.5	92.7
900	7.8	39.2
1760	4.0	20.0
1910	3.7	18.5
3600	2.0	9.8
5400	1.3	6.5
5470	1.3	6.4
6000	1.2	5.9

C. MAINTENANCE AND REPAIR OF UNDERGROUND STORAGE

Maintenance procedures are required to maintain the intended operation and safe condition of the stormwater management facility by reducing the occurrence of problems and malfunctions. To be effective, maintenance shall be performed on a regular basis and include such routine procedures as training of staff, periodic inspections, silt and debris removal and disposal, control of mosquitoes and other insects, and review of maintenance and inspection work to identify where the maintenance program could be more effective.

If visual inspection reveals the accumulation of unwanted sediments within the sump pit of the underground storage, outlet structure, manhole structures or the adjoining pipe network, it shall be

removed with either conventional methods (broom, shovel and pail), or by mechanical means (high power vacuum). The degree of accumulation shall dictate which methods to realistically employ.

The facility shall be inspected for accumulated sediments and those sediments shall be removed (regardless of their depth) on an annual basis.

Repair procedures are required to correct a problem or malfunction at a stormwater management facility and to restore the facility's intended operation and safe condition. Based upon the severity of the problem, repairs shall be performed on an as-needed or emergency basis and includes such procedures as structural repairs, mosquito control, removal of debris, sediment and trash which threaten discharge capacity, erosion repair and snow and ice removal.

General Maintenance Summary

- Inspections to be performed by a consulting engineer on an annual basis.
- Inspections to be performed by the property owner and/or a maintenance designee on a monthly basis and/or after a considerable storm event.
- Storage basin manhole access and debris removal to be performed on an annual basis and/or as inspection routine dictates.
- Surface debris, including garbage, leaf matter and snow removal are encouraged as necessary to maintain a safe condition.

D. INSPECTION AND MAINTENANCE OF INFILTRATION BASIN

Routine Inspection and Maintenance of the Stormwater Management Facilities:

The stormwater management basins have been designed to control stormwater and reduce flooding and degradation of water quality. Without proper routine inspection and maintenance, the basins may lose some or all of their capability to function to their full capacity. Lack of adequate maintenance at these facilities could lead to system failures.

The proposed infiltration basins have been designed to address the applicable aspects of N.J.A.C. 7:8. Stormwater runoff generated by the subject site will be directed to the basins via the proposed stormwater conveyance network. Smaller runoff events will be infiltrated and larger runoff events will be released at a controlled rate through the proposed outlet structures to satisfy the N.J.A.C. 7:8 runoff rate reduction requirements.

Stormwater runoff that is detained below the lowest outlet and infiltrated shall drain from the basins in less than 72 hours. If significant increases or decreases in this drain time are observed in any of the infiltration basins, a qualified licensed Professional Engineer shall be contacted to evaluate possible corrective measures that may be required.

It is important to note that the bottom of the proposed above ground infiltration basins contain a 6" sand layer as required to provide water quality benefits. If the basin bottoms are disturbed during any preventative or corrective maintenance measures, the bottom of the basin shall be reestablished with the 6" of clean K5 sand.

A consulting Professional Engineer should perform regularly scheduled maintenance inspections of the stormwater facilities as outlined below and described in the following section:

- All structural components must be inspected, at least once annually, for cracking, subsidence, spalling, erosion and deterioration.
- Components expected to receive and/or trap debris and sediment must be inspected for clogging at least four times annually, as well as after every storm exceeding 1 inch of rainfall.
- Small scale and large-scale infiltration basins must be inspected at least twice annually to determine if the permeability of the basin has decreased.
- General regular inspection of all of the facilities should be conducted at least four times annually and as indicated below.

The primary purpose of these inspections is to ascertain the operational condition and safety of the facilities, particularly the condition of embankments, outlet structures, trash racks and other safety-related aspects. Inspections will also provide information on the effectiveness of regularly scheduled Preventative and Aesthetic Maintenance Procedures, and will help to identify where changes in the extent and scheduling of the procedures are warranted. Finally, the facility inspections should also be used to determine the need for and timing of Corrective Maintenance procedures.

Routine maintenance of the facilities should be separated into two (2) basic types: Functional Maintenance and Aesthetic Maintenance. Functional Maintenance is required to insure the safe and effective operation of the storm water management facilities and is further broken down into two (2) categories: Preventative and Corrective. It is important to note that a successful Functional Maintenance program will emphasize regularly scheduled preventative maintenance over emergency-based corrective maintenance. Aesthetic Maintenance, which is necessary to maintain the visual appeal and aesthetic quality of these facilities, should be incorporated on the same schedule as the preventative maintenance efforts. Listed below are the Preventative, Corrective and Aesthetic Maintenance Procedures to be performed on a routine basis:

Preventative Maintenance Procedures:

The purpose of Preventative Maintenance is to assure that the basin remains operational and safe at all times, while minimizing the need for emergency or corrective maintenance. These procedures are as follows:

a) Grass Cutting

A regularly scheduled program of mowing and trimming of grass at the basin during the growing season will help to maintain a tightly knit turf, and will also help to prevent diseases, pests and the intrusion of weeds. The actual mowing requirements of an area should be tailored to the specific site conditions, grass type, and seasonal variations in the climate. In general, lawn areas should be mowed at least once a month during the growing season and grass should not be allowed to grow more than 1 to 2 inches between cuttings. Allowing the grass to grow more than this amount prior to cutting it may result in damage to the grass' growing points and limit its continued healthy growth.

b) Grass Maintenance

Grassed areas require periodic fertilizing, de-thatching and soil conditioning in order to maintain healthy growth and to provide bank stabilization. Additionally, provisions should be made to re-seed and re-establish grass cover in areas damaged by sediment accumulation, stormwater flow, or other causes. These tasks should be performed, or at least evaluated, on a quarterly basis.

c) Vegetative Cover

Trees, shrubs, and ground cover require periodic maintenance, including fertilizing, pruning, and pest control in order to maintain healthy growth. Vegetated areas must be inspected at least annually for erosion and scour as well as unwanted growth, which should be removed with minimum disruption to the remaining vegetation. The basins should be evaluated regularly to determine whether excessive plant growth is evident. A correction in the application of fertilizers can often solve these problems. Weeds, which have become a problem, can be cleared through harvesting by professional maintenance technicians.

