

STONEFIELD

STORMWATER OPERATIONS & MAINTENANCE PLAN


ASHWORTH INVESTMENTS, LLC.

PROPOSED MULTI-FAMILY RESIDENTIAL PROJECT
MAP: 32-4, LOT: 21
2001 KINGSTOWN ROAD
TOWN OF SOUTH KINGSTOWN
WASHINGTON COUNTY, RHODE ISLAND

PREPARED FOR:
REILLY MILLER
40 MALBONE STREET
WARWICK, RHODE ISLAND, 02888

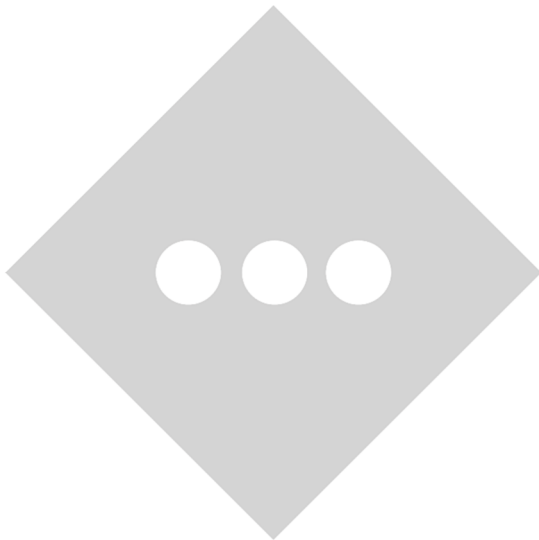
PREPARED BY:
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REPORT DATE:
DECEMBER 10, 2025



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1.0 INTRODUCTION

This Stormwater Operations & Maintenance Plan has been prepared to identify the operational and maintenance responsibilities for the proposed stormwater facilities for the development of the parcel located at 2001 Kingstown Road, South Kingstown, Washington County, Rhode Island. This Plan has been prepared in conjunction with the Preliminary & Final Land Development Plans and Stormwater Management Plan, prepared by Stonefield Engineering & Design LLC. and in accordance with the standards and regulations set forth by The Town of South Kingstown of Washington County and the Rhode Island Department of Environmental Management (RIDEM).

Operation and maintenance of the permanent stormwater control Best Management Practices (BMPs) shall be the responsibility of the operator of the project site at the time that the applicable maintenance is required. Stormwater management improvements associated with this development include the implementation of two (2) below ground infiltration basins, two (2) Contech CDS water quality unit and two (2) deep sump and hooded catch basins with associated subsurface conveyance system. All guidelines, standards and requirements set forth in this Plan shall be implemented for all proposed stormwater infrastructure, as well as any existing features that will remain, including areas of preserved landscaping. These guidelines are not exclusive to the proposed improvements, and existing infrastructure that is to remain in post development conditions shall be maintained in accordance with this document as applicable.

A copy of this report shall be kept on-site at all times both during and after construction. Upon reviewing agency approval, the title and date of the maintenance plan as well as the contact information of the current agent responsible for maintaining the stormwater management measures for the project shall be recorded (as deemed required).

1.1 RESPONSIBILITY

The purpose of the Stormwater Operations and Maintenance (O&M) Plan is to ensure adequate inspection of the systems, removal of accumulated sediments, oils and debris, and implementation of corrective action and record keeping activities. The enclosed O&M activities will be performed by a Contract Operator for the scope of maintenance. The Contract Operator will be a professional engineer or other professional with expertise and experience with stormwater management facilities operation and maintenance. The Owner, its successors, and/or assigns shall be responsible for the maintenance of the stormwater infrastructure associated with the proposed site improvements. Adequate maintenance is defined in this document as good working condition.

The current responsible agent shall evaluate the maintenance plan for effectiveness at least annually and revise the plan, as necessary. A detailed, written log of all preventative and corrective maintenance performed for each

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stormwater management measure must be kept, including a record of all inspections and copies of maintenance-related work orders. Upon request from a public entity with jurisdiction over the project area the responsible agent shall make available the maintenance plan and associate logs and other records for review.

Responsible Agent:

Name: TBD
Address: TBD
Contact: TBD
Phone: TBD
Email: TBD

I.2 DOCUMENTATION

Quarterly Operation and Maintenance Record Log and Schedule will be kept by the Owner summarizing inspections, maintenance, repairs and any corrective actions taken. The log will include the date on which each inspection or maintenance task was performed, a description of the inspection findings or maintenance completed, and the name of the inspector or maintenance personnel performing the task. If a maintenance task requires the clean-out of any sediments or debris, the location where the sediment and debris was disposed after removal will be indicated. Sample Inspection and Maintenance Logs for each stormwater BMP are enclosed. Additionally, invoices and other documentation of performance of maintenance activities (e.g., sediment disposal) shall be kept by the Owner or the legally authorized representative. The documentation will be kept on file.

The site supervisor shall be responsible for ensuring that the scheduled tasks as described in this plan are appropriately completed and recorded in the Maintenance Log. Accurate records of all inspections, routine maintenance and repairs shall be documented and these records shall be available for inspection by members of the governing authority as designated by the Town of South Kingstown, or their designated agent, upon request.

I.3 CHANGES TO OPERATIONS & MAINTENANCE PLAN

The Owner(s) and/or Responsible Agent shall notify the designated Governing Authority of any changes to the Operations & Maintenance Plan. Amendments to the Plan include but are not limited to changes in ownership, changes in assignment of financial responsibility, change in responsible parties, and modifications to the procedures outlined herein. Changes to the Plan shall be recorded on the Amendment Log in **APPENDIX F** of this Plan.

2.0 INSPECTION & MAINTENANCE OF STORMWATER SYSTEMS

The Owner, Property Manager and maintenance staff will conduct the Operation and Maintenance program set forth in this document. The Owner or Property Manager will ensure that inspections and record keeping are timely and accurate, and that cleaning and maintenance are performed in accordance with the recommended frequency for each stormwater component. Inspection & Maintenance Log Forms (provided herein) shall include the date and the amount of the last significant storm event in excess of 1” of rain in a 24-hour period, physical conditions of the structures, depth of sediment in structures, evidence of overtopping or debris blockage and maintenance required of each structure.

The following areas, facilities and measures will be inspected by the Owner or Property Manager and maintained as specified below. The following guidelines are applicable to all known stormwater structures and facilities on the parcel. Identified deficiencies will be corrected. Accumulated sediments and debris will be properly handled and disposed of off-site, in accordance with local, state, and federal guidelines and regulations.

2.1 DEEP SUMP CATCH BASINS

Structures: Two (2) Deep Sump Catch Basins

Description: Inspect or clean deep sump catch basins at least two (2) times per year and at the end of the foliage and snow-removal seasons. Sediments must also be removed annually or whenever the depth of deposits is greater than or equal to 50% the sump depth.

Maintenance Equipment: Vacuum trucks are the preferred method of cleaning as they remove trapped sediment and supernatant more efficiently than alternative methods such as clamshells. Vacuuming is a more time efficient process and is less likely to snap the cast iron hood within the deep sump catch basin. Clamshell buckets and vacuuming are both approved methods of removal of sediment within deep sump catch basins and may be used at the discretion of the responsible party. Precautions shall be taken to maintain the integrity of the oil trapping hoods during cleaning. Dispose of removed catch basin debris in accordance with RIDEM regulation.

Maintenance Access: Access to the Deep Sump Catch basins shall be provided via the associated frame and grate. Inlet grate shall be constructed of a durable material and fit tightly so as to not be dislodged by traffic, however, the grate must not be welded to the frame in order to provide access for maintenance personnel.

Inspection & Maintenance Summary: The table below provides a summary of inspection and maintenance actions and required frequency for Deep Sump Catch Basins:

TABLE I: DEEP SUMP CATCH BASIN GENERAL MAINTENANCE SCHEDULE

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Frequency	Operation & Maintenance Activity
<ul style="list-style-type: none"> • Minimum two times per year • At the end of the foliage & snow removal seasons • After Street Sweeping 	<p><u>Deep Sump Catch Basin Inspection</u></p> <ul style="list-style-type: none"> • Inspections shall be conducted in accordance with local and manufacturer recommendations. • Inspect inflow and outflow pipes for leaking, cracks, clogging, or other forms of damage or indication of malfunction. • Inspect condition of frame and grate and trap hood. • Inspect overall structure for structural integrity, cracks, settlement, leaking, sediment accumulation.
<ul style="list-style-type: none"> • Annually at minimum • At the end of the foliage & snow removal seasons • When sediment accumulation is 50% of depth from lowest pipe invert to bottom of unit. • As needed after Street Sweeping 	<p><u>Preventive Maintenance Actions</u></p> <ul style="list-style-type: none"> • Clean units / remove accumulated sediment. • Sediment and/or floatable pollutants shall be pumped from the basin and disposed of at an approved offsite facility in accordance with all applicable regulations. • During colder periods, catch basin grates must be kept free of snow and ice. • During warmer periods, catch basin grates must be kept free of leaves, litter, sand and other debris. • More frequent sweeping of paved surfaces will result in less accumulation of sediment in catch basins.
<ul style="list-style-type: none"> • Promptly as Needed 	<p><u>Corrective Maintenance Actions</u></p> <ul style="list-style-type: none"> • Notify Owner of any structural damage or other indication of malfunction and of all system repairs needed in a timely manner. • Perform corrective maintenance activities as required on applicable system components in accordance with all applicable local and manufacturer recommendations. Responsible party shall thoroughly document all required and completed corrective actions including repair and replacement of system components.

2.2 CONTECH® CDS WATER QUALITY UNITS

Structures: Two (2) Contech® CDS Water Quality Unit

- **WQ-1**
 - Design Intent: Pretreat discharge prior to infiltration through Basin B-1.
 - Approximate Location: Immediately east of proposed basin B-1.
 - Composition: CDS I515-3-C; Frame and Grate; Inline structure with internal bypass
- **WQ-2**
 - Design Intent: Pretreat discharge prior to infiltration through Basin B-2.
 - Approximate Location: Located in front of proposed five (5) guest parking spaces.
 - Composition: CDS I515-3-C; Frame and Grate; Inline structure with internal bypass

Description: The CDS system must be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on-site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation. Inspection is the key to effective maintenance and is easily performed. At a minimum, inspections shall be performed twice per year (e.g. spring and fall), however, more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations shall also be inspected more frequently where excessive amounts of trash are expected. Each individual owner must ensure that any and all of their proprietary stormwater pretreatment devices are maintained in accordance with the requirements stated in *Stormwater Rule 250-RICR-150-10-8.31-C*, which requires the sump to be inspected a minimum of 2 times per year. Additionally, the device must be cleaned out when either pollutant removal capacity is reduced by 50% or more, or when 50% or more of the device’s pollutant storage capacity is filled or displaced. The system must be cleaned and maintained in accordance with manufacturer specifications as identified in **APPENDIX D**.

Maintenance Equipment: Cleaning of CDS systems must be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Operator shall perform all maintenance in accordance with the manufacturer specifications.

Maintenance Access: Access to the CDS unit is typically achieved through two manhole or grate access covers. One allows inspection and cleaning out of separation chamber and isolated sump while the other allows for inspection and cleaning out of sediment captured and retained on the outside screen. Confined space entry procedures must be followed if physical access is required.

Inspection & Maintenance Summary: The table below provides a brief summary of inspection and maintenance actions for the CDS water quality units. Operator shall refer to manufacturer specifications enclosed herein for specific means and methods inspection and maintenance.

