STORMWATER MAINTENANCE PLAN

Prepared for:
A&R SKYLINE LLC
704 Passaic Ave
West Caldwell, New Jersey 07006

Regarding the:

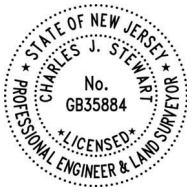
COMMONS AT VERONA
885 Bloomfield Avenue
Township of Verona
Essex County, New Jersey

Block 2205, Lot 6

Prepared by:

E2 Project Management, LLC
87 Hibernia Avenue
Rockaway, New Jersey 07866

August 25, 2026
E2PM Project No. P-25-55



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Charles J. Stewart
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Charles J. Stewart, P.E., P.L.S.
Professional Engineer & Professional Land Surveyor
New Jersey License No. 24GB035884

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining and preparing the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for knowingly submitting false information, including the possibility of fine and imprisonment.

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APPENDICES

1.0 INTRODUCTION

1.1 Subject Property

This report has been prepared to present the operations and maintenance protocols for the stormwater management system associated with the proposed project. The subject property located at 885 Bloomfield Avenue, known as Block 2505, Lot 6, as identified in the survey prepared by E2PM entitled "Boundary and Topographic Survey, ALL COUNTY-VERONA, 885 Bloomfield Avenue, Township of Verona, Essex County, New Jersey, Block 2205, Tax Lot 6". The site is measured at approximately 1.66 Acres.

Lot 6 fronts on the South side of Bloomfield Avenue. Bloomfield Avenue is classified as CR-506 and has a 35 mph speed limit in this section of the road. To the west the property is adjacent to a townhouse development in Essex Fells. Along the southern property line there are residential family houses and a portion of Fells Road. To the east the property is adjacent to Fells Road.

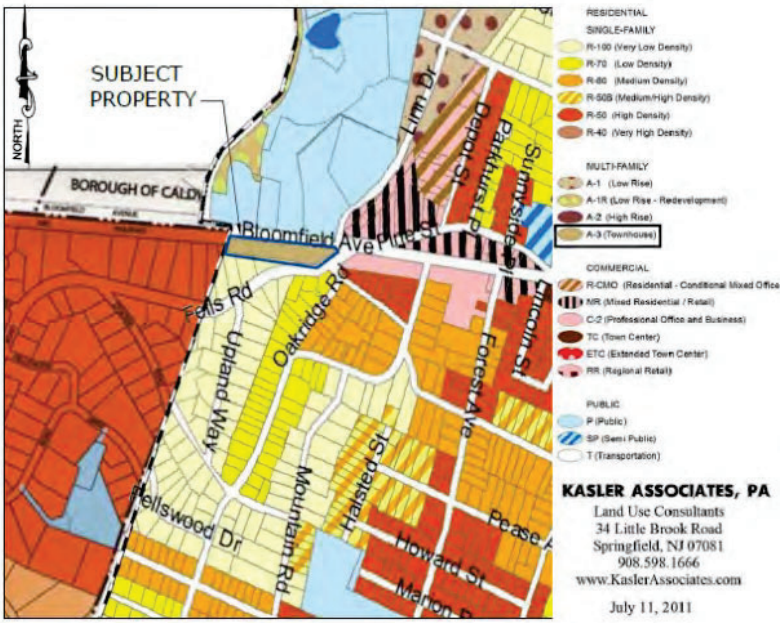


Fig1- Verona Zoning Map

The New Jersey Planning Advocacy Locator Map classifies the subject property within the metropolitan planning area, placing it inside the urban redevelopment area. The current site use is undeveloped, vacated land, there's a Bus Stop for NJ Transit 29 & 105. There are no wetlands surrounding the existing property and Lot 6 is located outside of any FHA according to FEMA map 34013C0084F.

The property is steeply sloped inward towards the center where thee is a 10' deep dry pond. Water from the neighboring southern lots is routed to this site and does not flow off-site. The site was previously used as an active rail bed for trains.

- Site Centroid Location Northing: 728,988 Easting: 559,104

1.2 Project Description

The proposed activities on-site will consist of a 28 unit townhouse development with affordable housing. There will be two driveways to the site. The driveway between building #2 and building #3 has two-way access and the westerly driveway is a one-way entrance only. Landscaping, traffic signage, site lighting, and grading have been designed in accordance with local ordinance.

The proposed improvements will have stormwater conveyed with Stormwater management measures in accordance with the New Jersey Department of Environmental Protection Best Management Practices Manual.

2.0 STORMWATER MAINTENACE PLAN

2.1 Purpose of Document

This stormwater maintenance manual is being prepared as a part of the Preliminary and Final Site Plan Approval for a multi-family development at 885 Bloomfield Avenue with the Township of Verona's Planning Board. The developer shall maintain the facilities, structures and land areas associated with the storm water management systems during the construction and instillation process. After completion and approval of the facilities by the city, the maintenance and operation of the storm water management facility shall be the responsibility of the designated owner.

This Stormwater Maintenance Plan has been prepared in accordance with the Township of Verona municipal Stormwater Management ordinance and applicable chapters of the NJDEP Stormwater BMP Manual. The site's stormwater management measures shall be maintained in accordance with the NJDEP BMP Manual, the Standards for Soil Erosion and Sediment Control in New Jersey, and any manufacturer's specifications. The agent responsible for maintenance of the stormwater management system at the completion of construction is the following:

Responsible Person(s)

Name: Ralph Valente
Phone: 973-226-7000 Ext. 7020
Company: Corporate Benefit Solutions
Address: 704 Passaic Avenue Suite A, West Caldwell, NJ 07006

Responsible Governmental Entities

Name: N/A
Phone: 862-333-4505
Agency: HEP Soil Conservation District
Address: 80 Orchard St. Bloomfield, NJ 07003

Name: Sanjeev Varghese, P.E., P.P.
Phone: 973-226-8500 ext. 2660
Agency: Essex County Public Works Director & County

Name: Peter Ten Kate, Boswell Engineering,
Phone: 201 641 0770
Agency: Verona Township Engineer/Boswell Engineering
Address: 330 Phillips Avenue, South Hackensack, NJ 07606

2.2 Instructions for Responsible Party

The party responsible for the maintenance of the stormwater management facility shall follow through and abide by the following instructions in accordance with the NJDEP Stormwater Management Rules:

1. If there is a change in ownership, copies of this maintenance plan shall be provided to the future owner and operator of the stormwater management facility.
2. The title and date of this maintenance plan and the name, address, telephone number of the party responsible for the maintenance of the stormwater management facility must be recorded on the deed of the property on which the facilities are located. Any change in this information due, for example, to a change in property ownership, must also be recorded in the deed.
3. The party responsible for the maintenance of the stormwater management facility must evaluate this maintenance plan for effectiveness at least annually and revise as necessary.
4. A detailed written log of all preventative and corrective maintenance performed at the stormwater management facility must be kept, including a record of all inspections and copies of maintenance- related work orders.
5. The person responsible for the maintenance of the stormwater management facility must retain and, upon request, make available this maintenance plan and associated logs and other records for review by a public entity with engineering, environmental, or administrative authority over the maintenance compliance of the site.

2.3 Description of Stormwater Management System

The project proposes a stormwater management system to meet the requirements for stormwater quantity reductions as detailed in the Township of Verona Stormwater Management Ordinance and N.J.A.C. 7:8. The stormwater management system consists of a two bio-retention basins in series that drain into the municipal storm system along Mountain Avenue.

The following is a list of structures for the proposed on-site stormwater management system:

1. Porous Pavement System 1 (Porous Pavement #1A):
    - 4,950 CF of storage with approximately 2,750 SF of pavement.
    - Outlet control pipe/structure with orifice and weir flow control. (OCS-1)
2. Stormwater Management System 2 (Bio-retention Basin #1B):
    - 10,372 CF of storage with approximately 3,805 SF of pavement.
    - Outlet Control Structure with orifice and weir flow control. (OCS-2)
3. Stormwater Management System 3 (Green Infrastructure Manufactured Treatment Device):
    - Treatment Device able to treat 80% of TSS
4. Outlet Control Structure (OCS-1) Porous Pavement System 1A

- Discharge Pipe
    - Size: 12” HDPE Invert Out: 469.0

Outlet Control Structure (OCS-2) Porous Pavement System 1B

- Discharge Pipe
    - Size: 14” HDPE Invert Out: 465.5

Type of Stormwater Management Measure	Location Description	State Plane Coordinates (Northing, Easting)
Porous Pavement #1A	Building #3 & #4	728,945; 559,166
Porous Pavement #1B	Building #1 & 2	728,978; 558,797
OCS #1	End of Porous Pavement #1A	728,950; 559,086
OCS #2	End of Porous Pavement #1B	729,013; 558,702
Green Infrastructure MTD	NW corner of property	729,054;558,693

2.4 Maintenance of Stormwater Management Features

Maintenance procedures for stormwater management facilities can be categorized as Functional Maintenance and Aesthetic Maintenance. Functional Maintenance includes preventative (routine) maintenance and corrective (emergency) maintenance. Aesthetic Maintenance can be considered maintenance, which enhances or maintains the visual appearance of the facilities. Aesthetic maintenance is not required for assuring the intended operation of the stormwater management facility, but it can improve the quality of life in the community and reduce the amount of required Functional Maintenance.

Maintenance Schedule

Equipment	Inspection	Maintenance	Timetable
Outlet Control Structure	Silt & Sediment Build Up	Plumber to verify no silt/sediment building up in the control outlet and its trash rack	Every 6 months
Inlets/Area Drains	Silt & Sediment Build Up	Plumber to verify no silt/sediment clogging in the inlet grate and pipes	Every 6 months
Pipes	Silt & Sediment Build Up	Plumber to verify access holes for sediment clogging water flow	Every 6 months
Inspection Ports	Silt & Sediment Build Up	Building Super to verify under drains are free flowing and clear of debris.	After every storm event
		Plumber to provide a system flush	Every 3 months
GI MTD	Sediment & Debris Build Up	Contractor to inspect unit for sediment accumulation, floatables, oils, grease, and debris; clean as necessary per manufacturer recommendations.	Every 6 Months and after major storm event
Bio Retention Basin	Vegetation & Soil media	Landscape Contractor to remove invasive species, reseed bare areas, replace dead plantings, and maintain healthy vegetative cover. Landscape Contractor to replenish mulch and redistribute displaced mulch as necessary.	Every 6 months

General Maintenance

- Proper and timely maintenance is essential to continuous, effective operation; therefore, an access route must be incorporated into the design, and it must be properly maintained.
- 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.
- Sediment removal should take place when all runoff has drained, and the basin is dry.
- 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.
- Access points for maintenance are required on all enclosed areas within an infiltration basin; these access points must be clearly identified in the maintenance plan. In addition, any special training required for maintenance personnel to perform specific tasks, such as confined space entry, must be included in the plan.
- Stormwater BMPs may not be used for stockpiling of plowed snow and ice, compost, or any other material.

Bio retention Basin Maintenance

- Inspect the bio-basin/bioretention area on a routine basis and after major storm events for proper operation, ponding, erosion, sediment buildup, trash, and structural damage.
- Maintain healthy vegetation by mowing where applicable, pruning, weeding invasive species, replacing dead vegetation, reseeding bare areas, and maintaining dense vegetative cover to prevent erosion.
- Water newly established plantings during establishment periods and drought conditions as necessary to ensure survival and proper growth.
- Repair erosion, scour, rills, or washouts immediately using stabilized soils, mulch, vegetation, stone stabilization, or other approved measures.
- Maintain mulch layers at appropriate thicknesses and replenish depleted mulch periodically while avoiding excessive buildup that may obstruct flow.
- Inspect soil media for clogging, excessive compaction, crusting, or standing water that exceeds allowable drain-down times; scarify, aerate, amend, or replace media if infiltration performance declines.
- Stabilize contributing drainage areas to minimize sediment loading into the BMP and prevent premature failure of the basin media.
- Remove excessive sediment accumulation from pretreatment devices and forebays before sediment migrates into the primary treatment area.
- Prevent stockpiling of materials, vehicle parking, or heavy equipment operation within the basin area to avoid soil compaction and vegetation damage.
- Inspect side slopes, embankments, retaining walls, riprap, and flow spreaders for settlement, cracking, displacement, or instability.
- Confirm that overflow structures and emergency spillways are free of obstruction and functioning properly during storm events.
- Remove accumulated sediment when it reduces storage capacity, causes short-circuiting, or impairs infiltration/treatment performance.
- Replace dead or diseased plants with species consistent with the approved landscaping plan and suitable for wet/dry stormwater conditions.
- Maintain proper grading and ponding depths to preserve the original design intent and prevent nuisance standing water.
- Avoid use of excessive fertilizers, herbicides, or pesticides within the basin area unless specifically required for vegetation management.
- Maintain access routes and safety features needed for inspection and maintenance activities.

Other Inspection Notes

- Check inspection ports, inflow/outflow points, including inlet/manhole pipes and discharge area.