Note: All use of fertilizers, mechanical treatments, pesticides and other means to ensure optimum vegetation health must not compromise the intended purpose of the

storm water management facility. All vegetation deficiencies should be addressed without the use of fertilizers and pesticides whenever possible.

d) Removal and Disposal of Trash and Debris

All storm water management 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 one inch of rainfall. Such components may include the basins, stormwater conveyance network (piping and inlet), flared end sections, headwalls, basin bottoms, riprap or gabion aprons, trash racks and inflow points.

Removal of trash and debris will prevent possible damage to trash racks and outlets, vegetated areas and eliminate potential mosquito breeding habitats. Disposal of debris and trash must comply with all local, county, state, and federal waste flow control regulations. Only suitable disposal and recycling sites should be utilized.

e) Sediment Removal and Disposal

The basins should also be evaluated for excessive deposition of sediment. Accumulated sediment should be removed before it threatens the storage volume of the basin. Before de-sedimentation activities are performed, all runoff shall have been drained and the basin is dry. This may be accomplished by clearing any blocked openings of the outlet structure or by mechanical means such as pumping. If stable soil conditions exist on-site, sediment deposition should not be an excessive maintenance issue. Should a recurrent stabilization situation develop, the inspector should identify the upstream sources of sediment and recommend required stabilization measures.

Disposal of debris, trash, sediment and other waste material must be done at suitable disposal/recycling sites and in compliance with all applicable local, state and federal waste regulations.

f) Mechanical Components

Mechanical components such as valves, sluice gates, pumps, fence gates, locks, and access hatches, should remain functional at all times. Regularly scheduled maintenance should be performed in accordance with the manufactures' recommendations. Additionally, all mechanical components should be operated at least once every three months to assure their continued performance.

g) Elimination of Potential Mosquito Breeding Habitats

The most effective mosquito control program is one that eliminates potential breeding habitats. Almost any stagnant pools of water can be attractive to mosquitoes, and may become the source of a large mosquito population. A maintenance program dedicated to eliminating potential breeding areas is preferable to chemical means of controlling mosquitoes. The most important maintenance function is removal of all obstructions to natural flow patterns before stagnant water conditions can develop.

h) Parking Lot and Loading Area Maintenance

This management measure involves employing pavement cleaning practices, such as parking lot and loading area sweeping on a regular basis, to minimize pollutant export to the stormwater conveyance system/infiltration basins and eventually the receiving waters. These cleaning practices are designed to remove sediment, debris, and other pollutants from loading areas, access drives and parking lot surfaces that are a potential source of pollution impacting urban waterways. Mechanical machines that use vacuum assisted dry sweeping to remove particulate matter shall be utilized as these have the ability to remove finer sediment particles. Parking lots and access drives shall be swept/vacuumed at least once a month. The disposal of the swept material must be properly hauled off the site and transferred to an approved disposal site.

Additional parking lot maintenance features include the use of on-site trash receptacle. These receptacles should be located in strategic areas where the majority of the pedestrian traffic occurs. These receptacles should be emptied daily. The disposal of the solid waste must be properly hauled off the site and transferred to an approved disposal site.

i) Observation After Rainfall

This management measure involves monitoring the amount of time the infiltration basins take to drain to ensure the basins are working properly. The detention basins should drain to the bottom in less than 72 hours. If significant increases or decreases are observed in the drawdown time, a qualified licensed Professional Engineer shall be contacted to evaluate the basin's bottom surface, subsoil and both groundwater and tailwater elevations to determine what corrective measures may need to be implemented.

j) Maintenance of Infiltration Basin's Sand Layer

The bottom sand layer in a surface infiltration basin should be inspected at least monthly as well as after every storm exceeding one inch of rainfall. The permeability rate of the soil below the basin may also be retested periodically. If the water fails to infiltrate within the given amount of time as mentioned above, corrective measures must be taken. Annual tilling by light equipment can assist in maintaining infiltration capacity and break up clogged surfaces. This task is to be followed by re-grading and leveling of the sand layer. The thickness of the sand layer should be checked to ensure that a minimum of 6" is maintained throughout the basin bottom areas to ensure that the infiltration basin water quality treatment feature is operating correctly.

k) Vegetation Maintenance

All landscaped areas within the infiltration basins shall be periodically inspected a minimum of once per month and every two weeks during growing season or after each mowing session. In general, mowing should occur at least once a month during the growing season. Clippings from the mowing operations shall be removed and disposed of in accordance with all local, state and federal regulations. Reseeding, if required, shall occur within spring or early fall. Summer and fall seeding can be successful with a light mulching of weed-free straw to conserve moisture. All landscaped areas shall be inspected for invasive plant species. Invasive species should be removed immediately and properly disposed of at an approved disposal site.

l) Stockpiling

The Stormwater BMPs may not be used for stockpiling of plowed snow and ice, compost, or any other material.

m) Inspection and Reporting:

Regularly scheduled inspections of the facilities should be performed by a consulting Professional Engineer. The primary purpose of the inspections is to ascertain the operational condition and safety of the facility. Inspections will also provide information on the effectiveness of regularly scheduled Preventative and Aesthetic Maintenance procedures. It should be noted that, in addition to regularly scheduled inspections, an informal inspection should be performed during every visit to stormwater management facilities by maintenance or supervisory personnel.