TABLE 2: CDS WATER QUALITY GENERAL MAINTENANCE SCHEDULE *

Frequency	Operation & Maintenance Activity
<ul style="list-style-type: none"> • Minimum two times per year 	<p><u>Inspection Actions</u></p> <ul style="list-style-type: none"> • Visual inspection shall ascertain that system components are in working order & no visible blockages or obstructions. • Quantify accumulation of hydrocarbons, trash and sediment in system. • Inspect filter fabric for clogging, tearing, or other damage. • Inspect chambers for sediment, debris and other obstructions. • Evaluate structural integrity of overall system and inspect for cracks, settlement, leaking, or other indications of malfunction.
<ul style="list-style-type: none"> • Annually • When at 50% sediment capacity 	<p><u>Preventive Maintenance Actions</u></p> <ul style="list-style-type: none"> • Perform a clean-out when either pollutant removal capacity is reduced by 50% or more, or when 50% or more of the device’s pollutant storage capacity is filled or displaced or an appreciable level of hydrocarbons and trash has accumulated. Remove trash, debris, organic matter and other obstructions. • Cleaning shall only be conducted during dry weather conditions when no flow is entering the system. • In the event of a spill, units shall be cleaned immediately. • Remove and replace degraded perimeter stone as required. • Remove and replace damaged filter fabric as required.
<ul style="list-style-type: none"> • Promptly as Needed 	<p><u>Corrective Maintenance Actions</u></p> <ul style="list-style-type: none"> • Notify Owner of any structural damage or other indication of malfunction and of all system repairs needed in a timely manner. • Perform corrective maintenance activities as required on applicable system components in accordance with all applicable local and manufacturer recommendations. Responsible party shall thoroughly document all required and completed corrective actions including repair and replacement of system components.

***This table is a brief summary of inspection and maintenance measures required for the Contech® CDS Separator and is not intended to replace or overrule the enclosed manufacturer specifications. Operator is responsible for reviewing and adhering to all manufacturer specifications for the Contech® CDS Separator.**

2.3 SUBSURFACE INFILTRATION BASIN

Structures: R-Tank® SD/HD Modular Stormwater Storage System

- **Infiltration Basins B-1**
 - Design Intent: Capture, treat & infiltrate discharge from a the entirety of the private road and the roof runoff from the single family dwellings
 - Approximate Location: Within the open space running along the Northern property line
 - Composition: 285 R-Tank® HD Single Modules (15 rows of 19 chambers)
- **Infiltration Basin B-2**
 - Design Intent Capture, treat & infiltrate discharge rooftops and open space
 - Approximate Location: Within the open space at the northwest corner of the project site.
 - Composition: 180 R-Tank® HD Single Modules (12 rows of 15 chambers)

Description: As they are underground, subsurface infiltration systems are difficult to maintain and are prone to clogging and failure; therefore, aggressive and timely maintenance is required. Inspect the infiltration basin at least yearly, and after storms equal to or greater than the 1-year, 24-hour, Type III storm event. Ensure that the access points to components are not compromised, that inlet and outlet pipes are functioning as expected, standing water is not present within the infiltration BMP 72 hours after a rain event, there are no signs of illicit discharges or vandalism, there is no subsidence, erosion, or cracking of structures, there is no leakage through the structure, and evaluate the level of sedimentation and trash accumulation for acceptable levels. Prior to beginning any maintenance on the system, if applicable, the outlet pipe shall be plugged to prevent contamination of the downstream systems. The basin is equipped with a Treatment Row that shall be cleaned and maintained on the same schedule as the infiltration basin and in accordance with manufacturer specifications as identified in **APPENDIX D**.

Maintenance Equipment: Subsurface infiltration systems shall be cleared of accumulated and sediments through the use of a vacuum truck and hose. Precautions shall be taken to maintain the structural integrity of the system and associated internal equipment during cleaning.

Maintenance Access: Access to the subsurface infiltration basin shall be provided via the access risers installed on the system. The basin is also equipped with inspection ports at each end for more frequent inspections.

Inspection & Maintenance Summary: The table below provides a summary of inspection and maintenance actions and required frequency for Subsurface Infiltration Basins:

TABLE 4: SUBSURFACE INFILTRATION BASIN GENERAL MAINTENANCE SCHEDULE*

Frequency	Operation & Maintenance Activity
<ul style="list-style-type: none"> • Annually • After storms equal to or exceeding the 1-year, 24-hour Type III Storm Event 	<p><u>Infiltration Basin Inspection</u></p> <ul style="list-style-type: none"> • Inspect inflow pipes for leaking, cracks, clogging, or other forms of damage or malfunction. • Inspect basin for sediment, debris, trash, organic matter and other obstructions. • Inspect soil and infiltration functionality. Ensure no standing water remains within the basin after 72 hours. • Inspect overall structure for structural integrity, cracks, settlement, leaking, sediment accumulation. • Inspect internal components for signs of damage or loss of functionality. • Inspect Treatment Row in accordance with manufacturer specifications.
<ul style="list-style-type: none"> • Annually 	<p><u>Preventive Maintenance Actions</u></p> <ul style="list-style-type: none"> • Remove trash, debris, organic matter and other obstructions. • Remove and replace degraded perimeter stone. • Repair damage to components as required. • Maintain Treatment Row in accordance with manufacturer specifications.
<ul style="list-style-type: none"> • Annually 	<p><u>Inspect & Clean Pretreatment Devices</u></p> <ul style="list-style-type: none"> • Treatment Row <ul style="list-style-type: none"> ○ Refer to manufacturer field manual for specific means and methods of operation and maintenance for treatment row. • Deep Sump Catch Basins <ul style="list-style-type: none"> ○ Refer to Section 2.1 of this Plan for specific means and methods of operations & maintenance of deep sump catch basins. • Contech CDS Water Quality Unit <ul style="list-style-type: none"> ○ Refer to Section 2.2 of this Plan for specific means and methods of operations & maintenance of the water quality treatment device.
<ul style="list-style-type: none"> • Promptly as Needed 	<p><u>Corrective Maintenance Actions</u></p> <ul style="list-style-type: none"> • Notify Owner of any structural damage or other indication of malfunction and of all system repairs needed in a timely manner. • Perform corrective maintenance activities as required on applicable system components in accordance with all applicable local and manufacturer recommendations. Responsible party shall thoroughly document all required and completed corrective actions including repair and replacement of system components. • Prior to start of any maintenance actions, plug basin outlet pipe(s) to prevent contamination of downstream systems.

*This table is a brief summary of inspection and maintenance measures required for the R-Tank® SD Module and is not intended to replace or overrule the enclosed manufacturer specifications. Operator is responsible for reviewing and adhering to all manufacturer specifications for the R-Tank® SD Module.

3.0 GENERAL SITE OPERATIONS & MAINTENANCE

3.1 ONSITE CONVEYANCE SYSTEM

STORM DRAIN PIPING

The proposed site storm drain system is comprised of a network of piping and structures discharging to two (2) subsurface infiltration systems.

- Sediments and hydrocarbons will be properly handled and disposed of off-site, in accordance with local, state and federal guidelines and regulations.
- If there is evidence of clogging, blockages, or other failure of the conveyance system, appropriate remediation measures shall be conducted in a timely manner. All corrective measures taken shall be appropriately logged in accordance with this Plan.

ROOF DRAIN LEADERS

Roof runoff from the proposed multi-tenant building is directed to the proposed conveyance system via roof leaders and ultimately to Basins B-1, B-2 and B-3. The Property Owner shall be responsible for maintenance of all material associated with roof leaders.

- Perform routine roof drain inspections and cleanings multiple times per year as needed and at the end of the foliage and snow removal seasons.
- Keep roofs clean and free of debris.
- Keep roof drainage systems clear.
- Keep roof access limited to only those responsible for maintenance and cleaning.
- Keep gutters clear of leaves and debris.

3.2 VEGETATED AREAS

The maintenance of vegetated areas is essential in maintaining the functionality of the stormwater management system. This includes the health/density of vegetative cover and activities such as the application and disposal of lawn and garden care products, disposal of leaves and yard trimmings and proper aeration of soils.

It is the responsibility of the Property Owner to coordinate Landscape Maintenance of the onsite open space areas. Post-construction conditions shall incorporate a mix of existing and proposed landscape features and open space. This Plan is inclusive of all vegetation, both existing and proposed. At a minimum, the following maintenance and operations requirements shall met be during and after construction period:

- Inspect slopes and embankments early in the growing season to identify active or potential erosion problems. Replant bare areas or areas with sparse growth. If erosion is evident, armor the area with an appropriate lining or riprap stone.
- Inspect planted areas on a semi-annual basis and remove any litter.
- Maintain planted areas adjacent to pavement to prevent soil washout.
- Immediately clean any soil deposited on pavement.

- Re-seed bare areas; install appropriate erosion control measures when native soil is exposed, or erosion channels are forming.
- Plant alternative mixture of grass species in the event of unsuccessful establishment.
- The grass vegetation should be cut to a height between three and four inches.
- Pesticide/Herbicide Usage – No pesticides are to be used unless a single spot treatment is required for a specific control application unless approved and applied by a licensed professional.
- No pesticides or herbicides are allowed within the 100' adjacent upland resource area property without prior approval of the Governing Authority unless approved and applied by a licensed professional.
- Fertilizer usage should be avoided. If deemed necessary, fertilizer may only be of the low nitrogen and phosphorous variety. Fertilizer may be used to begin the establishment of vegetation in bare or damaged areas but should not be applied on a regular basis unless necessary.
- Fertilizer applications shall be limited to the spring and early fall and applied per the manufacturers' specifications. Nitrogen content shall not exceed 25% with ratios for Nitrogen, Phosphorus, and Potassium at 3-1-2 or 3-1-1. It is also recommended that at least 30%-50% of total nitrogen be slow release.
- Annual application of compost amendments and aeration are recommended.

3.3 MAINTENANCE OF STREETS & PARKING AREAS

Roadways with curbs and catch basins must be swept at a minimum of once per year. Roadways with curbs and catch basins that discharge to nitrogen or phosphorus impaired waters, or their tributaries are swept at a minimum of twice per year, once in the spring and once in the fall. Sweeping on central pedestrian pathway, used for emergency vehicles only, must be conducted on an as-needed basis. All street sweepings collected must be disposed of in accordance with RIDEM regulations. The responsible party may temporarily store street sweepings in labor yards, but street sweepings must be disposed of offsite in a reasonable timeframe. Street sweepings may not be disposed of on parking lots or lands.

The following minimum maintenance measures shall be implemented:

- Sweep or vacuum standard asphalt pavement areas with a rotary brush sweeper (or another method approved by licensed professional) and properly dispose of removed material.
- Minimum recommended sweeping schedule:
 - October / November
 - April / May
 - More frequent sweeping of paved surfaces will result in less accumulation in catch basins, less cleaning of subsurface structures, and less disposal costs.

- Check dumpster areas frequently for spillage and/or pavement staining and clean, as necessary.
- No coal-tar, petroleum-based, or other parking lot “sealants” are permitted to be used on-site unless approved by local authority. Normal maintenance activities intended to extend the life expectancy of the pavement surfaces including the use of bitumen asphalt to seal developing cracks, asphalt repair are not subject to this special condition.

The following street and parking lot sweeping procedures shall be performed to reduce the discharge of pollutants:

Sweeping

- Street sweeping will be conducted in dry weather. Sweeping will not be conducted during or immediately after rainstorms.
- Dry cleaning methods will be used whenever possible with the exception of very fine water spray for dust control. Avoid wet cleaning or flushing of the pavement.
- When necessary, parking bans will be enacted to facilitate sweeping on busy streets.
- More frequent sweeping of paved surfaces will result in less accumulation in catch basins. Sweeping will be conducted in a manner that avoids depositing debris into storm drains. Deep sump catch basins shall be inspected and/or cleaned as needed after street sweeping concludes in accordance with the procedures set forth in *Section 2.1 Deep Sump Catch Basins* of this Plan.
- Sweeping shall generally be conducted with a vacuum sweeper, however alternative sweeping equipment (mechanical, regenerative air, vacuum filter, tandem sweeping) may be selected depending on the level of debris. Brush alignment, sweeper speed, rotation rate, and sweeping patterns will be set to optimize levels to manage debris.
- Sweeping equipment will be routinely inspected and maintained to reduce the potential for leaks.