- Identify and report maintenance required, including sediment and debris accumulation, system backing up, and flow rate change.

Maintenance Procedures

- Conform to all local, state and federal regulations.
- Determine if maintenance is required.
- Use a vacuum pump truck to evacuate debris from the inflow and outflow points.
- Flush the system with clean water forcing debris from the system. Take care to avoid extreme direct water pressure when flushing the system.
- Clear inlets, outlets, overflow devices of debris and obstructions

Structural Components

- All structural components (i.e. inlets, manholes, outlet control structures, water quality units, etc.) must be inspected for cracking, subsidence, spalling, erosion and deterioration at least annually and per manufacturer's specifications.

Maintenance Cost Estimate

Task	Cost
Pruning and restoration of vegetation	$250 - $750 per workday
Elimination of mosquito breeding areas	$250 - $1,000 per workday
Control of aquatic vegetation	$500 - $1,000 per workday
Repair or replacement of damaged or deteriorated components	$250 - $4,000 per workday
Vacuum Truck	$2,000 per workday

Log Records for Annual Evaluation

Sample Record Keeping Form provided in Appendix B.

The party responsible shall maintain records documenting the condition of the stormwater management system, maintenance work performed and maintenance work necessary, and any safety hazards. The records shall include a schedule for performing needed maintenance, repairs or safety improvements.

Written maintenance and repair records for all components of the stormwater management system must be maintained for at least five (5) years by the responsible party. Copies of these documents must be submitted to the Borough Engineer every five (5) years. This should include all receipts for materials and labor purchased. Manufacturers' documents, including warranty information, shall also be retained.

2.5 Preventative Maintenance Procedures

The purpose of preventative maintenance is to assure that a stormwater management facility always remains operational and safe, while minimizing the need for emergency or corrective maintenance. The preventative maintenance plan for the stormwater management facility in this project should comply with the following schedule:

Vegetation Maintenance

Vegetated areas will be inspected. Any areas of dead or dry vegetation will be noted as well as any areas without ground cover. An assessment by the inspection personnel shall be made to determine the cause of any observed problems and corrective measures will be implemented and may include fertilizing, de-thatching and soil conditioning in order to maintain healthy growth. Additionally, provisions will be made to replace green roof patch to reestablish ground cover in areas damaged by severe weather conditions, stormwater flow, or other causes.

Removal and Disposal of Trash and Debris

A regularly scheduled program of debris and trash removal from the stormwater management facility will reduce the chance of roof drains and outlet pipes from becoming clogged and inoperable during storm events. Trash and debris will be removed during the monthly inspections or on an as need basis whenever it is present within the system.
Additionally, removal of trash and debris will prevent possible damage to pipe system 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 will be utilized.

Sediment Removal and Disposal

Accumulated sediment will be removed before it threatens the operation of the storage volume in the stormwater management facility. Sediment removal may be required once a year or after major storm events (if the amount of accumulated sediment requires removal). Sediment is to be removed in accordance with the manufacturer's recommendations. If a large amount of sediment has accumulated, the use of a commercial vacuum truck may be required. A commercial vacuum truck shall perform sediment removal from the stormwater detention vault. Disposal of the sediment will be performed in accordance with local and state regulations.

Mechanical Components

The detention basin of the proposed development facility has been designed to have a limited number of mechanical components. However, access hatches and cleanouts should always remain functional. Regularly scheduled maintenance will be performed in accordance with the manufacturer's recommendations. Additionally, all mechanical components will be operated at least once every three months to assure their continued performance.

Elimination of Potential Mosquito Breeding Habits

The most effective mosquito control program is one that eliminates potential breeding habitats. If proper sediment and debris removal practices are followed, water will not lay stagnant, limiting mosquito breeding habitats. Areas exhibiting stagnant ponds of water must be remedied in accordance with the inspector's recommendation.

Inspection

Regularly scheduled inspections of the facility will be performed, minimum once every three months. The primary purpose of the inspection is to ascertain the operational condition and safety of the facility, particularly the condition of roof drains, storm water vault, conveyance system, 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 any changes in the extent and scheduling of the procedures, if warranted. Finally, the facility inspections will also be used to determine the need for, and timing of, Corrective Maintenance procedures.

Corrective Maintenance Procedures

Corrective Maintenance may be required on an emergency or non-routine basis to correct problems or malfunctions and to restore the intended operation and safe condition of a stormwater management facility. Corrective Maintenance should be performed for stormwater detention vault in accordance with manufacturer's recommendations.

Removal of Debris and Sediment

Sediment, debris and trash, which threaten the discharge capacity of a stormwater management facility, will be removed immediately and properly disposed of in a timely manner. Equipment and personnel must be available to perform the removal work on short notice. Debris and sediment will be disposed of off-site at a predetermined location, which accepts refuse in an appropriate manner consistent with all local, state and federal regulations.

Structural Repairs

Structural damage shall be repaired immediately to cracks in pipes, broken or warped lids or roof drains. Equipment, materials and personnel must be available to perform these repairs on short notice. The immediacy of the repairs will depend upon the nature of 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 shall be undertaken by qualified personnel. The industry standard of life expectancy of outlet structures is 40 years.

Embankment and Slope Repairs

Damaged embankments and side slopes will be repaired promptly. This damage can result from rain or flood events, vandalism, animals, vehicle or neglect. Typical problems include settlement, sloughing, seepage and rutting.

Equipment, materials and personnel must be available to perform these repairs on short notice. The immediacy 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 damage and the design performance of geotechnical repairs should only be undertaken by qualified personnel.

Extermination of Mosquitoes

If neglected, a stormwater management facility can readily become an ideal mosquito breeding area. Extermination of mosquitoes will usually require the services of an expert, such as the local Mosquito Extermination Commission.

Proper procedures carried out by trained personnel can control the mosquitoes with a minimum of damage or disturbance to the environment. If mosquito control in a facility becomes necessary, the preventative maintenance program should also be re-evaluated, and more emphasis placed on control of mosquito breeding habitats.

Erosion Repair

Vegetative cover or other protective measures are necessary to prevent the loss of soil from the erosive 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 will be initiated to prevent further loss of soil and any subsequent danger to the stability of the facility. Soil loss can be controlled by a variety of materials and methods, including gabion lining, sod, seeding, and re-grading. The local Soil Conservation District can provide valuable assistance in recommending materials and methodologies to control erosion.

Elimination of Animal Burrows

The landscape stability can be impaired by animal burrows and can also present a safety hazard for maintenance personnel.

Burrows will be plugged by filling with materials like the existing material and capped just below the grade with stone, concrete or other material. If plugging of the burrows does not discourage the animals from returning, further measures shall be taken to either remove the animal population or to make critical area of the facilities unattractive to them.

Snow and Ice Removal

Accumulations of snow and ice can threaten the functionality of a stormwater management facility, particularly at roof drains and discharge pipes. Structures shall be inspected after major storm events or extended periods of cold weather. Providing the equipment, materials and personnel necessary to monitor and remove snow and ice from these areas is critical to the continued functioning of the facility during the winter months. Standing water should not be tolerated due to damage caused during the freeze/ thaw cycles.

Details

Careful, meticulous, and frequent attention to the performance of maintenance items such as painting, tree pruning, leaf collection, debris removal, and grass cutting will result in a stormwater management facility that remains both functional and attractive.

2.6 Maintenance Log Measures and Procedures

Log Records for Annual Evaluation

Preventative Maintenance Logs

Maintenance Schedule	Stormwater Management Equipment No.	Preventative Maintenance Record No.	Date(s) of Maintenance
(1st Quarter) MM/DD/YYYY			
(2nd Quarter) MM/DD/YYYY			
(3rd Quarter) MM/DD/YYYY			
(4th Quarter) MM/DD/YYYY			
(Unscheduled) MM/DD/YYYY			

Corrective Maintenance Logs

Maintenance Schedule	Stormwater Management Equipment No.	Corrective Maintenance Record No.	Date(s) of Maintenance
(1st Quarter) MM/DD/YYYY			
(2nd Quarter) MM/DD/YYYY			
(3rd Quarter) MM/DD/YYYY			
(4th Quarter) MM/DD/YYYY			

(Unscheduled) MM/DD/YYYY			

The party responsible shall maintain records documenting the condition of the stormwater management system, maintenance work performed and maintenance work necessary, and any safety hazards. The records shall include a schedule for performing needed maintenance, repairs or safety improvements.

Inspection Checklist Logs

1. The responsible party shall report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.
2. The maintenance crew should fill out the checklist in the field manual when performing each inspection/maintenance task.
3. After the maintenance task is performed, the checklist should be filed in the Maintenance Plan and recorded in the log.

Sample Inspection Checklist is found in Appendix B

2.7 Soil Erosion & Sediment Control Notes

The proposed development plans to disturb greater than 5,000 square feet of land, therefore, a Soil Erosion and Sediment Control (SESC) Plan has been developed and will be submitted for certification to the Hudson-Essex-Passaic Soil Conservation District (HEPSCD), pursuant to the SESC Act, Chapter 251, P.L. 1975 as amended (N.J.S.A. 4:24-39 et. seq.). The proposed SESC measures have been designed in accordance with the Standards for SESC in New Jersey.

A soil erosion and sediment control plan and associated engineering details have been developed to control sediment during construction activities. Silt fence will be installed around the perimeter of the areas to be disturbed prior to start of construction. The project entrances will be stabilized with 1" to 2" stone tracking pads. Inlet protection will be provided at existing and proposed inlets as indicated on the soil erosion control drawings to minimize sediment from entering the subsurface storm drainage system. Tree protection fencing will be implemented around the trees on-site that are to be protected during construction.

Stabilized Construction Access (SCA)

SCA is proposed for the site accesses along South 10th Street. The SCA will reduce the tracking of sediment onto the public roadway and mitigate the potential for sediment laden runoff to enter the municipal stormwater and adjacent waterways. All SCAs should be installed and maintenance in accordance with the Somerset Union County Soil Conservation District and SESC plan.

Silt Fence Perimeter Protection

Silt Fence (SF) perimeter controls shall be installed along the down gradient edge of the active construction site. Per the SESC standard, the fence posts shall be construction of a hardwood with minimum diameter

of 1 ½ inches, spaced a minimum of 8-feet apart and extend a minimum of 2 feet above and below grade. The geotextile fabric hall be buried at least 6-inches below grade and extend at least 2 feet above grade. Metal fasteners and high strength reinforcement material shall be used to fasten the geotextile fabric to the posts in a manner that resists tearing away from the post. The fabric shall incorporate a drawstring in the top portion of the fence for added. The sediment barrier will intercept and detain small amounts of sediment from being discharged off-site. The silt fence perimeter controls shall be maintained in accordance with the SESC standards.

Stockpile Controls

Stockpile controls shall be placed around all stockpiles of fine materials that are inactive. See SESC notes. Stockpiles of suspect contaminated material should be placed on plastic sheeting and contained such that no potentially contaminated runoff can infiltrate the groundwater or flow off site.

Steep Slope Protection

Disturbed slopes shall be stabilized as soon as possible and slopes greater than 2:1 require steep slope stabilization per SCD. Stabilizations methods include temporary/permanent seeding, mulch, blankets and/or rolled products.

Inlet Protection

Existing and proposed inlets shall be protected per the SESC standards, which may include filter fabric with perimeter controls and/or inlet protection bags. The installation and maintenance of the inlet protection measures shall be in accordance with the SESC standards.

Dust Control

During demolition and construction activities, especially during dry conditions, a water truck shall be present on-site to mitigate the generation and release of fugitive dust and gaseous air pollutants. Areas of disturbed sediment and heavy traffic should be wetted regularly. Dust control shall be maintained, during demolition activities. The application of dust control polymers and/or perimeter screen fencing may be warranted depending on site conditions.

Concrete Truck Washout Areas

If on-site washout of the concrete trucks is proposed, a prefabricated washout container shall be delivered to the site. Per the SESC standards, the washout area shall not be located adjacent to identified surface drainage features or wetland areas. The washout container should be cleaned or changed when it is filled to 75% capacity.

Hazardous Material Storage and Spill Protection

All hazardous materials shall be properly stored and maintenance with appropriate spill protection measures.

HUDSON-ESSEX-PASSAOC SOIL EROSION AND SEDIMENT CONTROL NOTES

1. All soil erosion and sediment control practices on this plan will be constructed in accordance with the "new jersey standards for soil erosion and sediment control" last revised December 2017. These measures will be installed prior to any major soil disturbance or in their proper sequence and maintained until permanent protection is established.

2. All soil to be exposed or stockpiled for a period of greater than 14 days, and not under active construction, will be temporarily seeded and hay mulched or otherwise provided with vegetative

cover. This temporary cover shall be maintained until such time whereby permanent re-stabilization is established.

3. Seeding dates: the following seeding dates are best recommended to establish permanent vegetative cover within most locations in the HEPSCD: spring - 3/1-5/15 and fall - 8/15 - 10/1

4. Sediment fences are to be properly trenched and maintained until permanent vegetative cover is established

5. All storm drainage inlets shall be protected by one of the practices accepted in the standards, and protection shall remain until permanent stabilization has been established. storm drainage outlet points shall be protected as required before they become functional.