The recording of all maintenance work and inspections provides valuable data on the condition of the stormwater management facilities. Review of this information will also help to establish more efficient and beneficial maintenance procedures and practices. All recorded information should be directed to the owner of the facility for review and subsequent follow-up on recommendations. Inspection and maintenance checklists and logs are included in the Appendix of this manual.

Corrective Maintenance Procedures:

Corrective Maintenance is required on an emergency or non-routine basis to correct problems or malfunctions and to restore the intended operation and safe condition of the stormwater management facilities.

a) Removal of Debris and Sediment

Sediment, debris and trash which threaten the discharge capacity of the basins should be removed immediately and properly disposed. As noted previously, it is recommended that all water be evacuated from the basin with a pump before any significant amount of sediment, settled debris or trash is removed from the basin. The lack of an available disposal site should not delay the removal of trash, debris and sediment. Temporary disposal sites should be utilized if necessary.

b) Structural Repairs

Structural damage to outlet and inlet structures, trash racks, access hatches, roadways and headwalls as a result of vandalism, flood events, settlement or other causes must be repaired promptly. The urgency of the repairs will depend upon the nature of the damage and its effects on the safety and operation of the facility. The analysis of structural damage and the design and performance of structural repairs should only be undertaken by the consulting Professional Engineer.

c) Embankment and Slope Repairs

Damage to embankments, and side slopes must be repaired promptly. This damage can be the result of rain or flood events, vandalism, animals, vehicles or neglect. Typical problems include settlement, scouring, cracking, sloughing, seepage and rutting. The urgency of the repairs will depend upon the nature of the damage and its effect on the safety and operation of the facility. The analysis of the damage and the design and performance of geotechnical repairs should only be undertaken by qualified personnel and under the direction of a consulting Professional Engineer.

All basin embankments shall be inspected quarterly and after each significant storm greater than one (1) inch of rainfall. Any damage or indication of erosion shall be immediately inspected by a professional engineer.

d) Dewatering

It may be necessary to remove ponded water from within a malfunctioning basin. This ponding may be the result of a blocked principal outlet or poor bottom drainage. Portable pumps may be necessary to remove the ponded water temporarily until a permanent solution can be implemented.

e) Weed Harvesting

It may be necessary to remove congested weeds from the basin. Companies with specialized harvesters should be contacted to perform these operations. Note that such work may require the approval of various regulatory agencies.

f) Extermination of Mosquitoes

If neglected, the basin can become an ideal mosquito breeding area. The extermination of mosquitoes will usually require the services of the County Mosquito Commission. If mosquito control in the facility becomes necessary, the preventative maintenance program should be re-evaluated, and more emphasis should be placed on control of mosquito breeding habitats.

g) Erosion Repair

Vegetative cover or other protective measures are necessary to prevent the loss of soil due to the forces of wind and water. Where a re-seeding program has not been effective in maintaining a non-erosive vegetative cover, or other factors have exposed soils to erosion, corrective steps should be initiated to prevent further loss of soil that may result in danger to the stability of the facility. Soil loss can be controlled by a variety of materials and methods, including rip-rap, gabion lining, geotextile fabrics, sod, seeding, concrete lining and re-grading.

h) Fence Repair

Fences are damaged by many factors, including vandalism and storm events. Timely repair will maintain the security of the site.

i) Elimination of Trees, Brush, Roots and Animal Burrows

The stability of embankments can be impaired by large roots and animal burrows. Additionally, burrows can present a safety hazard for maintenance personnel. Trees and brush with extensive, woody root systems should be completely removed to prevent destabilization and the creation of seepage routes. Roots should also be completely removed to prevent decomposition within the embankment. Root voids and burrows should be filled with material similar to the existing material, and capped just below grade with stone, concrete or other material. If the filling of the burrows does not discourage the animals from returning, further measures should be taken to either move the animal population or to make critical areas of the facility unattractive to them.

j) Snow and Ice Removal

Accumulations of snow and ice can threaten the functioning of the inlets, outlets and emergency spillways. Provision of the equipment, material and personnel to monitor and remove snow and ice from critical areas will assure the function of the facility during the winter months.

k) Basin Drain Time

As mentioned above, the stormwater management facilities for the development are all infiltration basins. In accordance with the project Stormwater Management Report, the amount of time for the water quality storm volume to drain and reach the sand elevation is as summarized in the below table:

Basin Number	Drain Time
1	7 Hours
2	7 Hours
3 (UG)	2.5 Hours

If the any basin fails to drain in the above indicated time, the basin should be dewatered down to the sand elevation and the 6" sand layer of the basin shall be replaced partially or completely depending on field inspection result. This task is to be followed by re-grading and leveling of the sand layer. The thickness of the sand layer should be checked to ensure that a minimum of 6" is maintained throughout the basin bottom area to ensure that the infiltration basin water quality treatment feature operates correctly. The sand material to be utilized shall be K5 sand with a maximum of 15% fines and a minimum permeability rate of 20 inches per hour. Any disturbed vegetated area should be re-vegetated immediately to prevent erosion

IV. FUNCTIONAL MAINTENANCE

Functional maintenance is necessary to keep the stormwater management system operating properly at all times. Functional maintenance has two components: preventative maintenance and corrective maintenance.

A. Preventative Maintenance

Preventative maintenance refers to procedures that are performed on a regularly scheduled basis to keep the BMP in proper working order. Preventive maintenance tasks include: surface debris removal (twice monthly) and removal of accumulated sediments as needed.

B. Corrective Maintenance

Corrective Maintenance is that which is required on an emergency or non-routine basis to correct problems and to restore the intended operation and safe functioning of the stormwater management system. Prompt response to maintenance problems is essential to providing minimal disruption of the functioning SWM system.

V. AESTHETIC MAINTENANCE

Aesthetic Maintenance is obviously more important for high profile, above ground facilities than for underground facilities. In general, policing of the grounds and parking lots will prevent foreign debris and floating materials from entering into the system.