Disposal

- If street sweepings are reused, e.g., as anti-skid material or to fill in parking lots, they will be properly filtered to remove solid waste, such as paper or trash, in accordance with their intended reuse. All reuse and/or disposal of street sweeping will be managed in accordance with current RIDEM policies and regulations.
- Street sweepings can be stored for up to one year in approved temporary storage areas. Storage areas will be protected to prevent erosion and runoff and should be located away from wetland resource areas and buffer zones, surface water, or groundwater.
- Sweepings are classified as solid waste and are disposed of at solid waste disposal sites.

3.4 WINTER MAINTENANCE AND SNOW & ICE MANAGEMENT

It is the responsibility of the Property Owner to contract with a professional snow removal/winter conditions management contractor to treat the paved parking and walking areas within the developed area for safe access during winter conditions. All snow and ice operators are required to be trained in the RIDEM practices. The contractor is responsible for minimizing de-icing applications while ensuring safe vehicle and pedestrian access to onsite facilities.

Snow storage and removal shall be conducted in accordance with the following minimum requirements:

- Snow will be stored in areas that do not block or hinder access to any structure or accessory facility.
- Snow storage areas will be managed to prevent blockage of storm drain catch basins, stormwater drainage channels, and on-street parking. Snow combined with sand and debris may block a storm drainage system, diminishing the drainage capacity of the system and causing localized flooding.
 - Storm drain catch basins and stormwater management systems shall be inspected and cleaned as needed at the end of the snow removal season in accordance with the procedures outlined in this Plan.
- Sand and debris deposited on vegetated or paved areas shall be cleared from the site and properly disposed of at the end of the snow season, no later than springtime.
- Snow shall not be dumped into any waterbody, pond, or wetland resource area.
- Snow shall not be dumped within a Wellhead Protection Area (WHPA) of a public water supply or within 200 feet of a private well, where road salt may contaminate water supplies.
- Snow shall not be dumped in sanitary landfills and gravel pits.

In addition to snow removal, potentially icy and unsafe paved surfaces are addressed as follows:

- The de-icing program consists of two treatment zones: The largest area, parking and vehicle circulation areas, and the smaller area, the sidewalks/front doors of the facility.
- The parking and vehicle circulation areas within the development will be treated with approved treatment product mixed with sand. Per deicing event up to 200 gallons per acre may be applied.
- The front door entrances and sidewalks of commercial units will have a non-sodium pelletized de-icing material that may contain calcium chloride or magnesium chloride as the active ice melting ingredient. The pellets are broadcast at a rate up to 1 lb. per 75-100 square feet.
- Only calcium or magnesium-based de-icing chemicals shall be used on surfaces where runoff/drainage will discharge into any wetland resources, or the 100' adjacent upland resource area.

The following winter maintenance procedures shall be performed to reduce the discharge of pollutants:

- Minimize the use and optimize the application of sodium chloride and other salt (while maintaining public safety) and consider opportunities for use of alternative methods.
- Optimize sand and/or chemical application rates through the use, where practicable, of automated application equipment (e.g., zero velocity spreaders), anti-icing and pre-wetting techniques. Implementation of pavement management systems, and alternate chemicals. Maintain records of the application of sand, anti-icing and/or de-icing chemicals to document the reduction of chemicals to meet established goals.
- Prevent exposure of de-icing product (salt, sand, or alternative products) storage piles to precipitation by enclosing or covering the storage piles. Implement good housekeeping, diversions, containment, or other measures to minimize exposure resulting from adding to or removing materials from the pile. Store piles in such a manner as not to impact surface water resources, groundwater resources, recharge areas, and wells.

4.0 ESTIMATED ANNUAL BUDGET

The Owner and/or the Responsible Agent should perform a cost analysis and establish the annual operation and maintenance budget for the site. Once the budget has been established the below breakdown can be utilized to help track yearly costs for various onsite features and can be updated within **Table 4**.

The below values are subject to modification upon establishment of party responsible for completing associated work and/or consultation from manufacturers or responsible local authorities. Certain factors are not considered in the below estimates that may have significant cost implications. For example, removal and disposal of catch basin cleanings and sediment must be completed in accordance with local regulations and taken to a facility permitted by RIDEM to accept solid waste; the cost, policy, requirements, proximity or other factors of the specific disposal facility is not able to be accurately accounted for at the time of this Plan. Significant corrective measures such as unforeseen structural repairs may not be considered in initial estimates.

TABLE 4: OPERATION AND MAINTENANCE BUDGET

System / Feature	Approximate Cost / Year
Infiltration Basin Inspection & Maintenance	--
Hood & Sump Inspection & Maintenance	--
Conveyance System Inspection & Maintenance	--
Sediment Debris and Trash Removal/Disposal	--
Landscape & Vegetation Inspection & Maintenance	--
Street Sweeping	--
Winter Maintenance / Snow & Ice Management	--

5.0 INSPECTION & LOGS OF PREVENTATIVE AND CORRECTIVE MEASURES

The person responsible for maintenance shall maintain a detailed log of all preventative and corrective maintenance for the structural stormwater management measures incorporated into the design of the development, including a record of all inspections and copies of all maintenance-related work orders.

A maintenance plan shall include a schedule of regular inspections and tasks, and detailed logs of all preventative and corrective maintenance performed on the stormwater management measure, including all maintenance-related work orders. The person with maintenance responsibility must retain and, upon request, make available the maintenance plan and associated logs and other records for review by a public entity with administrative, health, environmental, or safety authority over the site.

All inspection and maintenance activities shall be recorded to document frequency of inspection and maintenance, and implementation of corrective action. All regularly scheduled inspections, inspections following major storm events, maintenance activities, and repairs shall be recorded. General Inspection and Maintenance Logs for each Stormwater BMP can be found in **APPENDIX E** of this Plan. The enclosed general log forms shall be considered a minimum standard for recording purposes; the Operator and Inspection/Maintenance Personnel are strongly encouraged to supplement the Log with additional notes and photos.

6.0 ANNUAL EVALUATION OF THE EFFECTIVENESS OF THE PLAN

The person responsible for maintenance shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed. The responsible party should evaluate the effectiveness of the maintenance plan by comparing the maintenance plan with the actual performance of the maintenance. The items to evaluate may include, but not limited to:

- Whether the inspections have been performed as scheduled;
- Whether the preventive maintenance has been performed as scheduled;
- Whether the frequency of preventative maintenance needs to increase or decrease;
- Whether the planned resources were enough to perform the maintenance;
- Whether the repairs were completed on time;
- Whether the actual cost was consistent with the estimated cost;
- Whether the inspection, maintenance, and repair records have been kept.

If actual performance of those items has been deviated from the maintenance plan, the responsible party should find the causes and implement solutions in a revised maintenance plan. Should modifications to the Plan be deemed necessary to ensure longevity of the site systems, the changes should be noted within the enclosed Amendment Log in **APPENDIX F**.

APPENDIX A PROJECT FIGURES

INVENTORY

FIGURE 1: RADIUS MAP

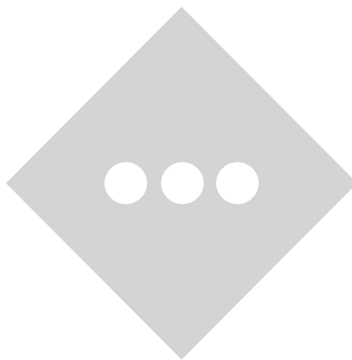
FIGURE 2: USGS MAP

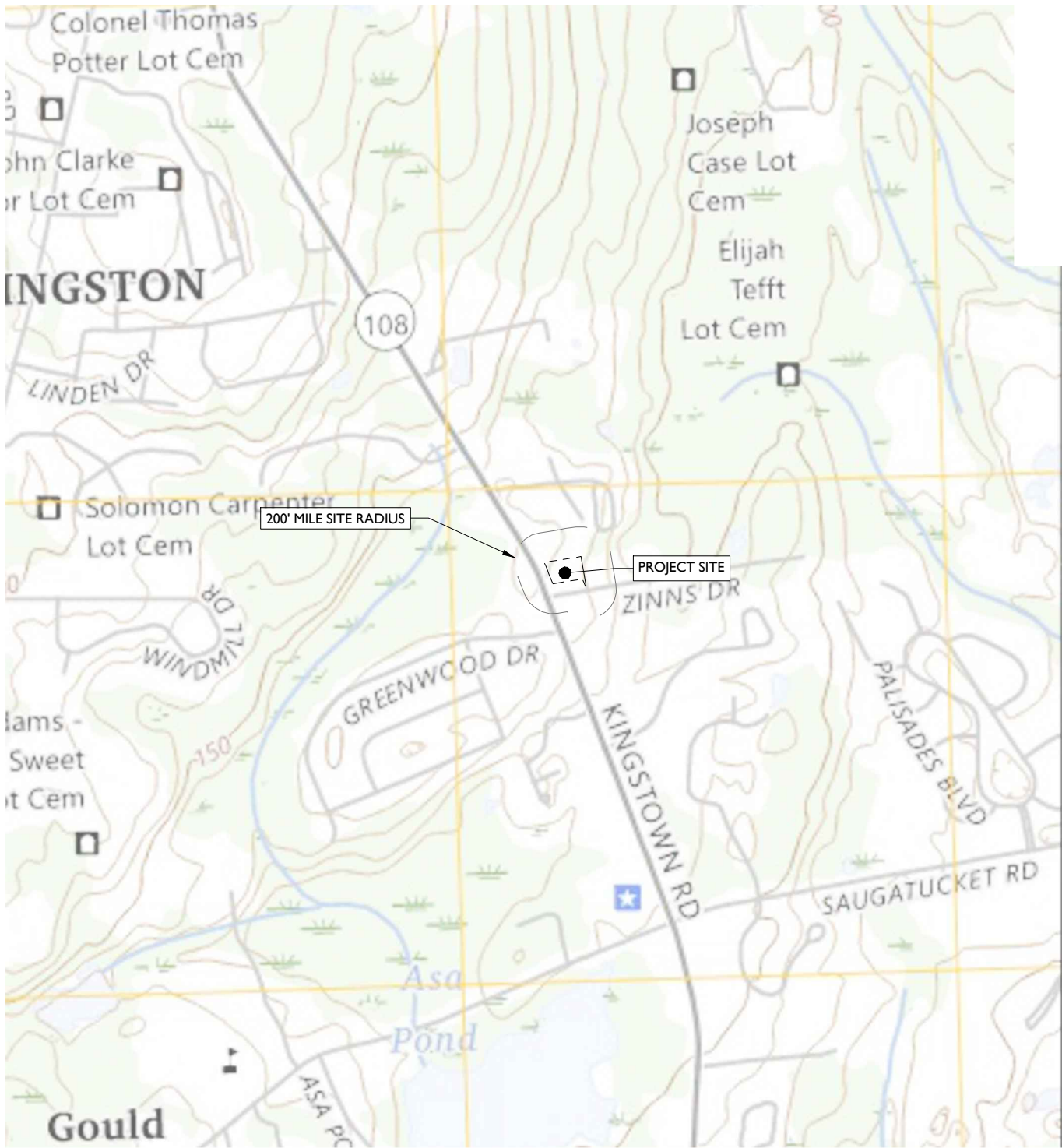
FIGURE 3: AERIAL LOCATION MAP

FIGURE 4: FEMA MAP

FIGURE 5: SOIL SURVEY MAP

FIGURE 6: RIDEM GROUNDWATER CLASSIFICATION MAP





USGS QUAD MAP



GRAPHIC SCALE IN FEET

1" = 1000'