6. Mulch materials shall be un-rotted salt hay or small grain straw applied at the rate of 70-90 pounds per 1000 square feet and anchored with a mulch anchoring tool, liquid mulch binders or a netting tie down. other suitable materials may be used if approved by the soil conservation district.

7. All erosion control devices shall be periodically inspected, maintained and corrected by the contractor. Any damage incurred by erosion shall be rectified immediately.

8. The Township of Verona, department of engineering will be notified at least 48 hours prior to any soil disturbing activities. Email mcaggiano@boswellengineering.com.

9. The applicant must obtain a district issued report-of-compliance prior to applying for the certificate of occupancy or temporary certificate of occupancy or temporary certificate of occupancy from the borough, NJ - DCA or any other controlling agency. Contact the township973-857-4773 or email mcaggiano@boswellengineering.com to request a final inspection, giving advanced notice upon completion of the re-stabilization measures. A performance deposit may be posted with the district when winter weather or snow cover prohibits the proper application of seed, mulch, fertilizer or hydro-seed.

10. Paved roadways must be kept clean at all times. do not utilize a fire or garden hose to clean roads unless the runoff is directed to a properly designed and functioning sediment basin. Water pumped out of the excavated areas contains sediments that must be removed prior to discharging to receiving bodies of water using removable pump stations, sump pits, portable sedimentation tanks and/or silt control bags.

11. All surfaces having a lawn or landscaping as final cover are to be provided topsoil prior to re-seeding, sodding or planting. a depth of 5.0 inches, firmed in place, is required, as per the standards for topsoil and land grading, last revised December 2017.

12. All plan revisions must be submitted to the district for proper review and approval.

13. A crushed stone wheel cleaning tracking-pad is to be installed at all site exits using 2 ½-1" crushed angular stone (ASTM 2 or 3) to a minimum length of 50 feet and minimum depth of 6". All driveways must be provided with crushed stone until paving is complete.

14. Steep slopes incurring disturbance may require additional stabilization measures. These "special" measures shall be designed by the applicant's engineer and be approved by the soil conservation district.

15. The Township of Verona department of engineering shall be notified, in writing, for the sale of any portion of the project or for the sale of individual lots. new owners' information shall be provided. additional measures deemed necessary by the township officials shall be implemented as conditions warrant.

2.8 Training Records

- Mandatory Stormwater Management Basic Training and Field Manual Usage Training for new maintenance crews
  - Occupational Safety Training
  - Subcontractor training, if applicable Content of Training

- Stormwater Management Basic Training
  - Purposes and Functions of BMPs Training Material

    NJDEP Stormwater BMP Manual, Chapter Nine: Structural Stormwater Management Measures

    Chapter 9.1 Bioretention Systems
    Chapter 9.2 Constructed Wetlands
    Chapter 9.3 Dry Wells
    Chapter 9.4 Extended Detention Basins
    Chapter 9.5 Infiltration Basins
    Chapter 9.6 Manufactured Treatment Devices
    Chapter 9.7 Pervious Paving Systems
    Chapter 9.8 Rooftop Vegetated Cover Chapter 9.9 Sand Filters
    Chapter 9.10 Vegetative Filter Strips
    Chapter 9.11 Wet Ponds
    Chapter 9.12 Grass Swales
    Chapter 9.13 Subsurface Gravel Wetlands

More training information is available at NJ Stormwater.org (http://www.nj.gov/dep/stormwater/training.htm)

Vegetation Care

Training Material

- NJDEP Stormwater BMP Manual, Chapter Seven: Landscaping (provides information on vegetation and landscaping for stormwater management

measures)
- Maintenance Plan Equipment and

Operation Training

Training Material
- Equipment or tool manufacturer's Operation & Maintenance Manual

Occupational

Safety
- OSHA Training
- Equipment or tool manufacturer's Operation & Maintenance Manual

Training attendance sheets should be attached by the responsible party after each training.

Safety Training

- Wear safety ropes before entering the system for maintenance,
- Check for the presence of hazardous gases before entering the system
- Check for the presence of any poisonous plants.
- Before commencing work, tenants should be notified with a 72-hour timeframe, unless in the case of an emergency.
- At time of work signs should be placed outside garage entrance notifying temporary "NO ACCESS"
- Licensed and qualified professionals only should be allowed to carry out the work. License number should be provided and recorded.

Professional is to adhere to all applicable local, state, and federal laws and regulations, and the safety instructions provided by the equipment or device manufacturers

Safety Equipment	**Purpose**	**Storage Location**	**Responsible Party**
Hard Hats	Protect workers from head injuries during maintenance and equipment operation	Maintenance vehicle / storage shed	Maintenance Supervisor
High-Visibility Safety Vest	Improves worker visibility when working near roadways or parking areas	Maintenance vehicle	Maintenance Staff
Safety Glasses / Goggles	Protect eyes from debris during sediment removal or vegetation cutting	Maintenance vehicle toolbox	Maintenance Staff
Work Gloves	Protect hands when handling debris, sediment, or tools	Maintenance vehicle	Maintenance Staff
Steel-Toe Boots	Protect feet from heavy objects and uneven terrain	Issued to personnel	Maintenance Staff

Safety Equipment	**Purpose**	**Storage Location**	**Responsible Party**
Hearing Protection (earplugs or earmuffs)	Required when operating loud equipment such as mowers or blowers	Equipment storage area	Maintenance Staff
First Aid Kit	Immediate treatment of minor injuries	Maintenance vehicle	Maintenance Supervisor
Flashlight / Headlamp	Illumination for inspecting inlets, pipes, or low-light areas	Maintenance vehicle	Maintenance Staff
Traffic Cones / Barricades	Establish safe work zone around maintenance area	Maintenance vehicle	Maintenance Staff
Gas Detector	Monitor hazardous gases during inspection of enclosed structures	Maintenance vehicle	Maintenance Supervisor
Safety Harness and Lifeline	Required for confined space entry into stormwater structures	Equipment storage area	Trained Personnel Only
Two-Way Radio / Mobile Phone	Communication in case of emergency	Maintenance vehicle	Maintenance Staff
Fire Extinguisher	Fire control for equipment or fuel hazards	Maintenance vehicle	Maintenance Supervisor

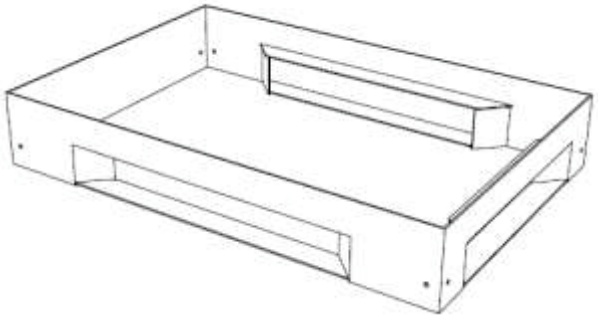
APPENDIX A – STORMWATER SYSTEMS MAINTENANCE

StormScape™
Assembly and Maintenance

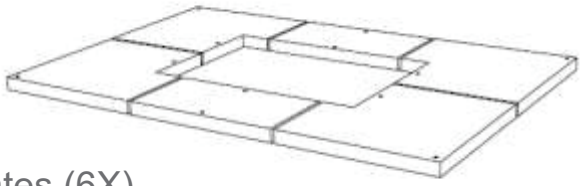
Hydro International, 94 Hutchins Drive, Portland, Maine 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro.com

Materials Supplied By Hydro International

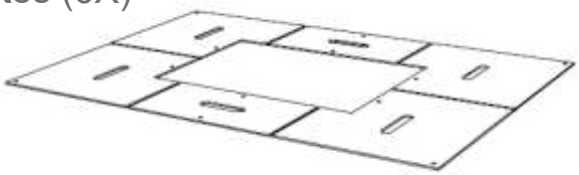
Frame

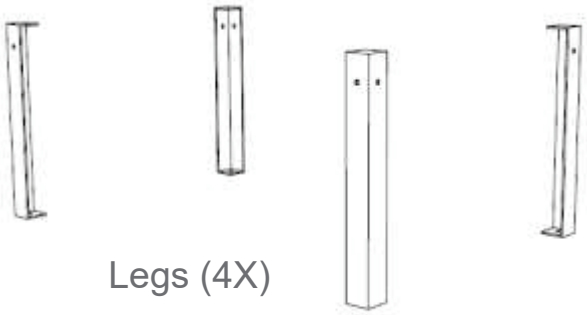


Tiles and bolts (6X)



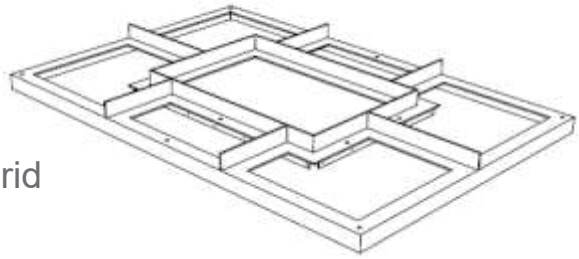
Plates (6X)





Legs (4X)

Grid



Perforated Baffle

- 1/2-inch Leg-to-Frame Bolt Set (4X)

- Filter Media (2 Tons)

Hydro International, 94 Hutchins Drive, Portland, Maine 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro.com

Materials Supplied By Contractor

- Perforated underdrain pipe as shown in General Arrangement Drawing
- Concrete post supports (i.e. precast block or Sonotube)
- Anchors to attach to post supports (i.e. wedge anchors or cast-in anchors)
- Shrub or small tree to meet local climate conditions

Handling and Storage

Hydro International's **StormScape** components are manufactured utilizing highly durable architectural grade components; however, improper handling can result in damage. Failure to comply with handling, storage, and assembly instructions voids all warranties.

1. Upon delivery of the **StormScape** components, inspect immediately for defects or shipping damage. If any discrepancies or missing components are identified, notify Hydro International prior to unloading to initiate corrective action.
2. At all times, avoid unnecessary and extreme impacts to the internal components. At no time shall anyone step, stand, or otherwise place an unnecessary load, on the components.
3. The **StormScape** shall be, as far as practical, assembled and installed as soon after delivery as possible.

Required Tools and Equipment

- Measuring Tape
- Socket Wrench and Set
- Box Wrench and Set
- Hex Key Set
- Wood Blocking
- Hammer Drill with 1/2 in. Masonry Bit
- Production Detail Drawings

Types of Installation

There are two options of installation available — **Underdrain** and **Stand-Alone**

In the **Underdrain** arrangement, the system is installed directly in a rough excavation with no enclosing box or line, but with an underdrain comprised of a perforated discharge pipe embedded in coarse stone. The discharge pipe is installed with an unperforated riser that acts as both a bypass and as an inspection port. Using this configuration, the Underdrain must meet the regulatory requirements for separation from the seasonal high water table.

If the surrounding soil testing confirms that the soil meets all regulatory requirements for infiltration (i.e., soil hydraulic conductivity, seasonal high water table, and groundwater mounding), the open structure of the system allows for installation as a **Stand-Alone** MTD that encourages stormwater infiltration and runoff volume reduction by maximizing contact with native soils. This arrangement does not have an underdrain installed.

The following set of photographs show the installation steps for a Stand-Alone arrangement. The additional steps required to install the discharge piping required in an **Underdrain** arrangement are shown on Page 6 of this document.

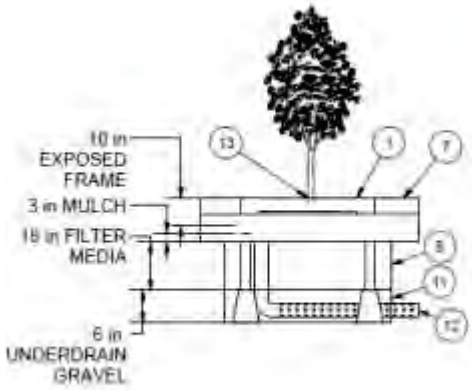
Assembly

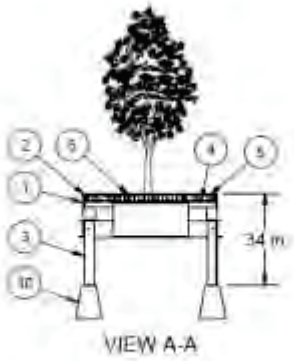
- Excavate a rectangular hole 4 x 6 feet by 3 feet deep.

Assembly

- Install **Post Supports** on gravel base.
- Bolt **Legs** to **Feet** with provided anchor bolts.