Collection and removal of surface debris should be performed in association with the lawn and grounds maintenance schedule and that should be accomplished twice monthly (or as necessary) to project a clean, healthy, community image.

Leaf debris and snow removal are also of concern for facilities in the Northeast and protection from accumulated leaf matter and expeditious snow removal are encouraged.

APPENDIX

ESTIMATED MAINTENANCE FEES

Estimated Maintenance Costs

An estimated total cost of approximately **\$15,500** will be incurred to maintain the proposed stormwater management systems on an annual basis. The following is a summary of the required maintenance tasks and associated costs in written and tabular form:

- Inspections to be performed by a consulting engineer on an annual basis.
- Inspections to be performed by the property owner and/or a maintenance designee on a monthly basis and/or after a storm event exceeding 1 inch of rainfall
- Stormwater conveyance system and outlet control structure access for debris removal to be performed on an annual basis and/or as inspection routine dictates.
- Surface debris removal including garbage and organic matter to be performed in conjunction with lawn and grounds maintenance, includes removal of leaves in the Fall and removal of excessive amounts of snow (as necessary) in the Winter. These tasks are encouraged as necessary to maintain safe operating conditions (twice a month from Spring through Winter recommended or on as-needed basis)

Maintenance Schedule Summary

Task Identification	Task Frequency	Estimated Cost	Annual Cost
Inspection by licensed professional consulting engineer	Four (4) times per year	\$1,500.00	\$6,000.00
Inspection by property owner and/or maintenance designee	Once (1) per month (or after a storm event exceeding 1 inch of rainfall)	Minimal Cost	Minimal Cost
Debris removal from conveyance system (inlets, pipes, manholes, and outlet control systems)	Twice (2) per year	\$1,750.00	\$3,500.00
Surface debris removal (garbage & organic matter) including leaves in the Fall and snow in the Winter	Once (1) per month (or on as-needed basis)	\$500.00	\$6,000.00

MAINTENANCE WORK ORDER & CHECKLIST

**MAINTENANCE WORK ORDER AND CHECKLIST
FOR STORMWATER MANAGEMENT FACILITIES**

NAME OF FACILITY: _____ DATE: _____
 LOCATION: _____ WORK STARTED: _____
 WEATHER: _____ WORK COMPLETED: _____
 MAINTENANCE PERFORMED BY: _____

A. PREVENTATIVE MAINTENANCE			
WORK ITEMS	ITEMS REQUIRED	ITEMS DONE	COMMENTS AND SPECIAL INSTRUCTIONS
1. GRASS CUTTING			
A. BOTTOMS			
B. EMBANKMENTS AND SIDE SLOPES			
C. PERIMETER AREAS			
D. ACCESS AREAS AND ROADS			
E. OTHERS			
2. GRASS MAINTENANCE			
A. FERTILIZING			
B. RE-SEEDING			
C. DE-THATCHING			
D. PEST CONTROL			
E. OTHERS			
3. VEGETATIVE COVER			
A. FERTILIZING			
B. PRUNING			
C. PEST CONTROL			
D. POISONOUS PLANTS			
E. OTHERS			
4. TRASH AND DEBRIS REMOVAL			
A. BOTTOMS			
B. EMBANKMENTS AND SIDE SLOPES			
C. PERIMETER AREAS			
D. ACCESS AREAS AND ROADS			
E. INLETS			
F. OUTLETS AND TRASH RACKS			
G. OTHERS			
5. SEDIMENT REMOVAL			
A. INLETS			
B. OUTLETS AND TRASH RACKS			
C. LOW FLOW CHANNELS			
D. BOTTOMS			
E. OTHERS			
6. PEST CONTROL			
A. GEESE			
B. MOSQUITO BREEDING			
C. RODENTS / RODENT HOLES			
D. OTHERS			
7. STRUCTURAL REPAIRS			
A. VALVES			
B. SLUICE GATES			
C. PUMPS			
D. FENCE GATES			
E. LOCKS			
F. ACCESS HATCHES			
G. OTHER:			
8. POND MAINTENANCE			
A. AERATION EQUIPMENT			
B. DEBRIS AND TRASH REMOVAL			
C. WEED REMOVAL			
D. OTHER:			
9. OTHER PREVENTIVE MAINTENANCE			
A. PARKING LOT SWEEPING			
B. EMPTYING TRASH RECEPTACLES			
C. PUMPS AND VALVES			
D. ELECTRICAL PANEL AND WIRING			
E. DEWATERING			
F. GRAFFITI REMOVAL			
E. OTHER:			

B. CORRECTIVE MAINTENANCE			
WORK ITEMS	ITEMS REQUIRED	ITEMS DONE	COMMENTS AND SPECIAL INSTRUCTIONS
1. REMOVAL OF DEBRIS AND SEDIMENT			
2. STRUCTURAL REPAIRS			
3. EMBANKMENTS AND SIDE SLOPES			
4. DEWATERING			
5. BASIN MAINTENANCE			
6. CONTROL OF MOSQUITOES			
7. EROSION REPAIR			
8. FENCE REPAIR			
9. SNOW AND ICE REMOVAL			
10. SAND LAYER REPLACEMENT			
11. OTHER			

C. AESTHETIC MAINTENANCE			
WORK ITEMS	ITEMS REQUIRED	ITEMS DONE	COMMENTS AND SPECIAL INSTRUCTIONS
1. GRAFFITI REMOVAL			
2. GRASS TRIMMING			
3. WEEDING			
4. OTHERS			

GENERAL NOTES AND REMARKS:

WORK ORDER PREPARED BY: _____

WORK COMPLETED BY: _____

MAINTENANCE EQUIPMENT AND MATERIALS

**MAINTENANCE WORK ORDER AND CHECKLIST
FOR STORMWATER MANAGEMENT FACILITIES**

NAME OF FACILITY: _____
 LOCATION: _____ DATE: _____
 WEATHER: _____ WORK STARTED: _____
 MAINTENANCE PERFORMED BY: _____ WORK COMPLETED: _____