SOURCE: USGS KINGSTOWN QUADRANGLE RHODE ISLAND WASHINGTON COUNTY 7.5-MINUTE SERIES

600 NJ STATE HIGHWAY ROUTE 36 PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT

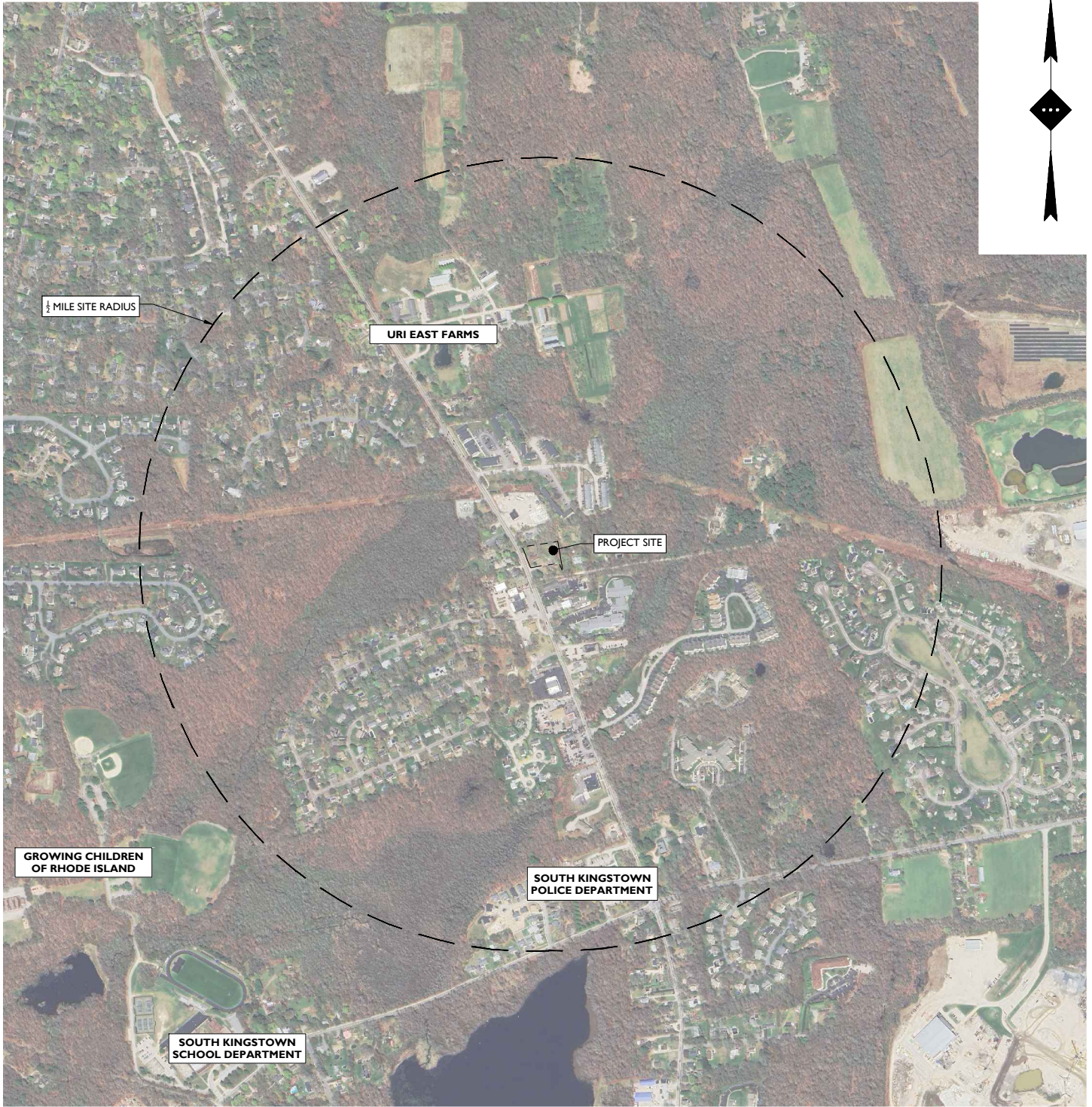
MAP 32-4, LOT 21
2001 KINGSTOWN ROAD
TOWN OF SOUTH KINGSTOWN, WASHINGTON COUNTY, RHODE ISLAND

DRAWN BY:	NNS
CHECKED BY:	JHK
DATE:	10/1/2025
SCALE:	1" = 1000'
PROJECT ID:	BOS-250053



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GRAPHIC SCALE IN FEET

1" = 1000'

AERIAL MAP

SOURCE: GOOGLE EARTH DATED APRIL 23, 2025

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MAP 32-4, LOT 21
2001 KINGSTOWN ROAD
TOWN OF SOUTH KINGSTOWN, WASHINGTON COUNTY, RHODE ISLAND

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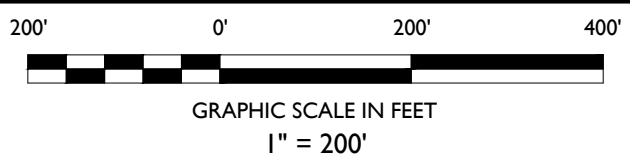
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ZONING LEGEND:

- (MU) - MIXED USE
- (CH) - COMMERCIAL HIGHWAY
- (R-10) - MEDIUM HIGH DENSITY RESIDENTIAL DISTRICT
- (RM) - RESIDENTIAL MULTI-HOUSEHOLD DISTRICT
- (R-20) - MEDIUM HIGH DENSITY RESIDENTIAL DISTRICT
- (R40) - MEDIUM DENSITY RESIDENTIAL DISTRICT
- (CN) - COMMERCIAL NEIGHBORHOOD



TAX & ZONING MAP

SOURCE: SOUTH KINGSTOWN, RI ONLINE ZONING MAP

2001 KINGSTOWN ROAD PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT

MAP 32-4, LOT 21
2001 KINGSTOWN ROAD
TOWN OF SOUTH KINGSTOWN, WASHINGTON COUNTY, RHODE ISLAND

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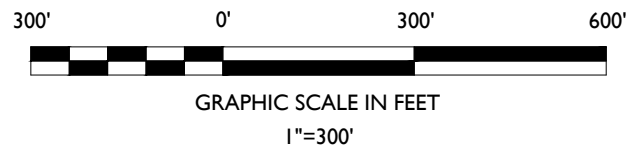
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FEMA FLOOD MAP



SOURCE: FEMA FLOOD MAPS NUMBER 44009C0184K & 44009C0185J

2001 KINGSTOWN ROAD PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT

MAP 32-4, LOT 21
2001 KINGSTOWN ROAD
TOWN OF SOUTH KINGSTOWN, WASHINGTON COUNTY, RHODE ISLAND

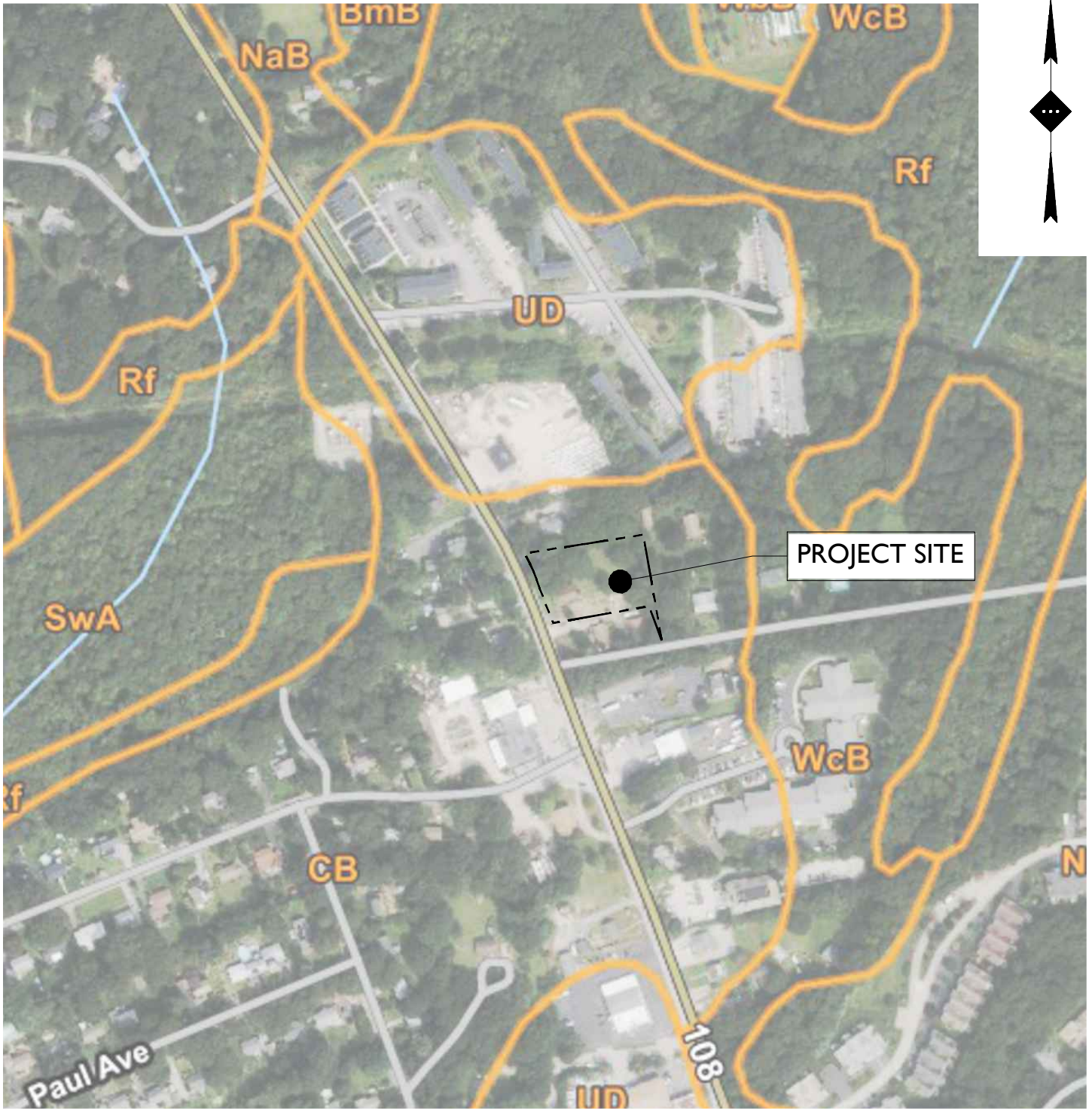
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PROJECT ID:	BOS-250053



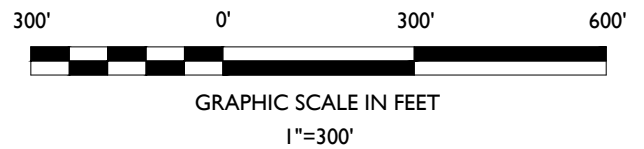
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SOILS MAP