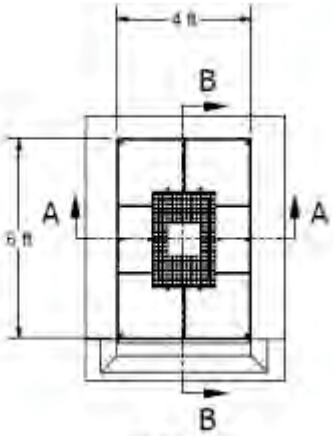
Underdrain Assembly



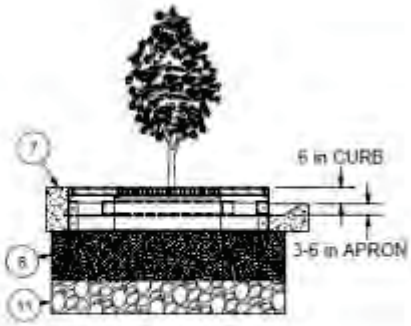


VIEW A-A

Parts List		
ITEM	PART NUMBER	QTY
1	FRAME	1
2	GRID	1
3	LEG	4
4	ACCESS PLATE	6
5	SURFACE TILES	6
6	GRATING	1
7	SIDEWALK (BY OTHERS)	1
8	MEDIA	2 CY
9	BAFFLE	1
10	CONCRETE FOOTING	4
11	GRAVEL FOR FOOTINGS (BY OTHERS)	1
12	OPTIONAL UNDERDRAIN/BYPASS (BY OTHERS)	1
13	TREE (BY OTHERS)	1



PLAN VIEW



VIEW B-B

- For **UNDERDRAIN** installation refer to diagram above:
  - Embed perforated pipe assembly (Item 12) roughly centered within underdrain gravel (Item 11) bed with perforated pipe positioned towards receiving drainage network.
  - Perforated pipe assembly, underdrain gravel or material specifications for these components can be provided by Hydro upon request.
  - Connect pipe to drainage pipe network per site drainage plans.

Assembly

- Bolt **Frame** to **Legs** with provided bolts.

Hydro International, 94 Hutchins Drive, Portland, Maine 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro.com

Assembly

- Place **Grid** in **Frame** and square the frame to fit.
- Install perforated pipe and riser as shown in General Arrangement drawing (not shown).
- Backfill gravel to within two feet of grade (not shown).

Assembly

- Backfill the excavation to grade with provided media and rake level.

Assembly

- Install **Baffle** to **Grid** (not shown).
- Install **Plates** and **Tiles** with supplied bolts.
- Plant tree root ball in supplied media.
- Top media with shredded bark mulch.
- Install **Grating** around tree trunk.

Assembly

- Smoothly grout apron to direct runoff to throat of unit.

Maintenance

- The StormScape collects trash and leaves in the perimeter of the unit
- To maintain the system, the tiles can be removed for easy access.

Maintenance

- View of throat of the StormScape clogged with leaves and debris

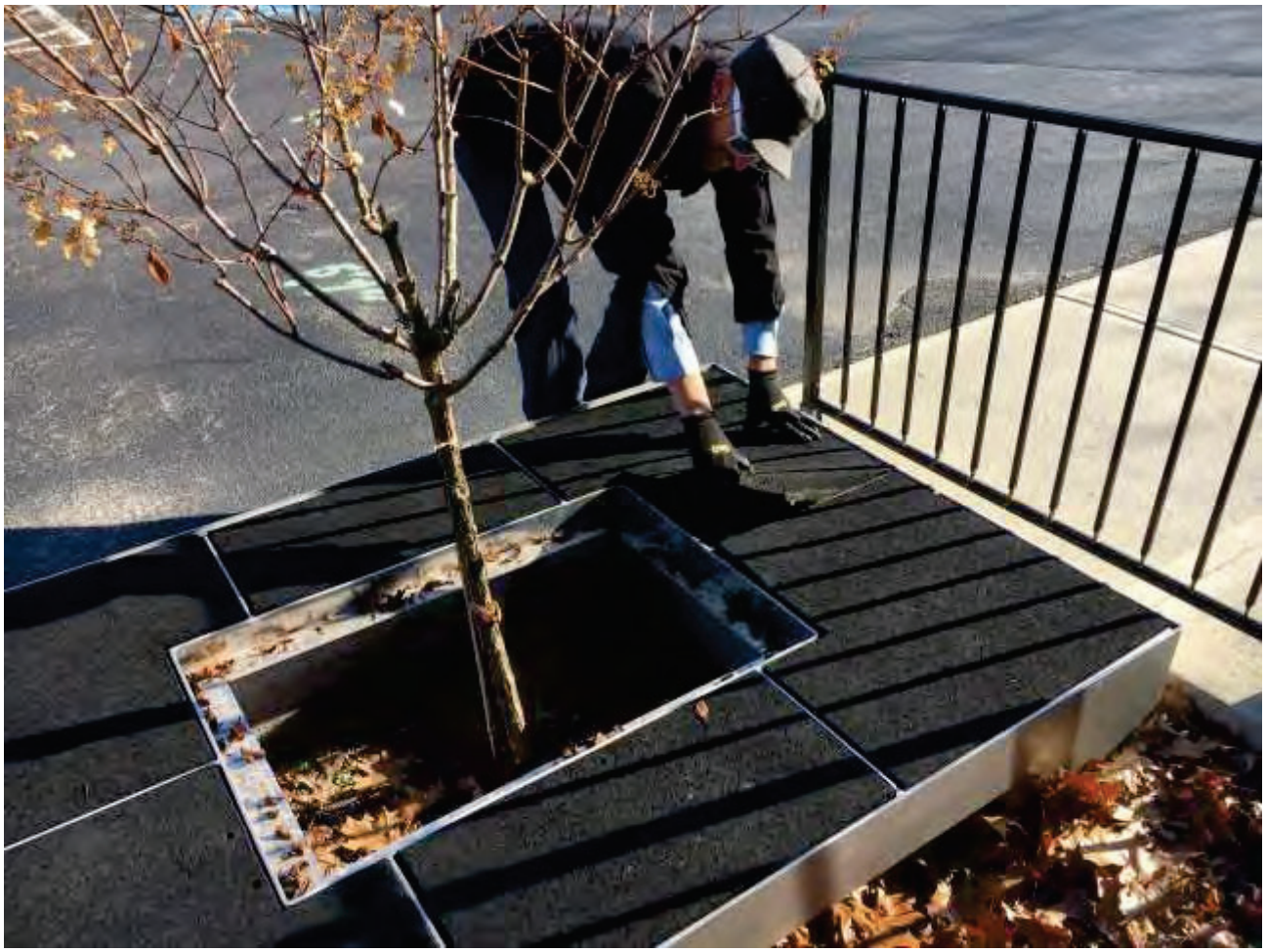
Maintenance

- Remove **Grating** from around the tree trunk.

Maintenance

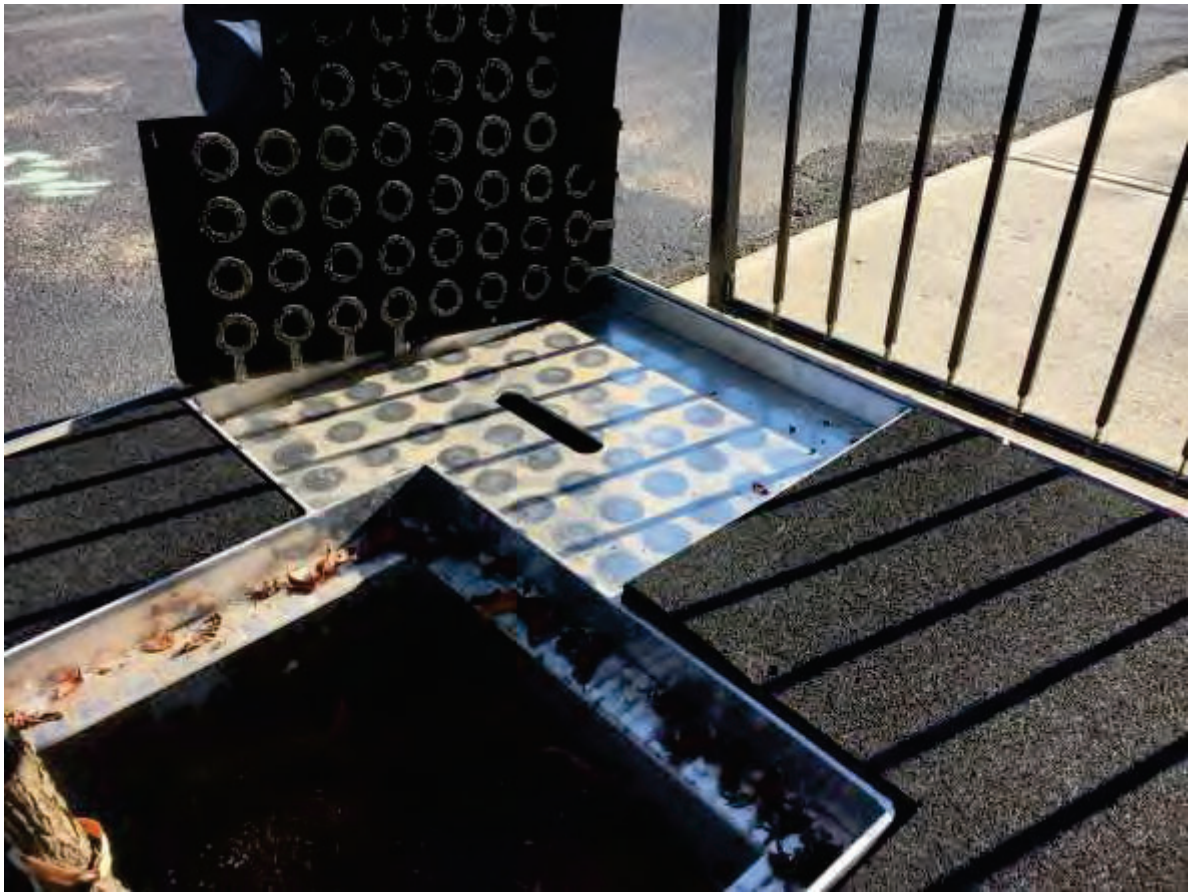
- Remove security bolts from the **Tiles** with hex wrench

Maintenance



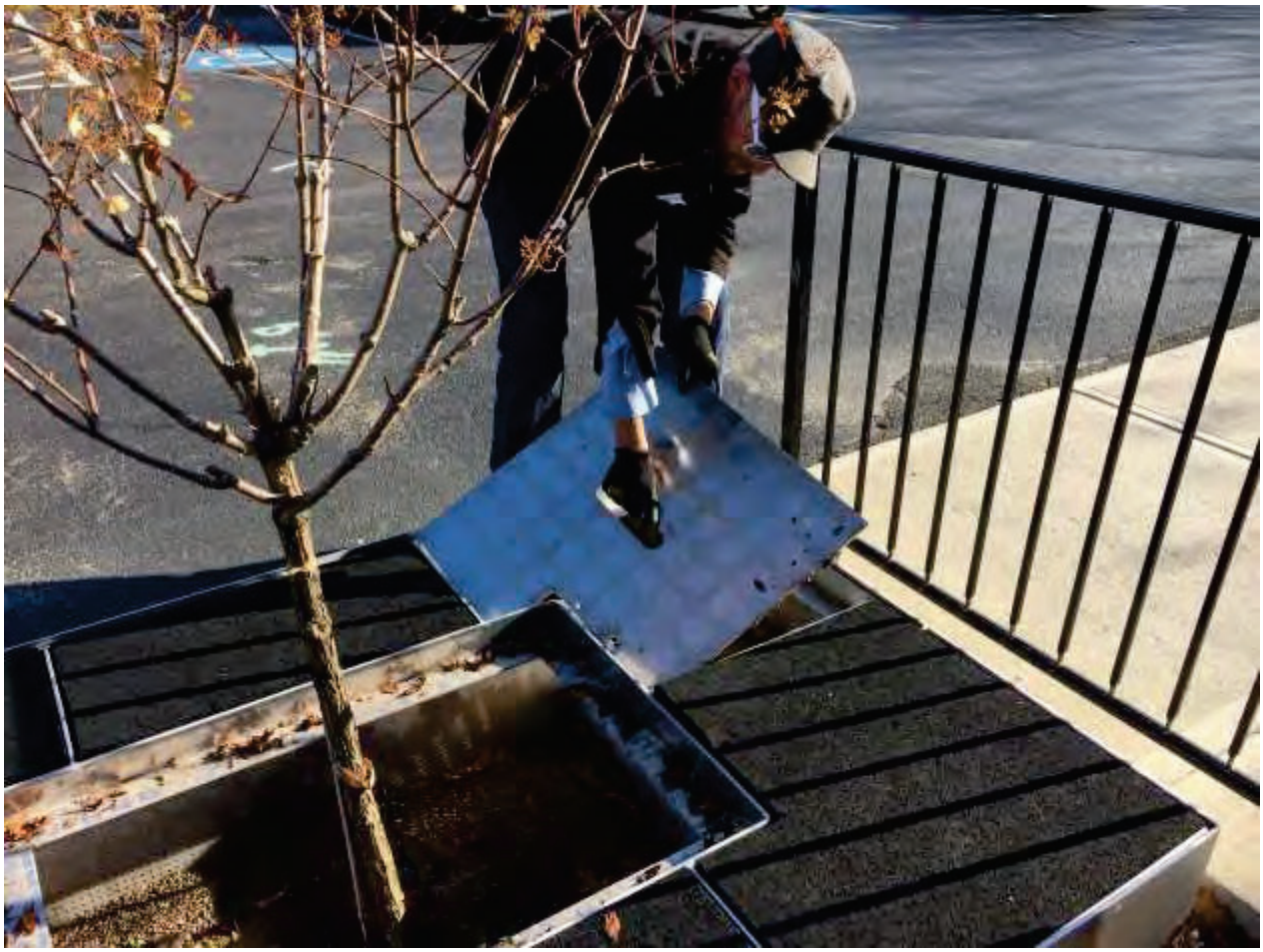
- Remove **Tiles** from surface of StormScape

Maintenance



- View of the **Tile** being removed from the StormScape

Maintenance



- Remove **Plate** from StormScape

Maintenance

- View of leaves and debris within StormScape

Maintenance

- View of StormScape with all **Tiles** removed

Maintenance

- Remove leaves, trash and debris by hand or with a small rake.
- Remove and replace mulch layer.
- Remove and replace top layer of media if necessary.
- Replace plates, tiles and security screws.