A. PREVENTATIVE MAINTENANCE			
WORK ITEMS	ITEMS REQUIRED	ITEMS DONE	COMMENTS AND SPECIAL INSTRUCTIONS
1. GRASS CUTTING			
A. BOTTOMS			
B. EMBANKMENTS AND SIDE SLOPES			
C. PERIMETER AREAS			
D. ACCESS AREAS AND ROADS			
E. OTHERS			
2. GRASS MAINTENANCE			
A. FERTILIZING			
B. RE-SEEDING			
C. DE-THATCHING			
D. PEST CONTROL			
E. OTHERS			
3. VEGETATIVE COVER			
A. FERTILIZING			
B. PRUNING			
C. PEST CONTROL			
D. POISONOUS PLANTS			
E. OTHERS			
4. TRASH AND DEBRIS REMOVAL			
A. BOTTOMS			
B. EMBANKMENTS AND SIDE SLOPES			
C. PERIMETER AREAS			
D. ACCESS AREAS AND ROADS			
E. INLETS			
F. OUTLETS AND TRASH RACKS			
G. OTHERS			
5. SEDIMENT REMOVAL			
A. INLETS			
B. OUTLETS AND TRASH RACKS			
C. LOW FLOW CHANNELS			
D. BOTTOMS			
E. OTHERS			
6. PEST CONTROL			
A. GEESE			
B. MOSQUITO BREEDING			
C. RODENTS / RODENT HOLES			
D. OTHERS			
7. STRUCTURAL REPAIRS			
A. VALVES			
B. SLUICE GATES			
C. PUMPS			
D. FENCE GATES			
E. LOCKS			
F. ACCESS HATCHES			
G. OTHER:			
8. POND MAINTENANCE			
A. AERATION EQUIPMENT			
B. DEBRIS AND TRASH REMOVAL			
C. WEED REMOVAL			
D. OTHER:			
9. OTHER PREVENTIVE MAINTENANCE			
A. PARKING LOT SWEEPING			
B. EMPTYING TRASH RECEPTACLES			
C. PUMPS AND VALVES			
D. ELECTRICAL PANEL AND WIRING			
E. DEWATERING			
F. GRAFFITI REMOVAL			
E. OTHER:			

B. CORRECTIVE MAINTENANCE			
WORK ITEMS	ITEMS REQUIRED	ITEMS DONE	COMMENTS AND SPECIAL INSTRUCTIONS
1. REMOVAL OF DEBRIS AND SEDIMENT			
2. STRUCTURAL REPAIRS			
3. EMBANKMENTS AND SIDE SLOPES			
4. DEWATERING			
5. BASIN MAINTENANCE			
6. CONTROL OF MOSQUITOES			
7. EROSION REPAIR			
8. FENCE REPAIR			
9. SNOW AND ICE REMOVAL			
10. SAND LAYER REPLACEMENT			
11. OTHER			

C. AESTHETIC MAINTENANCE			
WORK ITEMS	ITEMS REQUIRED	ITEMS DONE	COMMENTS AND SPECIAL INSTRUCTIONS
1. GRAFFITI REMOVAL			
2. GRASS TRIMMING			
3. WEEDING			
4. OTHERS			

GENERAL NOTES AND REMARKS:
<div></div>

WORK ORDER PREPARED BY: _____

WORK COMPLETED BY: _____

INSPECTION LOG

INSPECTION LOG FOR STORMWATER MANAGEMENT FACILITIES

NAME OF FACILITY: _____

LOCATION: _____

[illegible][illegible]

7. EMERGENCY SPILLWAY										
A. VEGETATION										
B. LINING										
C. EROSION										
D. TRASH AND DEBRIS										
E. OTHER:										
8. PERIMETER										
A. VEGETATION										
B. EROSION										
C. TRASH AND DEBRIS										
D. FENCES AND GATES										
E. AESTHETICS										
G. OTHER:										
9. ACCESS ROADS										
A. VEGETATION										
B. ROAD SURFACE										
C. FENCES AND GATES										
D. EROSION										
E. AESTHETICS										
F. OTHER:										
10. MISCELLANEOUS										
A. EFFECTIVENESS OF EXIST. MAINT. PROGRAM										
B. DAM INSPECTIONS										
C. POTENTIAL MOSQUITO HABITATS										
D. MOSQUITOES										

- (1) ITEM CHECKED IS IN GOOD CONDITION, AND THE MAINTENANCE PROGRAM IS ADEQUATE.
- (2) ITEM CHECKED REQUIRES ATTENTION, BUT DOES NOT PRESENT AN IMMEDIATE THREAT
FUNCTION OR OTHER FACILITY COMPONENTS.
- (3) THE ITEM CHECKED REQUIRES IMMEDIATE ATTENTION TO KEEP THE FACILITY
DAMAGE TO OTHER FACILITY COMPONENTS.
- (4) PROVIDE EXPLANATION AND DETAILS IF COLUMNS 2 OR 3 ARE CHECKED.