SOURCE: USDA: NATURAL RESOURCE CONSERVATION SERVICE RETRIEVED JULY 7, 2025

2001 KINGSTOWN ROAD PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT

MAP 32-4, LOT 21
2001 KINGSTOWN ROAD
TOWN OF SOUTH KINGSTOWN, WASHINGTON COUNTY, RHODE ISLAND

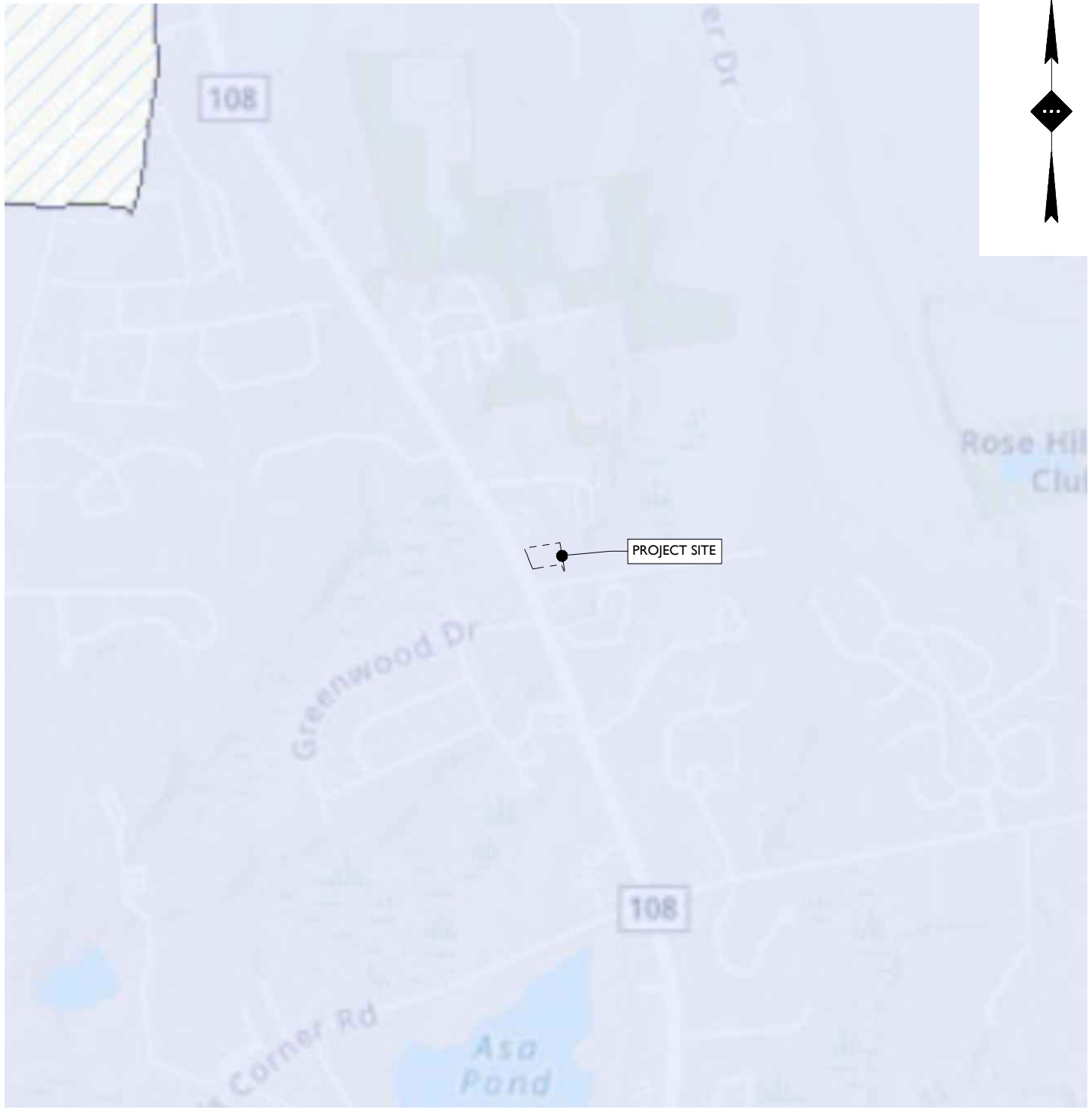
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PROJECT ID:	BOS-250053

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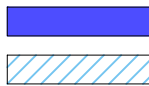
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GROUNDWATER CLASSIFICATION MAP



GA - TO BE PROTECTED TO MAINTAIN DRINKING WATER QUALITY
 GAA - TO BE PROTECTED TO MAINTAIN DRINKING WATER QUALITY



GRAPHIC SCALE IN FEET

1" = 1000'

SOURCE: RIDEM ENVIRONMENTAL RESOURCE MAP, RECEIVED OCTOBER 1, 2025

2001 KINGSTOWN ROAD PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT

MAP 32-4, LOT 21
 2001 KINGSTOWN ROAD
 TOWN OF SOUTH KINGSTOWN, WASHINGTON COUNTY, RHODE ISLAND

DRAWN BY:	NNS
CHECKED BY:	JHK
DATE:	10/1/2025
SCALE:	1" = 300'
PROJECT ID:	BOS-250053



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APPENDIX B

SITE PLANS

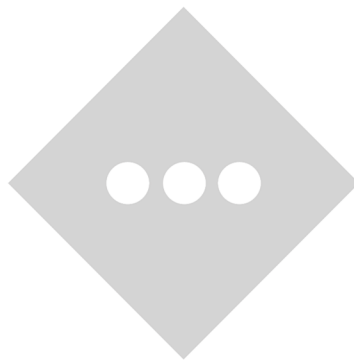
INVENTORY

B-1: SITE PLANS

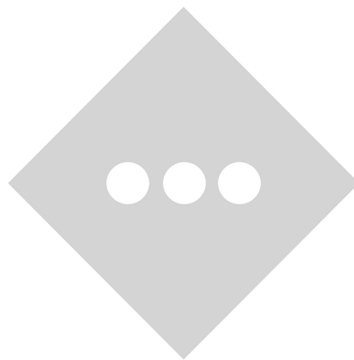
B-2: STORMWATER MANAGEMENT PLAN

B-3: SOIL EROSION & SEDIMENT CONTROL PLANS

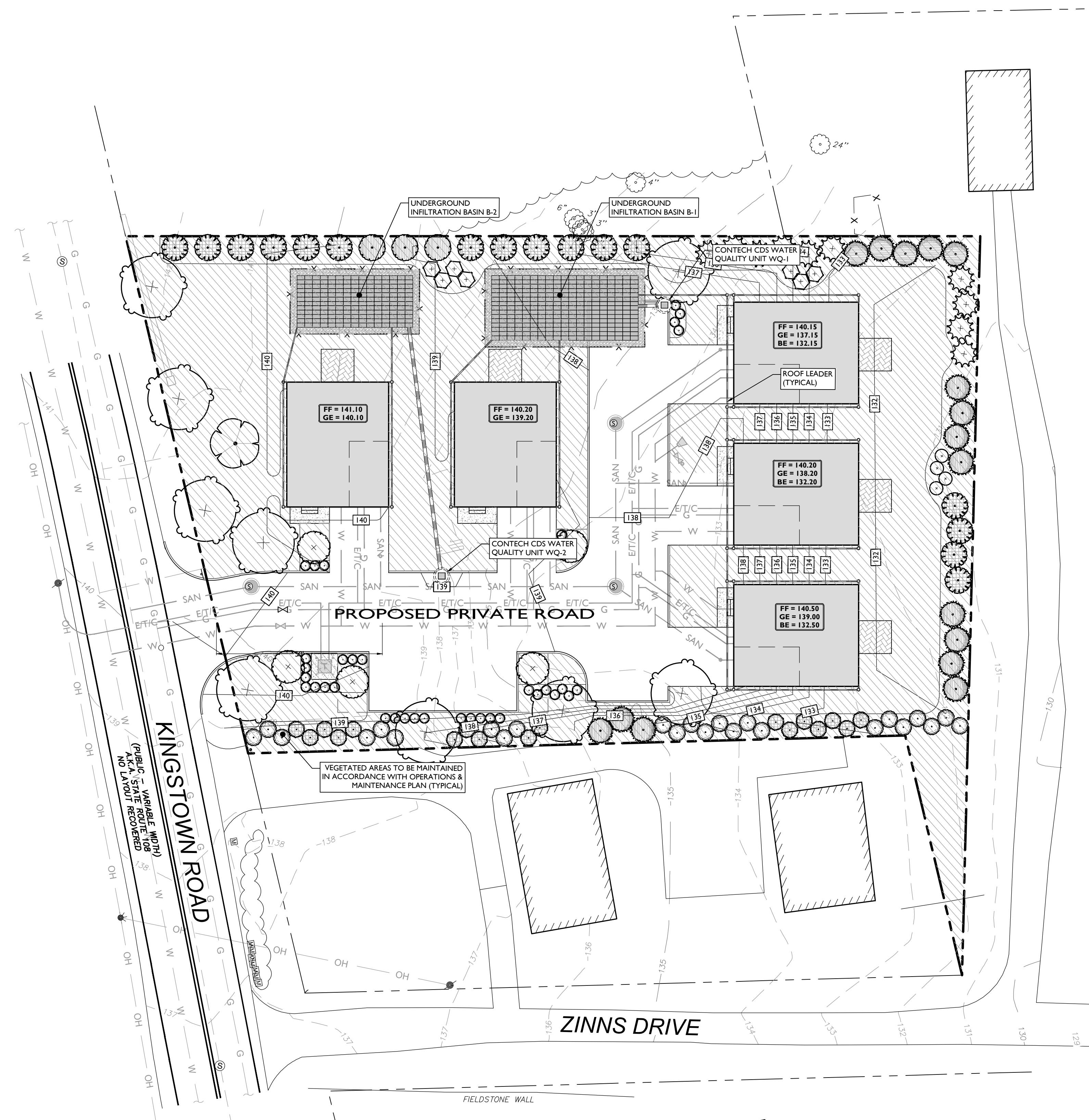
B-4: LANDSCAPING PLANS



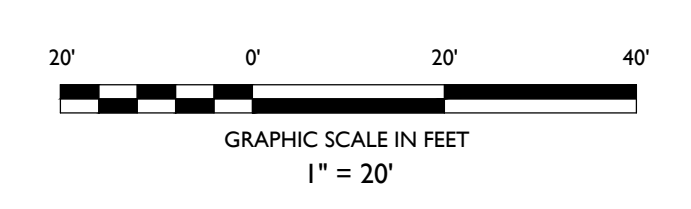
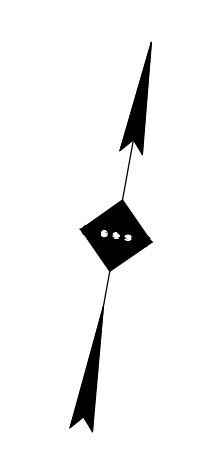
APPENDIX C
STORMWATER BMP LOCATION EXHIBIT



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SYMBOL	DESCRIPTION
	PROPERTY LINE
	EXISTING GRADING CONTOUR
	PROPOSED GRADING CONTOUR
	LANDSCAPED AREA



NOT APPROVED FOR CONSTRUCTION

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PLAN SET CLASSIFICATION

**PROPOSED MULTI-FAMILY
RESIDENTIAL DEVELOPMENT**

BLOCK 32.4, LOT 71
SOUTH KINGSTOWN
TOWN OF SOUTH KINGSTOWN
WASHINGTON COUNTY, RHODE ISLAND

JOSHUA H. KLINE, P.E.
RHODE ISLAND LICENSE No. 13607
LICENSED PROFESSIONAL ENGINEER

STONEFIELD
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SCALE: 1" = 20' PROJECT ID: BOS-250053

TITLE:
**STORMWATER BMP
LOCATION EXHIBIT**

DRAWING:
I OF I

NO.	DATE	ISSUE	BY	DESCRIPTION
00		ISSUE		
12/28/2021		AID		FOR MUNICIPAL SUBMISSION

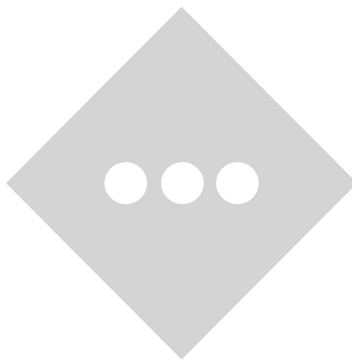
APPENDIX D

PROPRIETARY STORMWATER DEVICE MANUFACTURER SPECIFICATIONS

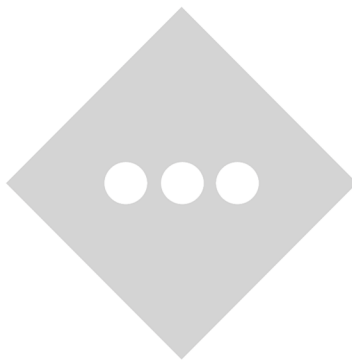
INVENTORY

**D-1: CONTECH CDS OPERATIONS & MAINTENANCE
GUIDE**

**D-2: R-TANK MODULE OPERATIONS AND
MAINTENANCE MANUAL**



APPENDIX D-I
CONTECH CDS OPERATIONS &
MAINTENANCE GUIDE



CDS Guide

Operation, Design, Performance and Maintenance



CDS®

Using patented continuous deflective separation technology, the CDS system screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls physically separate captured solids, and minimize the re-suspension and release of previously trapped pollutants. Inline units can treat up to 6 cfs, and internally bypass flows in excess of 50 cfs (1416 L/s). Available precast or cast-in-place, offline units can treat flows from 1 to 300 cfs (28.3 to 8495 L/s). The pollutant removal capacity of the CDS system has been proven in lab and field testing.