ACO StormBrixx®

Geocellular Stormwater Storage Product Maintenance

Prevention
Inspection
Maintenance
Cleaning

ACO StormBrixx® SD and HD

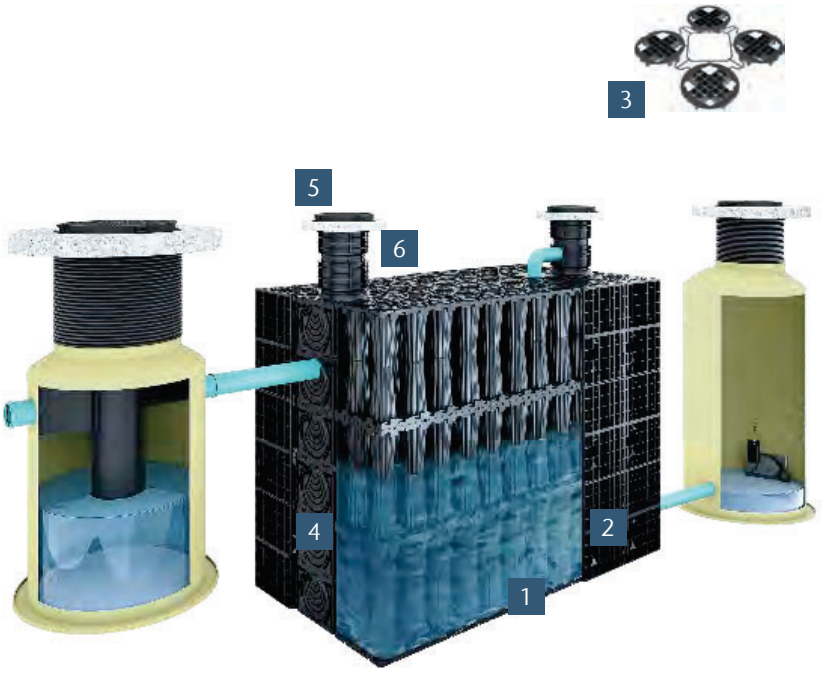
ACO StormBrixx® is a unique and patented geocellular stormwater management system for detention and infiltration usage.

Its versatile design allows the system to be used in configurations and applications across all construction environments as a standalone solution or as part of an integrated LID (Low Impact Development) or BMP (Best Management Practices). Systems may or may not include pre-treatment to remove sediment and/or contaminants prior to entering the storage area. Those without pre-treatment require greater attention to system functionality and may require additional maintenance.

In order to sustain proper system functionality, ACO offers the following general maintenance guidelines for the StormBrixx® product.

Contents

System Components



1. StormBrixx Tank Bodies*
2. Side Panel*
3. Top Cover*
4. Remote Access Unit*
5. Remote Access Cover - Ductile Iron
6. Extension Shaft*

* Image shown represents a StormBrixx® SD system. The Remote Access Unit may be swapped out with the Remote Access Plate. ACO offers vented and non-vented Remote Access Covers.

1 Prevention Measures

1.1 PRIOR TO & DURING CONSTRUCTION

Siltation Prevention of the Stormwater System
Conform to all local, state, and federal regulations for sediment and erosion control during construction.

Install site erosion and sediment BMP's (Best Management Practices) required to prevent siltation of the stormwater system.

Inspect and maintain erosion and sediment BMP's during construction.

1.2 POST CONSTRUCTION

Prior to Commissioning the ACO StormBrixx® System
Remove and properly dispose of construction erosion and sediment BMP's per all local, state, and federal regulations.

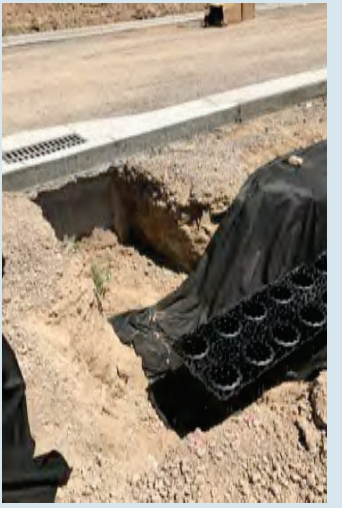
Care should be taken during removal of the BMP devices to prevent collected sediment or debris falling into the stormwater system.

Flush the ACO StormBrixx® system to remove any sediment or construction debris immediately after the BMP's removal. Follow the maintenance procedure outlined.

The prevention measures we recommend will increase the efficiency of the installed tank and the life of the entire system.

StormBrixx® is built to be used in areas in which protecting the environment is important. The prevention measures allow for the system as well as the locale it is installed to be sustainable.

StormBrixx® provides top of the line stormwater management solutions for detention, retention, reuse, and infiltration systems. The long term environmental focuses of StormBrixx® through LID, SuDS, MS4, and BMP will benefit the installer, the land owner, and the nearby environment.



Prevention measure

2 Inspections

Follow all local, state, and federal regulations regarding stormwater BMP inspection requirements. The results of the visual inspection, notes and repairs can be recorded in an operating logbook as a recommended best practice. These records will allow decisions to be made about the necessary frequency of future inspection and maintenance measures.

ACO makes the following recommendations:

2.1 VISUAL INSPECTION

Year One
During the first service year a visual inspection should be completed during and after each major rainfall event, in addition to every 6 month period to monitor and establish what sediment and debris buildup occurs.

Each ACO StormBrixx® system is unique to the application and multiple criteria can affect maintenance frequency as such:

- System Design: pre-treatment/no-treatment, inlet protection, stand-alone device.
- Surface area collecting from: hardscape, gravel, soil, or any other surface.
- Adjacent Area: soil runoff, gravel, trash.

2.2 ANNUAL INSPECTION

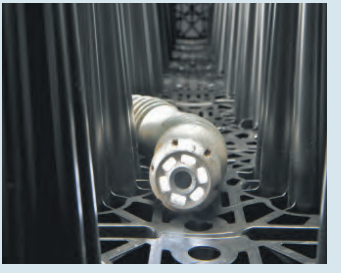
Year Two
Establish an annual inspection frequency based on the information collected during the first year. At a minimum an inspection should be performed at 6 month intervals.

2.3 ITEMS TO INSPECT

Components
- ACO StormBrixx® Remote Access Units/ Plates and inspection ports.
- Inlet and Outlet points.
- Discharge area.

2.4 IDENTIFY AND REPORT

Maintenance required if:
- Sediment and debris accumulation 6” or more.
- System backing up.
- Make operating logbook notes if needed.



Inspection camera

3 Maintenance Procedure

3.1 SURFACE ACCESS

Regulations
Conform to all local, state, and federal regulations.

Access Cover
Locate access cover(s) at the surface connected to the tank.

3.2 SAFETY

Access Cover
Once located, safely open lid and remove.

3.3 SYSTEM INSPECTION

System Debris
Perform an inspection of the tank to locate any debris. This can be done visually, with or without an inspection camera.

3.4 STANDING WATER

Remove Water
If the tank has standing water in it, you will need to vacuum the water first before visually inspecting the tank.

3.5 HIGH PRESSURE

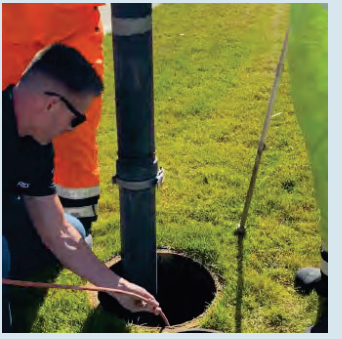
System Clearing
Use the high pressure jet nozzle/wand to loosen and suspend any solid debris that has built up.

Access to high pressure water and vacuum will be needed to clear the tank of any built up debris.

A minimum water pressure of 2,500 PSI is recommended. The maximum pressure depends on the geotextile fabric chosen. Please check with fabric manufacturer for max PSI.

To ensure correct insertion angle of the high pressure jet nozzle, we recommend using a pipe elbow.

Alternatively, a nearby fire hydrant can be used to suspend debris within the StormBrixx® system before vacuuming up the water.



Vacuum removal of debris

Wand used to loosen debris

3 Maintenance Procedure

3.6 WATER LEVEL

Optimal Water Depth
Once the water level has reached 12" or more, shut off and remove high pressure jet nozzle/wand.

3.7 VACUUM HOSE

Remote Access Unit/Plate
Insert vacuum hose via the remote access unit/plate and begin removing all debris that is now suspended in water. Do this until all water has been removed.

3.8 REPEAT

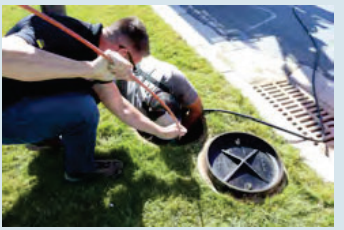
Water and Debris
Not all water and debris may be removed in the first round, you may need to add and remove more water.

3.9 FINAL INSPECTION

Cleared Tank
Once all debris has been removed, inspect tank again to make sure everything has been cleared.

3.10 REMOVE EQUIPMENT

Replace Cover
Once the tank is clear of debris and water, remove all equipment and place the cover back on the tank. Secure cover accordingly.



Final inspection

Camera view of clean tank

For further information on ACO products, please visit the ACO USA website. This allows access to technical data, videos, images, specifications, and installation instructions.

www.acoswm.com/stormbrixx

ACO, Inc.

West Sales Office
825 W. Beechcraft St.
Casa Grande, AZ 85122
Tel: (520) 421-9988
Toll Free: (888) 490-9552
Fax: (520) 421-9899

Northeast Sales Office
9470 Pinecone Drive
Mentor, OH 44060
Tel: (440) 639-7230
Toll free: (800) 543-4764
Fax: (440) 639-7235

Southeast Sales Office
4211 Pleasant Road
Fort Mill, SC 29708
Toll free: (800) 543-4764
Fax: (803) 802-1063

info@acousa.com
www.acousa.com

Print #SB701

ACO. creating the future of drainage

Pervious Pavement System Overview

Functionality

Pervious paving systems are paved areas that produce less stormwater runoff than areas paved with conventional paving. This reduction is achieved primarily through the infiltration of a greater portion of the rain falling on the area than would occur with conventional paving. This increased infiltration occurs either through the paving material itself or through void spaces between individual paving blocks known as pavers.

Pervious paving systems are divided into two general types. Each type depends primarily upon the nature of the pervious paving surface course and the presence or absence of a runoff storage bed beneath the surface course. Porous paving and permeable paver with storage bed systems treat the stormwater quality design storm runoff through storage and infiltration. Therefore, these systems have adopted TSS removal rates similar to infiltration structures. The adopted TSS removal rate for each type of pervious paving system is from 80%.

Pervious paving systems are used to reduce runoff rates and volumes from paved, on-grade surfaces such as patios, walkways, driveways, fire lanes, and parking spaces. Pervious paving systems with runoff storage beds achieve these reductions through storage of runoff and eventual infiltration into the subgrade soils. Through this infiltration process, these types of pervious paving systems also achieve stormwater quality requirements.

Proper care and attention in the long-term maintenance of the stormwater management measure is critically important to the safety and health of the public.

Type of BMP – Dry Stormwater Management Measure

The pervious pavement system shall fully drain within 72 hours of the most recent rainfall. Standing water in excess of 72 hours is a sign of the porous pavement failure. It may also contribute to mosquito breeding and other health and safety issues. At no time shall there be ponding on the surface of the pavement.

Adjacent Landscaping

- Runoff from pervious areas should be directed away from the pervious paving system, where possible.
- Where it is not possible to direct runoff from adjacent landscaping away from a pervious paving system, a gravel strip or swale should be provided to filter and reduce the intrusion of sediment, with additional monitoring and corrective measures added to the maintenance plan.

Care should be taken in the selection of top dressing for nearby vegetated areas; particulates transported by wind or during rainfall or snowmelt could result in the clogging of the surface course. Preventative measures should be included in the maintenance plan and should be re-evaluated as necessary to ensure long-term functionality of the system.