GENERAL NOTES AND REMARKS (REFER TO ITEM NUMBER IF APPLICABLE)										

MAINTENANCE LOG

MAINTENANCE LOG FOR STORMWATER MANAGEMENT FACILITIES

NAME OF FACILITY: _____
LOCATION: _____

[illegible][illegible]

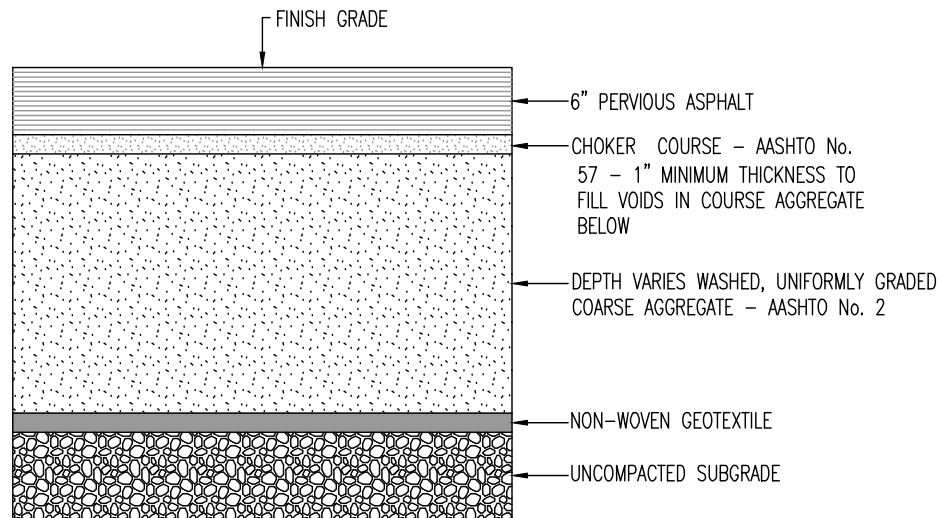
INSPECTION CHECKLIST

**INSPECTION CHECKLIST
FOR
STORMWATER MANAGEMENT FACILITIES**

NAME OF FACILITY: _____
 LOCATION: _____
 WEATHER: _____ DATE: _____

FACILITY ITEM	O.K. ¹	ROUTINE ²	URGENT ³	COMMENTS
1. EMBANKMENTS AND SIDE SLOPES				
A. VEGETATION				
B. LININGS				
C. EROSION				
D. SETTLEMENT				
E. SLOUGHING				
F. TRASH AND DEBRIS				
G. SEEPAGE				
H. AESTHETICS				
I. OTHER:				
2. BOTTOMS (DETENTION AND INFILTRATION)				
A. VEGETATION				
B. EROSION				
C. STANDING WATER				
D. SETTLEMENT				
E. TRASH AND DEBRIS				
F. SEDIMENT				
G. AESTHETICS				
H. OTHER:				
3. LOW FLOW CHANNELS (DETENTION)				
A. VEGETATION				
B. LININGS				
C. EROSION				
D. SETTLEMENT				
E. STANDING WATER				
F. TRASH AND DEBRIS				
G. SEDIMENT				
H. OTHER:				
4. PONDS (RETENTION)				
A. VEGETATION				
B. SHORELINE EROSION				
C. AERATION EQUIPMENT				
D. TRASH AND DEBRIS				
E. SEDIMENT				
F. WATER QUALITY				
G. OTHER:				
5. INLET STRUCTURE				
A. CONDITION OF STRUCTURE				
B. EROSION				
C. TRASH AND DEBRIS				
D. SEDIMENT				
E. AESTHETICS				
F. OTHER:				
6. OUTLET STRUCTURE				
A. CONDITION OF STRUCTURE				
B. EROSION				
C. TRASH AND DEBRIS				
D. SEDIMENT				
E. MECHANICAL COMPONENTS				
F. AESTHETICS				
G. OTHER:				

DETAIL FOR PERVIOUS PAVEMENT



NOTES:

1. POROUS PAVEMENT AREAS SHALL BE COMPACTED IF CONSTRUCTED IN-SITU SOILS OR DEEP FILLED IF CONSTRUCTED ON FILL SOILS, WHICH SHOULD BE A STRUCTURAL SAND BASED FILL.
2. POROUS PAVEMENT AREAS SHALL BE PROTECTED FROM RUNOFF UNTIL THE CONTRIBUTORY AREAS HAVE BEEN STABILIZED.
3. FILTER FABRIC SHOULD BE A NON-WOVEN GEOTEXTILE.
4. POROUS PAVEMENT SHOULD CONSIST OF COURSE AGGREGATE MIX WITH 100% PASSING 1/2", 95% PASSING 3/8", 35% PASSING #4, 15% PASSING #8, 10% PASSING #16 AND 2% PASSING #30 U.S. STANDARD SIEVE SIZES WITH A 5.75%-6.00% ASPHALT BINDER BY WEIGHT TO PROVIDE REQUIRED SHEAR STRENGTH AND DURABILITY.

POROUS PAVEMENT DETAIL

NOT TO SCALE



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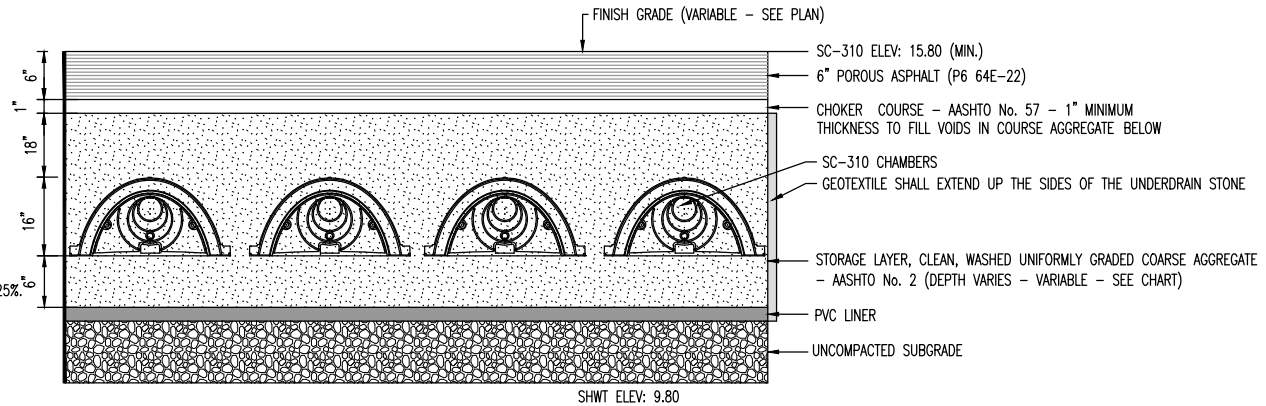
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**DETAIL FOR POROUS PAVEMENT WITH
UNDERGROUND CHAMBERS**