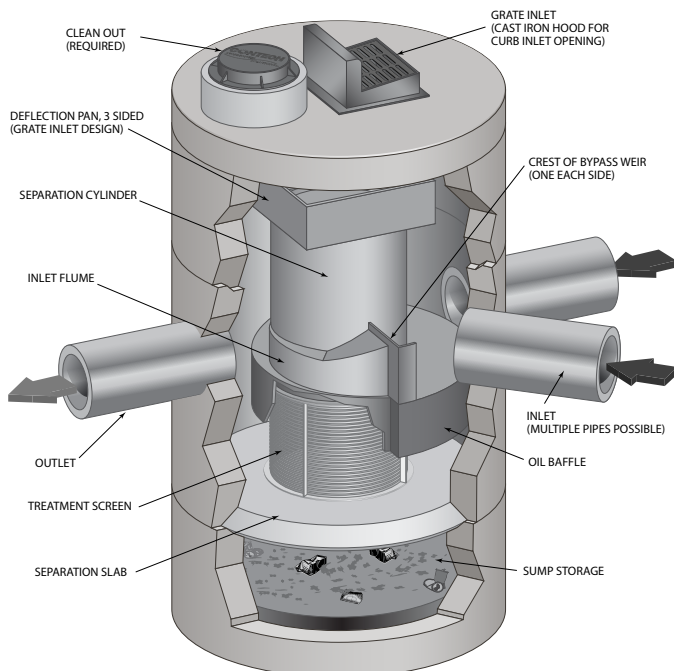
Operation Overview

Stormwater enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the system's treatment design capacity enter the separation chamber and are treated.

Swirl concentration and screen deflection force floatables and solids to the center of the separation chamber where 100% of floatables and neutrally buoyant debris larger than the screen apertures are trapped.

Stormwater then moves through the separation screen, under the oil baffle and exits the system. The separation screen remains clog free due to continuous deflection.

During the flow events exceeding the treatment design capacity, the diversion weir bypasses excessive flows around the separation chamber, so captured pollutants are retained in the separation cylinder.



Design Basics

There are three primary methods of sizing a CDS system. The Water Quality Flow Rate Method determines which model size provides the desired removal efficiency at a given flow rate for a defined particle size. The Rational Rainfall Method™ or the Probabilistic Method is used when a specific removal efficiency of the net annual sediment load is required.

Typically in the United States, CDS systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a gradation with an average particle size (d50) of 125 microns (μm). For some regulatory environments, CDS systems can also be designed to achieve an 80% annual solids load reduction based on an average particle size (d50) of 75 microns (μm) or 50 microns (μm).

Water Quality Flow Rate Method

In some cases, regulations require that a specific treatment rate, often referred to as the water quality design flow (WQQ), be treated. This WQQ represents the peak flow rate from either an event with a specific recurrence interval, e.g. the six-month storm, or a water quality depth, e.g. 1/2-inch (13 mm) of rainfall.

The CDS is designed to treat all flows up to the WQQ. At influent rates higher than the WQQ, the diversion weir will direct most flow exceeding the WQQ around the separation chamber. This allows removal efficiency to remain relatively constant in the separation chamber and eliminates the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as the rate at which the CDS will remove a specific gradation of sediment at a specific removal efficiency. Therefore the treatment flow rate is variable, based on the gradation and removal efficiency specified by the design engineer.

Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. It is important to take these factors into consideration when estimating the long-term performance of any stormwater treatment system. The Rational Rainfall Method combines site-specific information with laboratory generated performance data, and local historical precipitation records to estimate removal efficiencies as accurately as possible.

Short duration rain gauge records from across the United States and Canada were analyzed to determine the percent of the total annual rainfall that fell at a range of intensities. US stations' depths were totaled every 15 minutes, or hourly, and recorded in 0.01-inch increments. Depths were recorded hourly with 1-mm resolution at Canadian stations. One trend was consistent at all sites; the vast majority of precipitation fell at low intensities and high intensity storms contributed relatively little to the total annual depth.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Rainfall Method. Since most sites are relatively small and highly impervious, the Rational Rainfall Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS system are

determined. Performance efficiency curve determined from full scale laboratory tests on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Probabilistic Rational Method

The Probabilistic Rational Method is a sizing program Contech developed to estimate a net annual sediment load reduction for a particular CDS model based on site size, site runoff coefficient, regional rainfall intensity distribution, and anticipated pollutant characteristics.

The Probabilistic Method is an extension of the Rational Method used to estimate peak discharge rates generated by storm events of varying statistical return frequencies (e.g. 2-year storm event). Under the Rational Method, an adjustment factor is used to adjust the runoff coefficient estimated for the 10-year event, correlating a known hydrologic parameter with the target storm event. The rainfall intensities vary depending on the return frequency of the storm event under consideration. In general, these two frequency dependent parameters (rainfall intensity and runoff coefficient) increase as the return frequency increases while the drainage area remains constant.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Method. Since most sites are relatively small and highly impervious, the Rational Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS are determined. Performance efficiency curve on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Treatment Flow Rate

The inlet throat area is sized to ensure that the WQQ passes through the separation chamber at a water surface elevation equal to the crest of the diversion weir. The diversion weir bypasses excessive flows around the separation chamber, thus preventing re-suspension or re-entrainment of previously captured particles.

Hydraulic Capacity

The hydraulic capacity of a CDS system is determined by the length and height of the diversion weir and by the maximum allowable head in the system. Typical configurations allow hydraulic capacities of up to ten times the treatment flow rate. The crest of the diversion weir may be lowered and the inlet throat may be widened to increase the capacity of the system at a given water surface elevation. The unit is designed to meet project specific hydraulic requirements.

Performance

Full-Scale Laboratory Test Results

A full-scale CDS system (Model CDS2020-5B) was tested at the facility of University of Florida, Gainesville, FL. This CDS unit was evaluated under controlled laboratory conditions of influent flow rate and addition of sediment.

Two different gradations of silica sand material (UF Sediment & OK-110) were used in the CDS performance evaluation. The particle size distributions (PSDs) of the test materials were analyzed using standard method "Gradation ASTM D-422 "Standard Test Method for Particle-Size Analysis of Soils" by a certified laboratory.

UF Sediment is a mixture of three different products produced by the U.S. Silica Company: "Sil-Co-Sil 106", "#1 DRY" and "20/40 Oil Frac". Particle size distribution analysis shows that the UF Sediment has a very fine gradation ($d_{50} = 20$ to $30 \mu\text{m}$) covering a wide size range (Coefficient of Uniformity, C averaged at 10.6). In comparison with the hypothetical TSS gradation specified in the NJDEP (New Jersey Department of Environmental Protection) and NJCAT (New Jersey Corporation for Advanced Technology) protocol for lab testing, the UF Sediment covers a similar range of particle size but with a finer d_{50} (d_{50} for NJDEP is approximately $50 \mu\text{m}$) (NJDEP, 2003).

The OK-110 silica sand is a commercial product of U.S. Silica Sand. The particle size distribution analysis of this material, also included in Figure 1, shows that 99.9% of the OK-110 sand is finer than 250 microns, with a mean particle size (d_{50}) of 106 microns. The PSDs for the test material are shown in Figure 1.

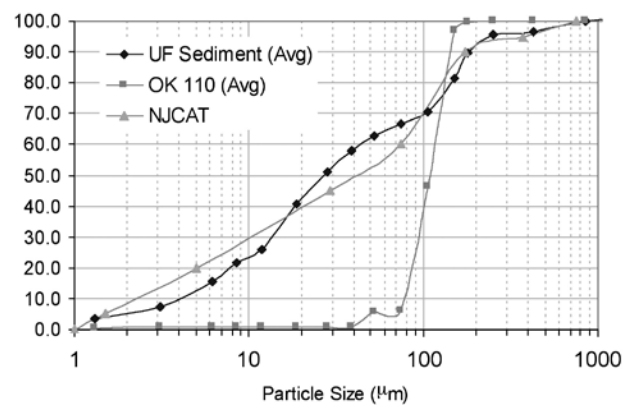


Figure 1. Particle size distributions

Tests were conducted to quantify the performance of a specific CDS unit (1.1 cfs (31.3-L/s) design capacity) at various flow rates, ranging from 1% up to 125% of the treatment design capacity of the unit, using the 2400 micron screen. All tests were conducted with controlled influent concentrations of approximately 200 mg/L. Effluent samples were taken at equal time intervals across the entire duration of each test run. These samples were then processed with a Dekaport Cone sample splitter to obtain representative sub-samples for Suspended Sediment Concentration (SSC) testing using ASTM D3977-97 "Standard Test Methods for Determining Sediment Concentration in Water Samples", and particle size distribution analysis.

Results and Modeling

Based on the data from the University of Florida, a performance model was developed for the CDS system. A regression analysis was used to develop a fitting curve representative of the scattered data points at various design flow rates. This model, which demonstrated good agreement with the laboratory data, can then be used to predict CDS system performance with respect

to SSC removal for any particle size gradation, assuming the particles are inorganic sandy-silt. Figure 2 shows CDS predictive performance for two typical particle size gradations (NJCAT gradation and OK-110 sand) as a function of operating rate.

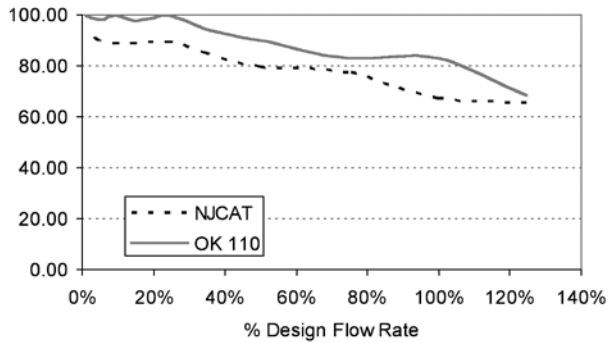


Figure 2. CDS stormwater treatment predictive performance for various particle gradations as a function of operating rate.

Many regulatory jurisdictions set a performance standard for hydrodynamic devices by stating that the devices shall be capable of achieving an 80% removal efficiency for particles having a mean particle size (d_{50}) of 125 microns (e.g. Washington State Department of Ecology — WASDOE - 2008). The model can be used to calculate the expected performance of such a PSD (shown in Figure 3). The model indicates (Figure 4) that the CDS system with 2400 micron screen achieves approximately 80% removal at the design (100%) flow rate, for this particle size distribution ($d_{50} = 125 \mu\text{m}$).