Maintenance

Regular and effective maintenance is crucial to ensure effective pervious paving system performance; in addition, maintenance plans are required for all stormwater management facilities on a major development. In addition to the manufacturer's maintenance requirements, there are a number of required elements in all maintenance plans, pursuant to N.J.A.C. 7:8-5.8; these are discussed in more detail in *Chapter 8: Maintenance of Stormwater Management Measures*. Furthermore, maintenance activities are required through various regulations, including the New Jersey Pollutant Discharge Elimination System (NJPDES) rules, N.J.A.C. 7:14A. Specific maintenance requirements for pervious paving systems are presented below; these requirements must be included in the maintenance plan for pervious paving systems. Detailed inspection and maintenance logs must be maintained.

General Maintenance

- Failure to correctly maintain a pervious paving system will shorten its lifespan or result in system failure; therefore, the maintenance plan must ensure proper training of personnel and include the special equipment necessary in accordance with the industry's or manufacturer's requirements.
- The surface course must be inspected after every storm exceeding 1 inch of rainfall. If mud or sediment is tracked onto the surface course, it must be removed as soon as possible. Removal should take place when all runoff has drained from the surface course.
- The surface course must be inspected, at least once annually, for cracking, subsidence, spalling, erosion, deterioration and unwanted vegetation. Remedial measures must be taken as soon as possible. Herbicides must not be applied.
- The surface course of a pervious paving system must be vacuum swept, not power swept, at least four times per year. Vacuum sweeping must be followed by either air blowing or high-pressure power washing performed in accordance with the specifications recommended for the particular type of system. All dislodged material must be promptly removed.
    - The first annual maintenance must be performed in the spring.
    - Maintenance must additionally be performed in the autumn, after the fallen leaves are collected and removed.

- Each spring, after the last snow or ice event, the infiltration rate of the surface course must be tested in accordance with the methods of either ASTM C1701 or C1781, as corresponds to the post-construction test performed for the system. At least 3 locations must be tested. One of the locations must be in an area where sediment is most likely to be deposited, such as, but not limited to, a parking lot entrance. The other test locations must be evenly spaced across the system surface. The locations and results obtained must be recorded in the maintenance plan for future reference and compared to the as-built testing results as a metric for determining if a system requires corrective action. The chart provided below shows the approximate infiltration rate based upon the time it takes to infiltrate either 8 or 40 pounds of water specified in the above-cited tests. This chart should be included in the maintenance plan for future reference. The infiltration rate, I, is based upon the following calculation:

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

K = 126,870 in-lbs
M = water mass, lbs
D = ring diameter = 12 inches
t = 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 lbs**	***M* = 40 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

Take note that should the test be performed with a different quantity of water, the values in the chart above cannot be used.

- Corrective action must be immediately taken to restore the infiltration capacity of the pervious paving system under the following scenarios:
  - □ Standing water is observed on the surface course; or
  - □ The testing methods above show an infiltration rate of 20 inches per hour or less for a system designed for quantity control or 6.4 or less for a system designed for water quality control only.
- 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.
- Under no circumstances may any sealants or coatings be applied to pervious paving systems, except for those approved by the manufacturer to improve surface course resistance to de-icing chemicals or refresh traffic striping.
- Over the lifetime of the surface course, no more than 10% of its surface area may be patched with impervious material such as bituminous asphalt or concrete. All patching must be recorded in the maintenance manual for future reference to prevent exceedance of this maximum.
- A detailed, written log of all preventative and corrective maintenance performed on the pervious paving system must be kept, including a record of all inspections and copies of maintenance-related work orders. Additional maintenance guidance can be found at https://www.njstormwater.org/maintenance_guidance.htm.

Storage Bed Drain Time

- The approximate drain time for the maximum design storm runoff volume below the top of the surface course must be indicated in the maintenance manual.
- If the actual drain time is significantly different from the design drain time, the components and groundwater levels must be evaluated and appropriate measures taken to return the pervious paving system to minimum and maximum drain time requirements.
- If the system fails to drain the maximum design storm volume within 72 hours, corrective action must be taken.

Cold Weather Maintenance

- Care must be taken when removing snow from the surface course; pervious paving surface courses may be damaged by snowplows or loader buckets set too low to the ground or not equipped with a rubber blade guard. Sand, grit or cinders may not be used on surface courses for snow/ice control.
- De-icing chemicals may not be used on pervious concrete less than one year old.
- De-icers containing magnesium chloride, calcium magnesium acetate or potassium acetate may never be used on pervious concrete.

PERVIOUS PAVEMENT MAINTENANCE GUIDE

TRIVERUS
CLEANING & ENVIRONMENTAL SOLUTIONS

INTRODUCTION

Pervious pavement is a specialized type of pavement that allows water to pass and filter directly through its porous structure. This reduces the water runoff from a site, allows groundwater recharge and limits the surface's contribution to stormwater. Pervious pavement includes pervious concrete, asphalt, and interlocking concrete pavers.

Properly maintaining pervious pavement will result in optimal performance, an operable infiltration rate, increased safety, reduced overall costs, and can prevent the need for total restoration. When needed, cleaning is performed by sweeping, vacuuming, and wet vacuuming to remove accumulated deposits. Each facility or project will have its own unique maintenance plan and schedule.

In this guide, we will review:

- Common misconceptions about maintaining pervious pavement
- Pervious pavement maintenance guidelines
- A pervious surface cleaning case study conducted by the University of New Hampshire Stormwater Center

This guide also includes:

- A sample maintenance log and inspection guide
- A "Best Practices" handout for facilities personnel

HOW DOES PERVIOUS PAVEMENT FAIL?

Before

After

Foreign material and organic deposits such as leaves, dust, and pine needles accumulate on pervious pavement. "Macro-plugging" forms a blocking layer on top of the pavement's porous structure, preventing water from penetrating the surface. Furthermore, if these organic deposits are not removed regularly, they begin to degrade and begin to plug below the pervious pavement's surface. This process limits the functionality of the pervious pavement, leading to increased water runoff, less groundwater recharge, and more contribution to stormwater.

According to the State of Washington's *Industrial Stormwater General Permit Coverage*, "Uncontrolled industrial stormwater runoff discharges oil, grease, silt, and toxic substances into our waterways. Even small concentrations of polluted runoff are bad for fish and other aquatic life. Copper and zinc, which are commonly found in industrial runoff, are harmful to salmon and other aquatic life, even at relatively low concentrations" (learn more about the dangers of uncontrolled industrial stormwater runoff in the *Industrial Stormwater General Permit Coverage* by the State of Washington referenced in the appendix on page 11).

In the *Before* photo to the left, organic deposits are clearly visible on top of the interlocking pervious pavers and aggregate. In the *After* photo, the pavers have been swept and cleaned, restoring the functional permeability and leaving behind only the aggregate between the pavers. All types of pervious pavement must be cleaned to maintain permeability. Routine inspection of your pervious surfaces will allow you to monitor any buildup and assess performance.

COMMON MISCONCEPTIONS ABOUT MAINTAINING PERVIOUS PAVEMENT

FICTION	FACT
Pervious parking lots, sidewalks, or other areas can be maintained just like a conventional non-pervious surface.	To perform properly, pervious pavement requires specific maintenance that differs from conventional maintenance.
It is possible for pervious pavement to be so clogged, replacement is the only way to restore percolation functionality	Almost all intact pervious surfaces can be restored to percolation functionality.
Routine maintenance of pervious pavement is expensive.	Routine maintenance is affordable and is much less expensive than total restoration.
Maintenance of pervious pavement is time-intensive.	Routine maintenance can be performed quickly, with little down-time. Routine maintenance ultimately takes much less time than total restoration or replacement.
Pervious pavement can't be maintained in freezing temperatures.	Pervious pavement can be maintained and will perform in freezing temperatures. They do have to be cleared of snow and ice differently than conventional surfaces.
Pervious pavement clogs from the bottom up.	Pervious pavement clogs from the top down. Organic and inorganic deposits break down on the surface and clog the permeable structure's voids.

MAINTENANCE GUIDELINES

TYPE OF MAINTENANCE	WHAT'S INVOLVED	HOW OFTEN
Inspection	• Visually inspect pervious pavement to ensure that it is clean of leaves, pine cones, pine needles, moss growth, and other organic deposits. • Visually inspect pervious surface for inorganic solids being deposited by rainwater flow from upland or adjacent areas and traffic. • Is the surface maintaining a satisfactory infiltration rate? Is there puddling or is water remaining within 30 minutes after rainfall has ended? If so, refer to periodic maintenance and/or spot cleaning. • Inspect for deterioration or spalling.	• Monthly
Routine Maintenance	• Remove organic deposits that have settled on the pervious surfaces. This can be done with blowing (with leaf blower or similar equipment), truck-sweeping, and/or dry vacuuming. • If organic deposits can be removed before they begin to degrade and break down, this can postpone the need for deeper cleaning.	• 2 to 4 times per year, more frequently for high use sites, sites near heavy trees or bush cover, or areas with high potential for run-off contamination. • As needed based on inspection
Periodic Maintenance	• Vacuum-assisted high-pressure water jet cleaning can be used regularly to remove foreign material and organic debris from above and below the permeable surface to restore percolation. • At a minimum, pavement vacuuming should occur following the last snow event of the year and just prior to the first snow event of the year to remove accumulated debris.	• Every 6 months • Immediately before and after winter
Spot Cleaning	• Clay soils are generally easy to remove using a Shop-Vac for a small area, a walk behind vacuum for a medium sized area, or a vehicle-mounted vacuum for larger areas. • For small areas of acute or subsurface clogging, high-pressure washing or high-pressure washing and vacuuming have proven to be more effective than vacuuming alone to regain lost infiltration.	• As needed

MAINTENANCE GUIDELINES *continued*

TYPE OF MAINTENANCE	WHAT'S INVOLVED	HOW OFTEN
Winter Maintenance	• Snow removal should be performed using a rotary broom. • If a rotary broom is not available, snow should be removed using a plow with a non-metallic cutting edge. Metallic cutting edges tend to catch stones and cause raveling. Consider hybrid rubber, rubber composite, or ceramic composite cutting edges for the application. • Do not use deicing chemicals. If the pavement is working properly there should not be ice. Small crushed aggregate (1/4 – 10, or similarly sized) can be used for anti-skid purposes. Do not use fine sands for this purpose. If anti-skid material is applied, it must be removed when winter maintenance ends (learn more about using crushed aggregate in the *Pervious Concrete Pavement Maintenance and Operations Guide* by the National Ready Mixed Concrete Association referenced in the appendix on page 11). • Perform aggressive periodic maintenance just before winter to ensure pervious voids are unclogged and free of organic deposits that may limit draining and contribute to freeze-thaw damage.	• Late fall prior to snowfall • During or after snowfall
Restoration	• Over time, restoration of pervious concrete percolation rates will become necessary, particularly if routine and periodic maintenance is not performed. • Typically, an average infiltration rate decrease of 25% from the initial value, or an infiltration rate less than 100 inches per hour, triggers the need for deep cleaning/unclogging. Neglected projects that have never been cleaned and are completely clogged should be restored to a drainage rate of 100-200 inches per hour, per ASTM C1701, by using specialized cleaning equipment. • Restoration is best accomplished by simultaneous pressure washing and vacuuming. There are several commercially available cleaning systems available to rehabilitate the pore structure of pervious pavement. Use of chemicals to clean pervious concrete should be done with extreme caution to prevent damage to the aquifer, the biological organisms within the pervious system, or the pervious concrete pavement itself.	• As needed
Administrative	• Fill out maintenance logs and record changes, results, etc. • Review the maintenance plan and adjust as necessary • If selling the property, pass on the maintenance history and maintenance plan to the new owners	• As needed

CASE STUDY: University of New Hampshire Stormwater Center

1. BACKGROUND

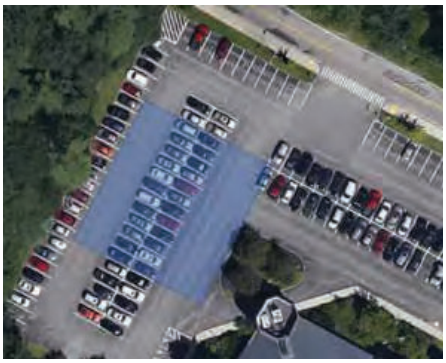
Triverus' high-efficiency surface cleaning technology has the ability to remove critical stormwater pollutants from impervious surfaces and restore the functionality of pervious/ porous surfaces. In 2019, an independent third party, the University of New Hampshire Stormwater Center (UNHSC), sought to quantify the capabilities of Triverus' cleaning technology.

A series of surface infiltration tests were conducted on various pervious pavements located on the UNH campus. These tests were performed using ASTN C1701 Standard Test Method for Infiltration Rate of In Place Pervious Concrete. This test is the industry standard for measuring pervious surface performance. Measurements were taken prior to and following cleaning with a Triverus Municipal Cleaning Vehicle (MCV), a commercially available cleaning vehicle that integrates Triverus 3800 PSI spray cleaning and recovery technology onto a Bobcat® Toolcat™ all-wheel steer carrier.