PERMEABLE ASPHALT NOTES

1. THE POROSITY OF THE PERMEABLE ASPHALT SURFACE COURSE MUST BE 15-25%.
2. THE POROSITY OF PERMEABLE ASPHALT BASE COURSE MUST BE \geq THAN 25%.
3. MINIMUM AIR TEMPERATURE FOR PAVING SHALL BE 50 DEGREES F.
4. INSTALLATION OF THE PERMEABLE ASPHALT SHALL BE INSTALLED IN ACCORDANCE WITH THE FOLLOWING TEMPERATURE GUIDELINES
 ASPHALT BASE COURSE: 200 - 245 DEGREES F.
 FINISH ROLLING BASE COURSE: 140-150 DEGREES F.
 ASPHALT SURFACE COURSE: 200-220 DEGREES F AND
 FINISH ROLLING SURFACE COURSE 110-140 DEGREES F.
5. VEHICULAR USE IS PROHIBITED FOR AT LEAST 48 HOURS ONCE THE PAVEMENT INSTALLATION IS COMPLETE.
6. POST CONSTRUCTION TESTING OF THE PERMEABLE ASPHALT SURFACE COURSE IS REQUIRED AND MUST CONFORM TO THE METHODS OF EITHER ASTM C1701: STANDARD TEST METHOD FOR INFILTRATION RATE OF IN PLACE PERVIOUS CONCRETE OR ASTM C1781: STANDARD TEST METHOD FOR SURFACE INFILTRATION RATE OF PERMEABLE UNIT PAVEMENT SYSTEMS. AT LEAST THREE LOCATIONS MUST BE USED FOR THE TEST, AND THEY SHOULD BE SPACED EVENLY ACROSS THE PERVIOUS PAVING SYSTEM. FAILURE TO ACHIEVE THE MINIMUM DESIGN INFILTRATION RATE OF THE SURFACE COURSE AT ONE OR MORE LOCATIONS INDICATES THE SYSTEM CANNOT BE PUT IN SERVICE UNTIL THE SYSTEM IS CORRECTED TO YIELD ALL PASSING VALUES. UNLIKE THE TEST METHODOLOGY OUTLINED IN THE ASTM STANDARDS, THE TEST RESULTS MUST NOT BE AVERAGE. THE MAINTENANCE PLAN MUST INCLUDE A LOG FOR RECORDING EACH LOCATION AND ITS TEST RESULT FOR FUTURE REFERENCE.



NOTES:

1. POROUS PAVEMENT AREAS SHALL BE COMPACTED IF CONSTRUCTED IN-SITU SOILS OR DEEP FILLED IF CONSTRUCTED ON FILL SOILS, WHICH SHOULD BE A STRUCTURAL SAND BASED FILL.
2. POROUS PAVEMENT AREAS SHALL BE PROTECTED FROM RUNOFF UNTIL THE CONTRIBUTORY AREAS HAVE BEEN STABILIZED.
3. FILTER FABRIC SHOULD BE A NON-WOVEN GEOTEXTILE.
4. POROUS PAVEMENT SHOULD CONSIST OF COURSE AGGREGATE MIX WITH 100% PASSING 1/2", 95% PASSING 3/8", 35% PASSING #4, 15% PASSING #8, 10% PASSING #16 AND 2% PASSING #30 U.S. STANDARD SIEVE SIZES WITH A 5.75%-6.00% ASPHALT BINDER BY WEIGHT TO PROVIDE REQUIRED SHEAR STRENGTH AND DURABILITY.

	SHWT ELEVATION	INFILTRATION RATE (IN/HR)	BOTTOM OF STORAGE BED	TOP OF STORAGE BED	FINISHED GRADE ELEV. (MIN)	CHAMBER INVERT	NUMBER OF BARRELS	WQ ELEVATION	100-YR ELEVATION
SC-310 CHAMBER	9.80	3.75 IN/HR	11.80	14.13	15.80	11.80	SEE DETAIL	11.82	14.08