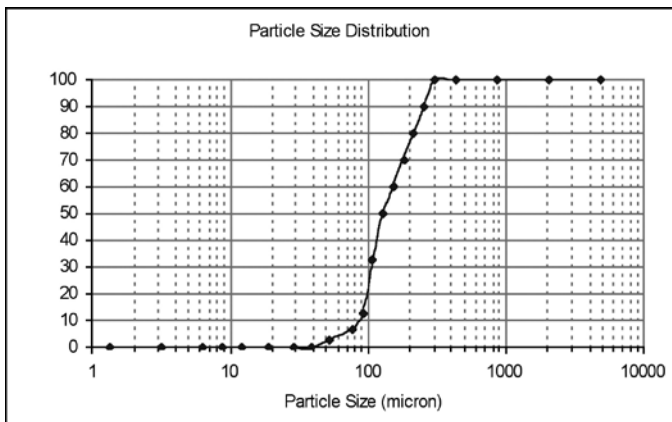


Figure 3. WASDOE PSD

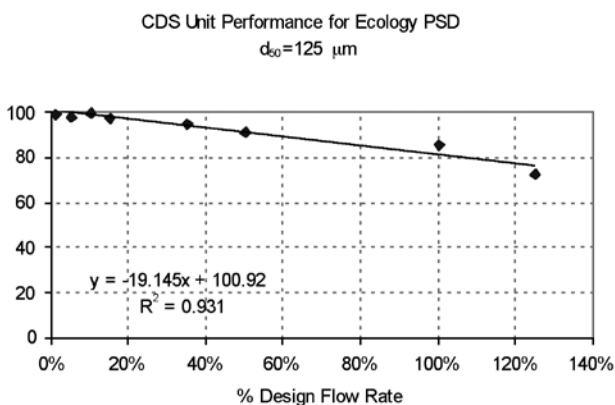


Figure 4. Modeled performance for WASDOE PSD.

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified



during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allow both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine whether the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS system should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be cleaned to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.



CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y ³	m ³
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Note: To avoid underestimating the volume of sediment in the chamber, carefully lower the measuring device to the top of the sediment pile. Finer silty particles at the top of the pile may be more difficult to feel with a measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.



SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.



800-338-1122

www.ContechES.com

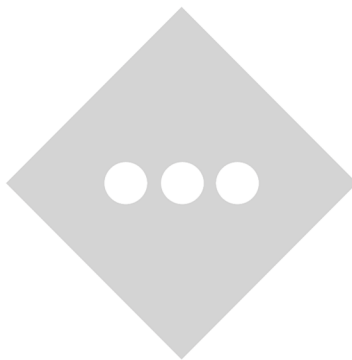
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APPENDIX D-2
R-TANK MODULE OPERATIONS &
MAINTENANCE MANUAL





STORMWATER STORAGE SYSTEM

OPERATIONS AND MAINTENANCE MANUAL

Green Stormwater Infrastructure Solutions



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DISCLAIMER

Read the following information before inspecting, cleaning, or performing maintenance on this Stormwater Treatment Device. This manual is intended to explain the specifics of the maintenance on R-Tank Stormwater Storage Systems.

It is the responsibility of all personnel to familiarize themselves with, understand and comply with all applicable local, state, and federal laws. All information in this manual is current at the time of printing but are subject to change based on the development of new processes and procedures. Ferguson Enterprises assumes no responsibility and is not accountable for any injuries, fines, penalties, or losses that occur involving any procedure in this manual or other actions taken. The R-Tank Stormwater Storage System performance is based on the procedures being followed in this manual. Non-Compliance with the outlined measures will be the responsibility of the owner.

GENERAL INFORMATION

Your R-Tank System has been designed to function in conjunction with the engineered drainage system on your site, the existing municipal infrastructure, and/or the existing soils and geography of the receiving watershed. Unless your site included certain unique and rare features, the operation of your R-Tank System will be driven by naturally occurring systems and will function autonomously. However, upholding a proper schedule of Inspection & Maintenance is critical to ensuring continued functionality and optimum performance of the system.

INSPECTION INFORMATION

During construction, the system shall be protected from sediment laden runoff and only activated once the site has been fully stabilized.

Both the R-Tank and all stormwater pre-treatment features incorporated into your site must be inspected regularly. Inspections should be done every six months for the first year of operation, and at least yearly thereafter. Inspections may be required more frequently for pre-treatment systems. You should refer to the manufacturer requirements for the proper inspection schedule.

With the right equipment most inspections and measurements can be accomplished from the surface without physically entering any confined spaces. If your inspection does require confined space entry, you must follow all local, regional, and OSHA requirements.

All maintenance features of your system can be accessed through a covering at the surface. With the lid removed, you can visually inspect each component to identify sediment, trash, and other contaminants within the structure. Check your construction plans to identify the maintenance features engineered into your R-Tank system, which may include:

Upstream Pipes, Inlets, and Manholes: Working from the structures adjacent the R-Tank toward those farther away, check for debris and sediment in both the structures and the pipes. Be sure to include all structures that contain pre-treatment systems. Some structures may include a sump.

Maintenance Ports / Inspection Ports: Maintenance/inspection ports are located near the inlet and outlet connections, treatment rows, and throughout the system. These should be used to check for sediment and typically allow access for backflushing and cleaning.

Treatment Row: On installations in 2018 or later, inlet pipes may connect to a row of modules with 12” diameter access holes running horizontally through the module that can be jet vacuumed. Check these rows for accumulation of sediment and debris.

All observations and measurements should be recorded on an Inspection Log kept on file. We have included a form you can use at the end of this guide.



INSPECTION CHECKLIST

Site Name:		Company:	
Location:		Contact:	
City and State:		Phone:	
System Owner:		Email:	

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Inspection Description	Frequency	Observations / Notes	Initials
Pretreatment Systems	Quarterly		
Connections	Bi-Annually		
Inspection Ports	Bi-Annually		
Accumulation of Sediment or Debris	Bi-Annually		
Upslope Erosion	Quarterly		
Accidental or Illicit Spillage	Quarterly		

--	--	--	--

Maintenance Items	Required Maintenance Activities	Initials
Pretreatment Systems		
Connections		
Inspection Ports		
Accumulation of Sediment or Debris		
Upslope Erosion		
Accidental or Illicit Spillage		

SYSTEM MAINTENANCE

For modules taller than 40" the R-Tank Stormwater Storage Systems should be back-flushed once sediment accumulation has reached 6". For modules less than 40" tall, perform maintenance when sediment depths are greater than 15% of the total system height. If your system includes a Treatment Row with linear access through the modules from the inlet pipe, backflush this area when sediment depths reach 6".

BEFORE ANY MAINTENANCE IS PERFORMED ON YOUR SYSTEM - PLUG THE OUTLET PIPE TO PREVENT CONTAMINATION OF THE DOWNSTREAM SYSTEMS.

Maintenance During Construction

Installed R-Tank Stormwater Storage Systems should be properly protected post installation, but before the System is accepted by owners in the following manner:

- **Vehicular Traffic:** Protect system from heavy construction equipment loads by using smaller vehicles, low ground pressure tracked equipment when possible, or protective measures such as steel plates to spread the load experienced by the system.
- **Sediment and Debris:** Use proper erosion control Best Management Practices to prevent sediment and debris from reaching the system.
- **Remove Sediment and Debris, as Needed:** If upslope practices fail to prevent sediment laden runoff from entering the upstream inlets, pipes, and system, sediment removal should be performed using jet-vac equipment.

Maintenance After Construction

Site specific conditions (land use, climate, tree cover, slopes, construction activities, etc.) along with data from regular inspections will determine how frequently the system must be cleaned. At a minimum, vacuum cleaning should occur every 1 to 2 years. Routine maintenance, such as pre-treatment inlet cleanout should occur every 3 to 6 months.

- Begin by cleaning all upstream structures, pipes, and pre-treatment systems containing sediment and/ or debris. If your system includes a Treatment Row, this portion of the system should be cleaned with traditional jet-vac equipment. Add a centralizer to the jet for easiest access through the modules.
- Complete initial debris removal by vacuuming debris up the inspection port locations, while using the jetting water to push debris to the hose. For finer debris, back-flush the R-Tank system. To perform this, water is pumped into the system through the inspection ports as rapidly as possible. The turbulent action of the water moving through the R-Tank will suspend sediments which may then be pumped out. If your system includes an outlet structure, this will be the ideal location to pump contaminated water out of the system. However, removal of back-flush water may be accomplished through the inspection ports, as well.
- For systems with large footprints that would require extensive volumes of water to properly flush the system, you should consider performing your maintenance within 24 hours of a rain event. Stormwater entering the system will aid in the suspension of sediments and reduce the volume of water required to properly flush the system.

INSPECTION AND MAINTENANCE COST ESTIMATE WORKSHEET

Project Name:		Engineer:	
Location:		City / State:	
Owner:		Contact:	
Phone:		Email:	

Life Expectancy (Yrs.) =	
---------------------------------	--

Inspection Description	Frequency / Year	Total Services*	Cost per Service	Total Cost**
Pretreatment Systems	4		\$	\$
Connections	2		\$	\$
Inspection Ports	2		\$	\$
Accumulation of Sediment or Debris	2		\$	\$
Upslope Erosion	4		\$	\$
Accidental or Illicit Spillage	4		\$	\$

Maintenance Items	Frequency / Year	Total Services*	Cost per Service	Total Cost**
Pretreatment Systems			\$	\$
Connections			\$	\$
Inspection Ports			\$	\$
Accumulation of Sediment or Debris			\$	\$
Upslope Erosion			\$	\$
Accidental or Illicit Spillage			\$	\$
System Vacuuming			\$	\$

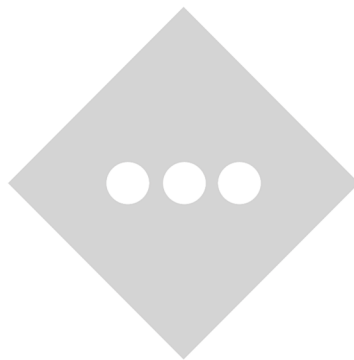
Total Costs = Inspection Costs + Maintenance Costs =	\$
--	----

Estimated Annual Operating Expenses = Total Costs / Years of Service =	\$
--	----

* Total Services = Frequency of Services / Yr. multiplied by Life Expectancy
 ** Total Cost = Total Services multiplied by Cost per Service

APPENDIX E

INSPECTION CHECKLISTS



F.3 CONSTRUCTION STANDARDS/SPECIFICATIONS FOR INFILTRATION BMPs

F.3.1 Infiltration Trench/Chamber General Notes and Specifications

Infiltration trench or chamber systems may not receive run-off until the entire contributing drainage area to the infiltration system has received final stabilization.

1. Construction equipment and traffic shall be restricted from traveling over the infiltration trench or chamber areas to minimize compaction of the soil.
2. Excavate the infiltration trench/chamber to the design dimensions. Excavated materials shall be placed away from the trench/chamber sides to enhance trench wall stability. Large tree roots must be trimmed flush with the trench sides in order to prevent fabric puncturing or tearing of the filter fabric during subsequent installation procedures. The side walls of the trench/chamber shall be roughened where sheared and sealed by heavy equipment.
3. A Class "C" geotextile or better shall interface between the trench/chamber side walls and between the stone reservoir and gravel filter layers. A partial list of non-woven filter fabrics that meet the Class "C" criteria is contained below..

Mirafi 180-N
Amoco 4552
WEBTEC N70
GEOLON N70
Carthage FX-80S

The width of the geotextile must include sufficient material to conform to trench/chamber perimeter irregularities and for a 6-inch minimum top overlap. The filter fabric shall be tucked under the sand layer on the bottom of the infiltration trench/chamber for a distance of 6 to 12 inches. Stones or other anchoring objects should be placed on the fabric at the edge of the trench/chamber to keep the trench open during windy periods. When overlaps are required between rolls, the uphill roll should lap a minimum of 2 feet over the downhill roll in order to provide a shingled effect.