Two locations were identified for detailed testing: the West Edge porous asphalt lot and the Elliot Alumni Center porous asphalt lot. Both locations were on the UNH campus in Durham, New Hampshire.

A Triverus MCV cleaning pervious asphalt at UNHSC

West Edge Porous Asphalt Lot



Elliot Alumni Center Porous Asphalt Lot

CASE STUDY: University of New Hampshire Stormwater Center

2. TESTING LOCATIONS

The West Edge Porous Asphalt Lot

Built in 2005, the West Edge porous asphalt lot was 14 years old at the time of testing and received maintenance for at least the first five years of operation. Since 2010, minimal studies and maintenance had taken place. The area is approximately 5,000 square feet in size and had an average pre-cleaning infiltration rate of 3 in./hr. Due to the variability of the testing method, any permeable pavement with a surface infiltration rate less than 10 in./hr. is considered failed from a hydraulic perspective.

The West Edge lot was cleaned on July 8th, 2019. Climate statistics for Durham, New Hampshire during testing are below.

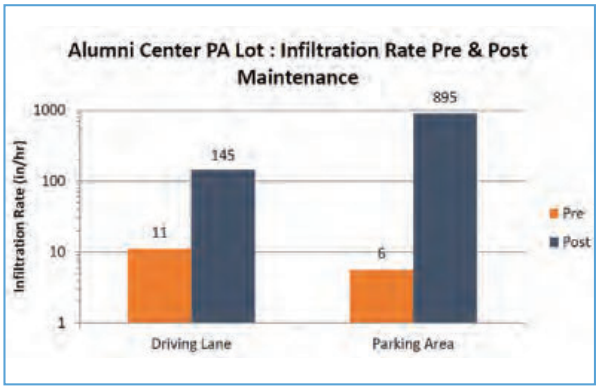
Parameter	Value
High Temperature	79 °F
Low Temperature	57 °F
Day Average Temperature	69.29 °F
Precipitation (past 24 hours from 04:56:00)	0.00 in
Dew Point	52.33 °F
High Dew Point	56 °F
Low Dew Point	49 °F
Average Dew Point	49 °F
Maximum Wind Speed	10 mph
Visibility	10 mi

Alumni Center Porous Asphalt Parking Lot

Built in 2012, the Alumni Center porous asphalt lot was seven years old at the time of testing and received maintenance for at least the first two years of operation. Since then, it was unclear how much maintenance was performed or if the maintenance was effective. From the very low pre-cleaning infiltration rate, it appeared no maintenance had occurred since 2014.

In 2015, a small test area of approximately 200 square feet in a parking spot and 200 square feet in a driving lane was conducted to assess restoration potential. The cleaning was conducted by UNHSC staff and consisted of low angle power washing into a vacuum. The overall restoration work took two staff approximately two hours per location. The experiment demonstrated the restoration potential of the technology and the need for advanced cleaning technology; at just over 50,000 square feet, the effort using staff and handwork was not insignificant (~125 hours for two staff).

The Alumni Center lot was cleaned on July 10th, 2019. Climate statistics for Durham, New Hampshire during testing are below. The infiltration results from this testing are shown below.

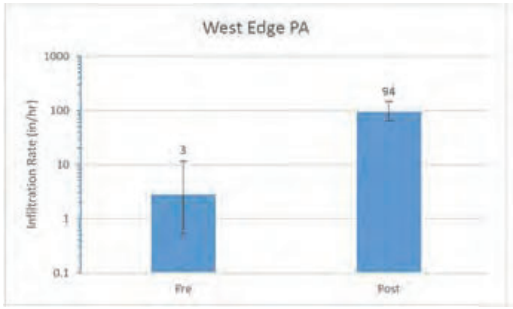


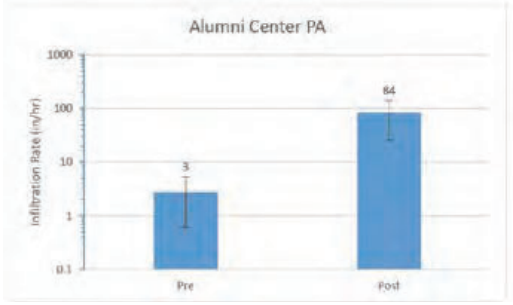
Parameter	Value
High Temperature	86 °F
Low Temperature	63 °F
Day Average Temperature	72.21 °F
Precipitation (past 24 hours from 04:56:00)	0.00 in
Dew Point	58.46 °F
High Dew Point	62 °F
Low Dew Point	54 °F
Average Dew Point	58.46 °F
Maximum Wind Speed	14 mph
Visibility	10 mi

CASE STUDY: University of New Hampshire Stormwater Center

3. CLEANING AND TESTING

During cleaning at both sites, material was removed from the pervious surfaces by the Triverus MCV and was separated and saved for testing. The water used and recovered by the MCV during the cleaning process was also saved for testing. The coarse solids were weighed and samples collected for laboratory analysis. Grab samples of the water slurry were taken and sent as a composite sample for laboratory analysis. The restoration process was inevitably longer and more time-intensive than typical routine maintenance, but resulted in a great performance increase. The average post-cleaning infiltration rate for the West Edge lot was 94 in./hr. This is considered functional and effectively restored. The cleaning took approximately 6 hours, and 150 lbs. of coarse sediment were removed from the area. The average post-cleaning rate for the Alumni Center lot was 84 in./hr. This is considered functional and effectively restored. The cleaning took approximately 4 hours, and 350 lbs. of coarse sediment were removed from the area*.





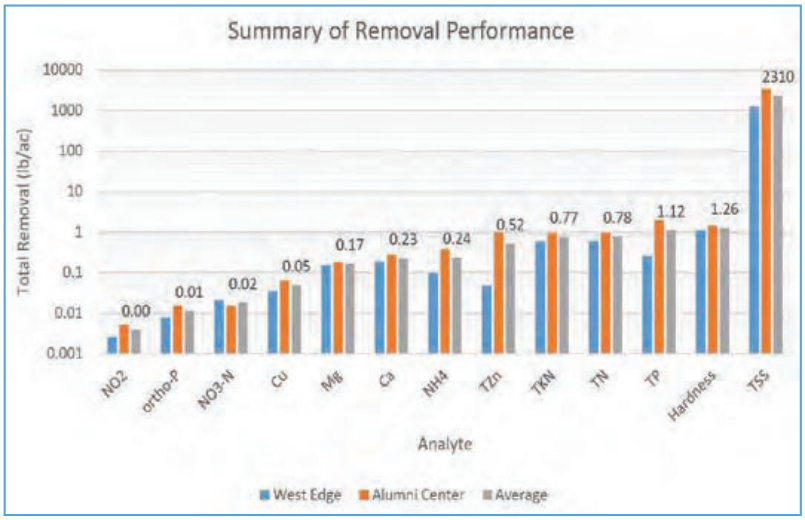
The coarse solids collected in the solids tray after several passes on the West Edge PA.

*The decrease in cleaning time from the West Edge lot was due in part to process efficiencies. Additional time reductions could be realized, particularly with respect to MCV support with a vacuum truck to reduce downtime associated with the disposal of removed material and refilling the water reservoir on the MCV. The detailed characterization and testing of the efforts take time and reduce restoration efficiency as well.

CASE STUDY: University of New Hampshire Stormwater Center

4. RESULTS

Overall, the restoration effort was extremely successful. UNHSC's research supports further exploration of restoration activities followed by more routine operation and maintenance such as vacuum sweeping twice per year. This data also reveals some significant differences in the pollutant partitioning between the liquid and solid fractions of the removed materials. It underscores the importance, particularly in nitrogen sensitive areas, of properly treating the removed waste materials. Learn more about this case study in the *Triverus Cleaning Technology Demonstration Report* by the University of New Hampshire Stormwater Center referenced in the appendix on page 11.



Summary of performance by site for the total removal of the solids, water, and slurry (note the logarithmic scale).

	REMOVAL (LB/AC)		
Analyte	Coarse Solid	Water & Fines	Total
Ca	-	0.23	0.23
Cu	0.05	0.00	0.05
Hardness	-	1.26	1.26
Mg	-	0.17	0.17
NH^4	0.22	0.02	0.24
NO^2	0.00	0.00	0.00
NO^3-N	0.00	0.02	0.02
ortho-P	0.00	0.01	0.01
TKN	0.49	0.27	0.77
TN	0.49	0.29	0.78
TP	1.01	0.12	1.12
TSS	2210	100	2310
TZn	0.48	0.04	0.52

Summary of average analyte removal rates for coarse solids, water and fines, slurry, and the total removed. Note the italicized values were measured BDL and assumed to be half the DL.

	Total Removal (lb/ac)			Equivalent Detection Limit (lb/ac)	
Analyte	West Edge	Alumni Center	Avg.	Solids	Water
Ca	.19	0.27	0.23	-	0.02
Cu	0.03	0.06	0.05	0.00	0.00
Hardness	1.10	1.42	1.26	-	0.11
Mg	0.15	0.18	0.17	-	0.00
NH^4	0.10	0.38	0.24	0.04	0.02
NO^2	0.00	0.01	0.00	0.00	0.00
NO^3-N	0.02	0.02	0.02	0.00	0.00
ortho-P	0.01	0.02	0.01	0.00	0.00
TKN	0.58	0.95	0.77	0.01	0.04
TN	0.60	0.96	0.78	0.01	0.04
TP	0.26	1.99	1.12	0.01	0.00
TSS	1253	3376	2310	0.00	0.75
TZn	0.05	0.99	0.52	0.00	0.00

Summary of performance by site for the total removal of the solids, water, and slurry. Note the Equivalent Detection Limit is converted to removal units from laboratory detection limits in units of mg/L. Detection Limits for Ca, Hardness, and Mg were not tested in the solids. Laboratory values BDL were assumed to be half the DL and are shown in italics.

Analyte	Coarse Solid	Water & Fines
NO^3-N	12%	88%
ortho-P	16%	84%
NO^2	47%	53%
TN	63%	37%
TKN	64%	36%
TP	90%	10%
NH^4	91%	9%
TZn	93%	7%
Cu	95%	5%
TSS	96%	4%

Percentages of the total mass of analyte found in the coarse solids and slurry (water & fines) fractions.

SOURCES CITED & FURTHER READING

Triverus Cleaning Technology Demonstration Report
University of New Hampshire Stormwater Center
https://www.unh.edu/unhsc/sites/default/files/media/triverus_infiltra□on_and_cleaning_report_final_10-19.pdf

Pervious Concrete Pavement for Stormwater Management
University of New Hampshire Stormwater Center
https://www.unh.edu/unhsc/sites/unh.edu.unhsc/files/unhsc_pervious_concrete_fact_sheet_4_08.pdf

Tech Brief: Pervious Concrete
U.S. Department of Transportation Federal Highway Administration
https://www.fhwa.dot.gov/pavement/concrete/pubs/hif13006/hif13006.pdf

Industrial Stormwater General Permit Coverage
State of Washington
https://apps.oria.wa.gov/permithandbook/permitdetail/17

Best Management Practice Fact Sheet 7: Permeable Pavement
Virginia Tech—Virginia State University
https://www.pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/426/426-126/BSE-275.pdf

Minnesota Stormwater Manual: Design criteria for permeable pavement
State of Minnesota
https://stormwater.pca.state.mn.us/index.php?□tle=Design_criteria_for_permeable_pavement

Standard Test Method for Infiltra□on Rate of In Place Pervious Concrete
ASTM
https://www.astm.org/Standards/C1701.htm

Pervious Concrete Pavement Maintenance and Operations Guide
National Ready Mixed Concrete Association
http://www.perviouspavement.org/downloads/pervious_maintenance_operations_guide.pdf

REGO PARK, QUEENS, NY

PERVIOUS RECOVERY

MCV in Action!

See the Municipal Cleaning Vehicle in action. View the video on Youtube!