*MEASURED AT LOWEST POINT OF BASIN

POROUS PAVEMENT W/ UNDERGROUND CHAMBERS DETAIL

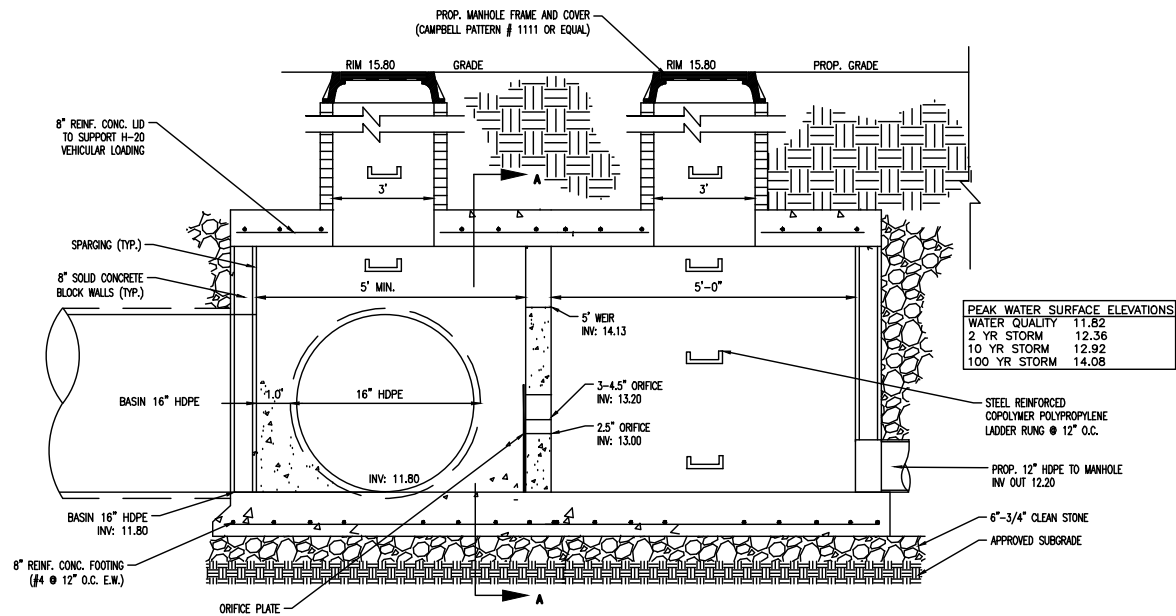
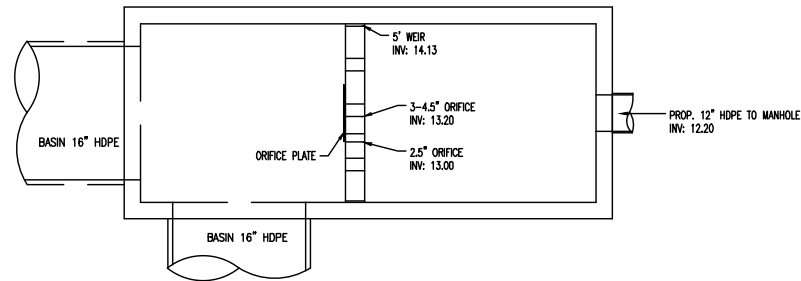
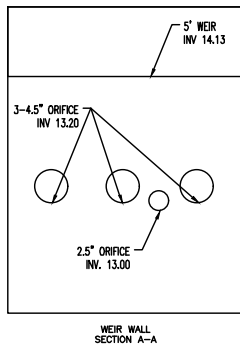
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**OUTLET STRUCTURE DETAIL FOR ONSITE
UNDERGROUND STORMWATER STORAGE SYSTEM**



BASIN 3 OUTLET STRUCTURE DETAIL

NOT TO SCALE

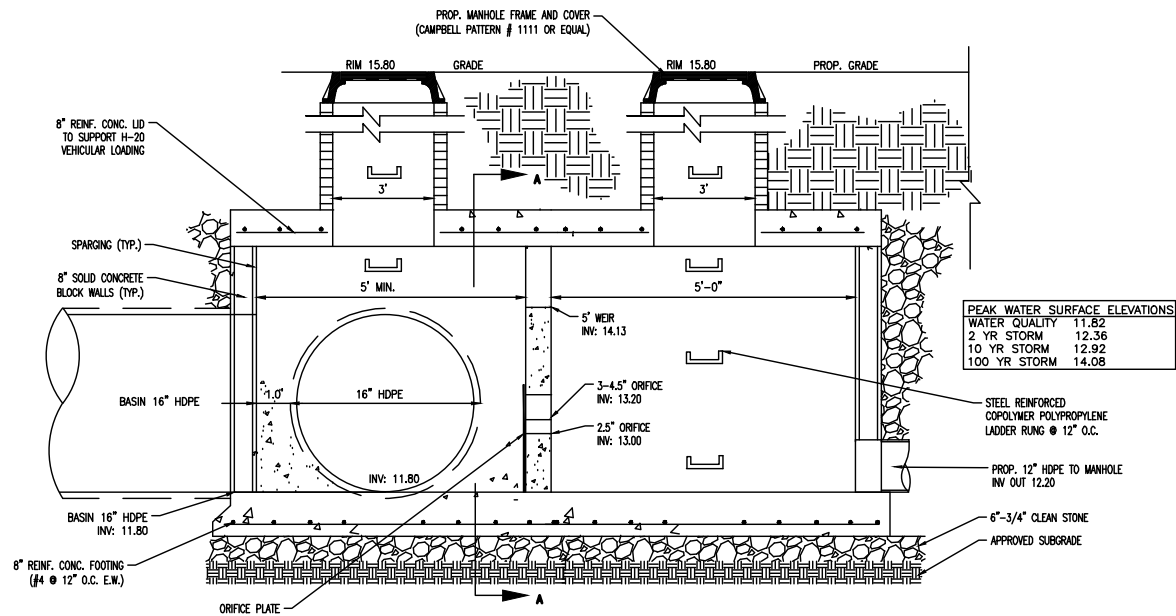
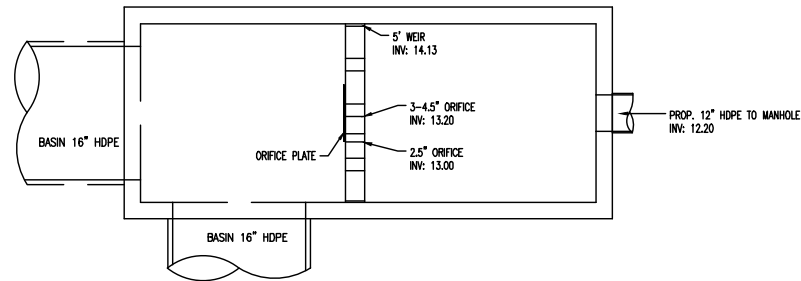
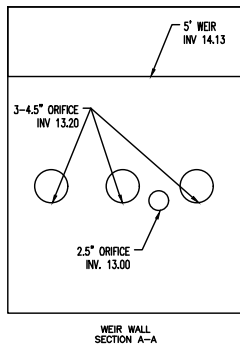


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**OUTLET STRUCTURE DETAIL FOR ONSITE
UNDERGROUND STORMWATER STORAGE SYSTEM**



BASIN 3 OUTLET STRUCTURE DETAIL

NOT TO SCALE



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