4. A 6-inch sand filter layer may be placed on the bottom of the infiltration trench/chamber in lieu of filter fabric, and shall be compacted using plate compactors. The sand for the infiltration trench shall be washed and meet AASHTO Std. M-43, Size No. 9 or No. 10.
5. The stone aggregate should be placed in lifts and compacted using plate compactors. A maximum loose lift thickness of 12 inches is recommended. The gravel (rounded "bank run" gravel is preferred) for the infiltration trench/chamber

shall be washed and meet one of the following AASHTO Std. M-43; Size No. 2 or No. 3.

6. Infiltration chambers should consist of high molecular weight high density polyethylene (HDPE) and meet AASHTO H10 and H20 standards. Chambers should have repeating endwalls for internal support. Infiltration chambers must be constructed in accordance with manufacturer's specifications.
7. Following the stone aggregate placement, the filter fabric shall be folded over the stone aggregate to form a 6-in minimum longitudinal lap. The desired fill soil or stone aggregate shall be placed over the lap at sufficient intervals to maintain the lap during subsequent backfilling.
8. Care shall be exercised to prevent natural or fill soils from intermixing with the stone aggregate. All contaminated stone aggregate shall be removed and replaced with uncontaminated stone aggregate.
9. Voids can be created between the fabric and the excavation sides and shall be avoided. Removing boulders or other obstacles from the trench walls is one source of such voids; therefore, natural soils should be placed in these voids at the most convenient time during construction to ensure fabric conformity to the excavation sides.
10. Vertically excavated walls may be difficult to maintain in areas where soil moisture is high or where soft cohesive or cohesionless soils are predominate. These conditions may require laying back of the side slopes to maintain stability.
11. PVC should be in accordance with RIDOT specification section M.04 Drainage and the following provisions, as applicable. PVC distribution pipes shall be Schedule 40 and meet ASTM Std. D 1784. All fittings and perforations (1/2 inch in diameter) shall meet ASTM Std. D 2729. A perforated pipe shall be provided only within the infiltration trench/chamber and shall terminate 1 ft short of the infiltration trench wall. The end of the PVC pipe shall be capped.
12. Corrugated metal pipes should be in accordance with RIDOT specification section M.04 Drainage and the following provisions, as applicable. The corrugated metal distribution pipes shall conform to AASHTO Std. M-36 and shall be aluminized in accordance with AASHTO Std. M-274. Coat aluminized pipe in contact with concrete with an inert compound capable of effecting isolation of the deleterious effect of the aluminum on the concrete. Perforated distribution pipe shall be provided only within the infiltration trench/chamber and shall terminate 1 ft short of the infiltration trench wall. An aluminized metal plate shall be welded to the end of the pipe.
13. Corrugated High Density Polyethylene (HDPE) pipe should be in accordance with RIDOT specification no. 701.02.1 – Non-Metallic Pipe and the following provisions,

as applicable. HDPE pipe, couplings and fittings shall conform to the following: 4-10-in pipe shall meet the requirements of AASHTO M252 Type S, and 12in through 24in shall meet the requirements of AASHTO M294 Type S. Perforated distribution pipe shall be provided only within the infiltration trench/chamber and shall terminate 1 ft short of the infiltration trench wall. The end of the pipe shall be capped.

14. The observation well is to consist of 4- to 6-inch diameter PVC Schedule 40 pipe (ASTM Std. D 1784) with a cap set 6 inches above ground level and is to be located near the longitudinal center of the infiltration trench or chamber. Preferably the observation well will not be located in vehicular traffic areas. The pipe shall have a plastic collar with ribs to prevent rotation when removing cap. The screw top lid shall be a "Panella" type cleanout or equivalent with a locking mechanism or special bolt to discourage vandalism.
15. Distribution structures should be in accordance with RIDOT specification section 700 – Drainage and Selected Utility Accessories and the following provisions, as applicable. If a distribution structure with a wet well is used, a 4-inch PVC drain pipe shall be provided at opposite ends of the infiltration trench/chamber distribution structure. Two (2) cubic feet of porous backfill meeting AASHTO Std. M-43 Size No. 57 shall be provided at each drain.
16. If a distribution structure is used, the manhole cover shall be bolted to the frame.

NOTE: PVC pipe with a wall thickness classification of SDR-35 meeting ASTM standard D3034 is an acceptable substitution for PVC Schedule 40 pipe.

Table F-4 Infiltration Trench/Chamber Construction Inspection Checklist

Project:

Location:

Site Status:

Date:

Time:

Inspector:

CONSTRUCTION SEQUENCE	SATISFACTORY/ UNSATISFACTORY	COMMENTS
1. Pre-Construction		
Pre-construction meeting		
Runoff diverted		
Soil permeability tested		
Groundwater / bedrock sufficient at depth		
2. Excavation		
Size and location		
Side slopes stable		
Excavation does not compact subsoils		
3. Filter Fabric Placement		
Fabric specifications		
Placed on bottom, sides, and top		

CONSTRUCTION SEQUENCE	SATISFACTORY/ UNSATISFACTORY	COMMENTS
4. Aggregate Material		
Size as specified		
Clean / washed material		
Placed properly		
5. Observation Well		
Pipe size		
Removable cap / footplate		
Initial depth = _____ feet		
6. Final Inspection		
Pretreatment facility in place		
Contributing watershed stabilized prior to flow diversion		
Outlet		

Comments:

Actions to be Taken:

F.3.2 Infiltration Basins Notes and Specifications

1. The sequence of various phases of basin construction shall be coordinated with the overall project construction schedule. A program should schedule rough excavation of the basin with the rough grading phase of the project to permit use of the material as fill in earthwork areas. The partially excavated basin, however, cannot serve as a sedimentation basin.

Specifications for basin construction should state: (1) the earliest point in progress when storm drainage may be directed to the basin, and (2) the means by which this delay in use is to be accomplished. Due to the wide variety of conditions encountered among projects, each should be separately evaluated in order to postpone use as long as is reasonably possible.

2. Initial basin excavation should be carried to within 1 foot of the final elevation of the basin floor. Final excavation to the finished grade should be deferred until all disturbed areas on the watershed have been stabilized or protected. The final phase excavation should remove all accumulated sediment. Relatively light-tracked equipment is recommended for this operation to avoid compaction of the basin floor. After the final grading is completed, the basin provides a well-aerated, highly porous surface texture.
3. Infiltration basins may be lined with a 6- to 12-inch layer of filter material such as coarse sand (AASHTO Std. M-43, Sizes 9 or 10) to help prevent the buildup of impervious deposits on the soil surface. The filter layer can be replaced or cleaned when it becomes clogged. When a 6-inch layer of coarse organic material is specified for discing (such as hulls, leaves, stems, etc.) or spading into the basin floor to increase the permeability of the soils, the basin floor should be soaked or inundated for a brief period, then allowed to dry subsequent to this operation. This induces the organic material to decay rapidly, loosening the upper soil layer.
4. Establishing dense vegetation on the basin side slopes and floor is recommended. A dense vegetative stand will not only prevent erosion and sloughing, but will also provide a natural means of maintaining relatively high infiltration rates. Erosion protection of inflow points to the basin shall also be provided.
5. Selection of suitable vegetative materials for the side slope and all other areas to be stabilized with vegetation and application of required lime, fertilizer, etc. shall be done in accordance with the RIDOT specification section L.01.
6. Grasses of the fescue family are recommended for seeding primarily due to their adaptability to dry sandy soils, drought resistance, hardiness, and ability to withstand brief inundations. The use of fescues will also permit long intervals between mowings. This is important due to the relatively steep slopes that make mowing difficult. Mowing 2 times a year, once in June and September, is generally satisfactory. Re-fertilization with 10-6-4 ratio fertilizer at a rate of 500 lb per acre (11 lb per 1000 sq ft) may be required the second year after seeding.

Table F-5 Infiltration Basin Construction Inspection Checklist

Project:

Location:

Site Status:

Date:

Time:

Inspector:

CONSTRUCTION SEQUENCE	SATISFACTORY/ UNSATISFACTORY	COMMENTS
1. Pre-Construction		
Runoff diverted		
Soil permeability tested		
Groundwater / bedrock depth		
2. Excavation		
Size and location		
Side slopes stable		
Excavation does not compact subsoils		
3. Embankment		
Barrel		
Anti-seep collar or Filter diaphragm		
Fill material		
4. Final Excavation		

CONSTRUCTION SEQUENCE	SATISFACTORY/ UNSATISFACTORY	COMMENTS
Drainage area stabilized		
Sediment removed from facility		
Basin floor tilled		
Facility stabilized		
5. Final Inspection		
Pretreatment facility in place		
Inlets / outlets		
Contributing watershed stabilized before flow is routed to the facility		

Comments:

Actions to be Taken:

Infiltration System Operation, Maintenance, and Management Inspection Checklist

Project:

Location:

Site Status:

Date:

Time:

Inspector:

MAINTENANCE ITEM	SATISFACTORY / UNSATISFACTORY	COMMENTS
1. Debris Cleanout (Annual)		
Trench/chamber or basin surface clear of debris		
Inflow pipes clear of debris		
Overflow spillway clear of debris		
Inlet area clear of debris		
2. Sediment Traps or Forebays (Annual)		
Obviously trapping sediment		
Greater than 50% of storage volume remaining		
3. Dewatering (Annual)		
Trench/chamber or basin dewateres between storms		
4. Sediment Cleanout of Trench/Chamber or Basin (Annual)		

MAINTENANCE ITEM	SATISFACTORY / UNSATISFACTORY	COMMENTS
No evidence of sedimentation in trench/chamber or basin		
Sediment accumulation doesn't yet require cleanout		
5. Inlets (Annual)		
Good condition		
No evidence of erosion		
6. Outlet/Overflow Spillway (Annual)		
Good condition, no need for repair		
No evidence of erosion		
7. Aggregate Repairs (Annual)		
Surface of aggregate clean		
Top layer of stone does not need replacement		
Trench/Chamber or basin does not need rehabilitation		

Comments:

Actions to be Taken:

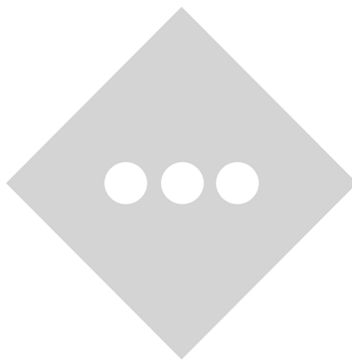
APPENDIX F

ANNUAL EVALUATION FORMS

INVENTORY

F-1: ANNUAL EVALUATION LOG

F-2: AMENDMENT LOG



ANNUAL EVALUATION RECORD

The person responsible for maintenance shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed.

The responsible party should evaluate the effectiveness of the maintenance plan by comparing the maintenance plan with the actual performance of the maintenance. The items to evaluate may include, but not limited to,

- Whether the inspections have been performed as scheduled;
- Whether the preventive maintenance has been performed as scheduled;
- Whether the frequency of preventative maintenance needs to increase or decrease;
- Whether the planned resources were enough to perform the maintenance;
- Whether the repairs were completed on time;
- Whether the actual cost was consistent with the estimated cost;
- Whether the inspection, maintenance, and repair records have been kept.

If actual performance of those items has been deviated from the maintenance plan, the responsible party should find the causes and implement solutions in a revised maintenance plan.

<i>Evaluator(s)</i>	<i>Date of Evaluation</i>	<i>Decision</i>
		<input type="checkbox"/> Maintain current version OR <input type="checkbox"/> Revise current version Revision date _____ (also update the last revision date on the cover page) <input type="checkbox"/> Requires a new deed recording (also update the last recording information on the cover page)
		<input type="checkbox"/> Maintain current version OR <input type="checkbox"/> Revise current version Revision date _____ (also update the last revision date on the cover page) <input type="checkbox"/> Requires a new deed recording (also update the last recording information on the cover page)
		<input type="checkbox"/> Maintain current version OR <input type="checkbox"/> Revise current version Revision date _____ (also update the last revision date on the cover page) <input type="checkbox"/> Requires a new deed recording (also update the last recording information on the cover page)