Pervious Concrete Maintenance Log

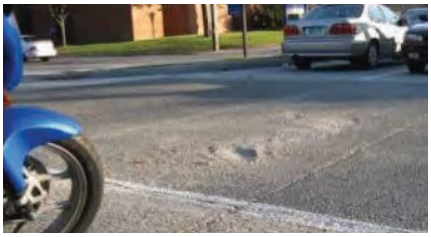
Site Name & Loction: ______________________________ Site #: ________ of ________

Date of Inspection	Weather & Pavement Conditions	ASTM C1701 Performed?	ASTM C1701 Results	Type(s) of Maintenance Performed	Type & Amount of Organic Buildup/ Debris Removed	Notes:	Maintenance Performed by:	Signature
	❑ Yes ❑ No	Before (in/hr): After (in/hr):						
	❑ Yes ❑ No	Before (in/hr): After (in/hr):						
	❑ Yes ❑ No	Before (in/hr): After (in/hr):						
	❑ Yes ❑ No	Before (in/hr): After (in/hr):						
	❑ Yes ❑ No	Before (in/hr): After (in/hr):						
	❑ Yes ❑ No	Before (in/hr): After (in/hr):						
	❑ Yes ❑ No	Before (in/hr): After (in/hr):						
	❑ Yes ❑ No	Before (in/hr): After (in/hr):						
	❑ Yes ❑ No	Before (in/hr): After (in/hr):						
	❑ Yes ❑ No	Before (in/hr): After (in/hr):						
	❑ Yes ❑ No	Before (in/hr): After (in/hr):						

PERVIOUS SURFACE INSPECTION:

ISSUE	CAUSE	REMEDY
	**ORGANIC DEPOSITS:** Organic deposits such as leaves, pine cones, and pine needles, collecting on pervious surfaces is normal.	• Cleaning with a blower (leaf blower or similar equipment), truck-sweeping, dry vacuuming, and/or vacuum sweeper fitted with water jets • Consistent, immediate cleaning will help prevent the need for deep cleaning or full restoration
	**LANDSCAPING RUNOFF:** Mulch, dirt, or grass can be deposited from upland or adjacent grassy areas that have loose soil or improper water flow. This is also caused by “track on/track off” deposits left by vehicles or workers leaving nearby worksites and travelling across the pervious pavement.	• Maintain upland and adjacent grassy areas • Seed upland and adjacent bare areas • Excessive water flow carrying debris toward the pavement should be diverted • Minimize “Track on/track off” deposits

WHAT TO LOOK FOR

ISSUE	CAUSE	REMEDY
	**SPALLING:** Spalling is caused by winter salt application leading to thawing and refreezing underneath the surface. This causes the surface to pop out, peel off, or flake off.	• Repair • Limit or stop use of salt in winter months • Initiate deep cleaning protocol prior to snowfall and cold weather
	**MOSS GROWTH:** Moss growth is caused by clogged pavement pores.	• Remove organic and inorganic deposits by aggressive pressure washing and vacuuming • Apply baking soda to the surface and vacuum within one to two weeks. Additionally, moss growth can be controlled with applications of limewater
	**PUDDLING:** Puddling is caused by clogged pavement pores, which in turn limits the permeability of the surface.	• Test with perking process • Remove organic and inorganic deposits by aggressive pressure washing and vacuuming

TRIVERUS

CLEANING & ENVIRONMENTAL SOLUTIONS

MCV Applications

- Pervious maintenance and recovery
- Parking structure hygiene
- Oil / grease accumulations
- Paint & crack seal surface prep
- Curing compound removal
- Spill response
- General surface cleaning

Triverus Cleaning and Environmental Solutions LLC

Palmer, AK • Burlington, VT

www.triverus.com

866-670-7117

Inspection Checklist / Maintenance Actions
Pervious Pavement System

Checklist (circle one)**:** Quarterly / Annual / Monthly / Special Event Inspection

Checklist No. _____ **Inspection Date: _____**

Date of most recent rain event: _____

Rain Condition (circle one):
Drizzle / Shower / Downpour / Other _____

Ground Condition (circle one):
Dry / Moist / Ponding / Submerged / Snow accumulation

The inspection items and preventative/corrective maintenance actions listed below represent general requirements. The design engineer and/or responsible party shall adjust the items and actions to better meet the conditions of the site, the specific design targets, and the requirements of regulatory authorities.

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative / Corrective Maintenance Actions**
A Pretreatment (Vegetative Filter Strip)	1	Poor quality vegetation, erosion, sedimentation, or debris	Y__ N__	(See Vegetative Filter Strip Field Manual)
B1 Pavement Surface (Porous Pavement)	1	Standing water is present after the design drain time The observed drain time is approximately _____ hours. Excessive sediment or mud accumulation on top of the pavement	Y__ N__	Recheck to determine if there is standing water after 72 hours If standing water is present longer than 5 days, report to mosquito commission. If excessive sediment is present, the system may be clogged - Sweep the surface - Power wash (at 45 degree angle to the top) - Vacuum the surface - Excavate to inspect the storage bed for clogging, replace the storage bed material if it is severely clogged - Check the permeability rate of the subsoil Work Order # _____
B 1 Pavement Surface (Porous Pavement)	2	Cracking, subsidence, spalling, or other damage to the pavement	Y__ N__	Repair according to the manufacturer's procedures and material. See Reference Documents section. Work Order # _____
	3	Weeds or other vegetation on the porous pavement	Y__ N__	Remove the vegetation
Note:				

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative / Corrective Maintenance Actions**
B 2 Pavement Surface (Permeable Paver)	1	Standing water is present after the design drain time The observed drain time is approximately _____ hours..	Y__ N__	Recheck to determine if there is standing water after 72 hours If standing water is present longer than 5 days, report to mosquito commission. If excessive sediment is present, the system may be clogged - Sweep the surface - Vacuum the surface - Excavate to inspect the storage bed for clogging, replace the storage bed material if it is severely clogged - Check the permeability rate of the subsoil Work Order # _____ (Note: Do not power wash a permeable paver system)
	2	Excessive sediment or mud accumulation on the system	Y__ N__	Sweep and/or vacuum surface Replenish aggregate in joints Work Order # _____
	3	Cracking, subsidence, spalling, deformation, uneven settlement, broken unit(s), or other damage to the pavers	Y__ N__	Repair according to the manufacturer's procedures and material. See Reference Documents section. Work Order # _____
	4	Loss of aggregate between joints	Y__ N__	Replenish aggregate in joint Work Order # _____
Note:				

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative / Corrective Maintenance Actions**
C Vegetation (for permeable pavers with vegetation)	1	Vegetation is overgrown	Y__ N__	Remove the vegetation according to the permeable paver manufacturer's instruction Work Order # _____
D Outlet	1	Clogged overflow outlet	Y__ N__	Clear and remove sediment
	2	Discharge pipe apron is eroded or scoured	Y__ N__	Restabilize the discharge riprap apron Work Order #_____
Note:				

Follow Up Items (Component No. / Inspection Item No.):
_(e.g., B/1, C/2)_____

Associated Work Orders: # _____, # _____, # _____, # _____, # _____

_____ _____ _____
Inspector Name **Signature** **Date**

Report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.

File this checklist in the Maintenance Log after performing maintenance.

APPENDIX B – MAINTENANCE LOG

Sample Record Keeping Form
for
Stormwater Management Facilities

Block 2205, Lot 6

885 Bloomfield Avenue, Township of Verona, NJ

This form is intended for maintaining a record of inspections and maintenance activies for the stormwater management facilities located on the Project Site in accordance with the approved Stormwater Management Facilities Operation and Maintenance Plan.

Date Completed: _____

Completed By: _____

Date of Last Rainfall and Rainfall Amount: _____

Stormwater Component	Type of Inspection	Overall Condition	Routine Maintenance Performed	Maintenance /Repair Work Needed*
Porous Pavement #1A				
Outlet Control Structure No. 1				
Porous Pavement #1B				
Outlet Control Structure No. 2				
GI MTD (Stormscape)				
Inlets & Manholes				

General Comments

_____

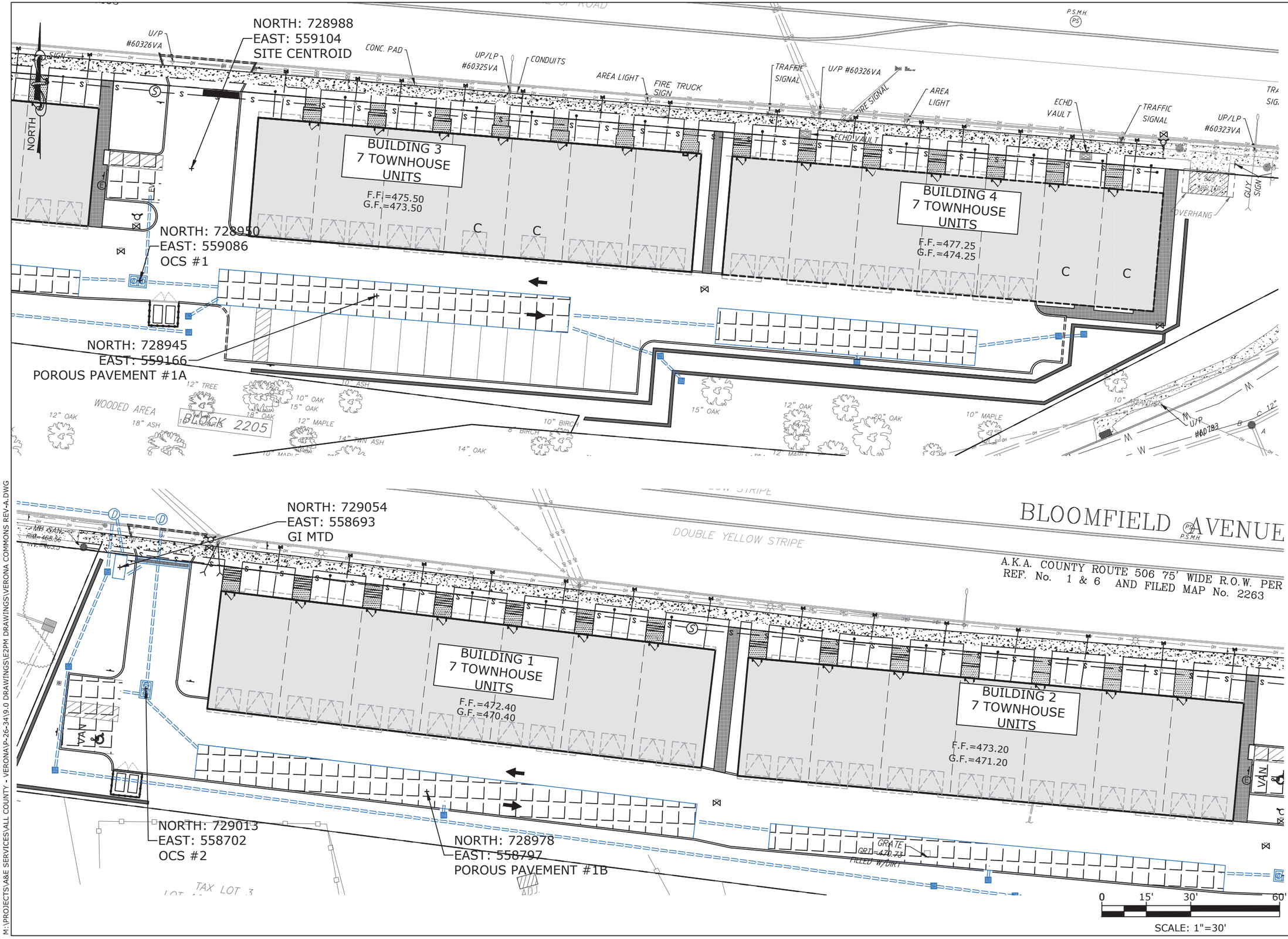
_____

_____

_____

* Provide a schedule for the completion of the action

APPENDIX C – STORMWATER MANAGEMENT LOCATION MAP



M:\PROJECTS\A&E SERVICES\ALL COUNTY - VERONA\P-26-349.0 DRAWINGS\E2PM DRAWINGS\VERONA COMMONS REV-A.DWG

SCHEDULE OF REVISIONS

REV.	DATE	DESCRIPTION OF CHANGES	DRAWN BY	CHK. BY
X	XX/XX/XX	XXXXX	XX	XX

OWNER/APPLICANT

A&R SKYLINE PROPERTIES URBAN RENEWAL LLC
704 PASSAIC AVENUE
WEST CALDWELL, NJ 07006
201-919-6004

ATTORNEY

STEVEN G. MLENAK, ESQ.,
GREENBAUM, ROWE, SMITH & DAVIS LLP
75 LIVINGSTON AVE, SUITE 301
ROSELAND, NJ 07068
732-476-2526

E 2 PROJECT MANAGEMENT LLC
87 HIBERNIA AVENUE
ROCKAWAY, N.J. 07866
PHONE: (973) 299-5200
FAX: (973) 299-5059
www.E2PM.com

N.J. ENGINEERING CERTIFICATE OF AUTHORIZATION No. 24GA28118200

I CERTIFY THAT THESE PLANS HAVE BEEN PREPARED UNDER MY SUPERVISION

CHARLES J. STEWART, P.E., P.L.S. N.J. NO. 24GB035884
REGISTERED PROFESSIONAL ENGINEER & LAND SURVEYOR

PROJECT NAME

VERONA COMMONS
885 BLOOMFIELD AVENUE
TOWNSHIP OF VERONA
ESSEX COUNTY, NEW JERSEY

BLOCK 2205 LOT 6

DRAWING TITLE

STORMWATER MEASURE LOCATION MAP

CHECKED BY: DC	DRAWN BY: RF
SCALE: 1:60	SHEET NO: 1 OF 1
PROJECT #: P-26-34	FIRST ISSUE: 08/07/2026

DRAWING NO.

SWMP-1