PARE PROJECT NO. 14173.00

STORMWATER MANAGEMENT REPORT

BUILDING 35 ADDITION FOR RESEARCH

VETERANS AFFAIRS MEDICAL CENTER

830 CHALKSTONE AVENUE

PROVIDENCE, RHODE ISLAND

Prepared by:

Pare Corporation
8 Blackstone Valley Place
Lincoln, RI 02865

June 30, 2015

PROJECT DESCRIPTION

Introduction

The purpose of this report is to document the support calculations necessary to adhere to the guidelines of Section 438 of the Energy Independence and Security Act (EISA), within the footprint of the proposed "Addition to the Neurological Research Building #35" project at the Providence, RI Veterans Affairs Medical Center (VAMC). This project consists of a two story addition to Building #35 of the VAMC Campus with associated site improvements such as retaining walls, an updated patio area, utility upgrades, and stormwater management practices.

The purpose of the proposed stormwater management practice is to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow. This report also contains a review of how the proposed stormwater management practice equates to the standards enforced by the Rhode Island Department of Environmental Management (RIDEM), which are listed in the December 2010 Rhode Island Stormwater Design and Installations Standards Manual (RISDISM).

Existing Conditions

The Providence Veterans Affairs Medical Center campus covers over more than 30 acres, however the disturbance limits for this project encompass about 11,000 square feet (0.25 acres). Existing conditions within this area consist of a concrete walk and a steep grassed and wooded area. Approximately 8.7% (868 square feet) of the site within the limit of disturbance exists as impervious areas.

The site is located outside of the flood zone, as shown on the firmette of community panel number 44007C0308H.

Per the Natural Resources Conservation Service, the soil within the project area is listed as Merrimac-Urban land complex (MU), which has a hydrologic soil group (HSG) rating of A. These soils are considered to have a high infiltration rate and therefore are well drained.

A Geotechnical Report was prepared in November 2014 by Pare Corporation that reviews below grade conditions on the site. Five test borings were conducted in October 2014 at locations in and around the proposed building addition. The on-site soils are primarily comprised of silty sand or

sands. Groundwater was not encountered during the subsurface investigation that ranged from 10 feet to 72 feet below grade. Groundwater within the campus has historically been at low elevations. In previous geotechnical studies conducted at other locations on campus (Buildings #1 and #32), groundwater was not encountered up to 50' below ground surface.

Proposed Conditions

The proposed improvements include the construction of a two-story building addition. Associated site, utility, and drainage improvements are proposed to support the new development. The proposed addition results in an impervious area of 45% (4500 square feet) within the limit of disturbance.

Stormwater is conveyed to a best management practice via overland flow and a stormwater conveyance system consisting of roof drains, catch basins, manholes, and piping. This project is on federal property and therefore the stormwater design is bound by Section 438 of the EISA. However, the stormwater drainage design was also developed to be in compliance with the state standards, the RISDISM.

Methodology

The following series of steps were taken to develop support calculations on harmony with Section 438 of the EISA:

1. Site evaluation and soils analysis
2. Calculate the 95th percentile rainfall event.
3. Determine the site-specific "maximum extent technically feasible".
4. Calculate the expected runoff for the 95th percentile rainfall event.
5. Select and size the onsite management practice.

Site Evaluation and Soils Analysis

See "Existing Conditions" section above.

Calculation of the 95th Percentile Rainfall Event

Precipitation data over a thirty-year period (September 1984 to September 2014) was downloaded from the website of the National Climatic Data Center (www.ncds.noaa.gov) for the location of Providence, Rhode Island (TF Green Airport). The data was imported into a Microsoft Excel spreadsheet and, after removing rainfall events less than 0.1 inches, the 95th percentile rainfall amount was calculated to be 1.7" – the event which captures all but the largest 5% of storms.

Determination of Maximum Extent Technically Feasible

Stormwater runoff from the proposed impervious areas is directed to the proposed stormwater management practice through a series of roof drains, catch basins, and drain piping. Thus, the retention of the 95th percentile rainfall included for all of the proposed impervious areas on site from the building addition and walks.

Estimation of Runoff Volume

Runoff from each land cover was estimated using a simplified volumetric approach based upon the following equation:

$$Runoff = Rainfall - Depression\ Storage - Infiltration\ Loss$$

where depression storage is 0.1" and 0.2" respectively for rooftop and pervious areas, and infiltration losses are assumed to be 9.7" (although the site has soil with an HSG of A, an HSG of B was assumed for calculation simplicity), per Appendix A of Section 438 of the EISA. Thus, the runoff from the roof is estimated to be

$$Runoff_{roof} = 95th\ Rainfall - Depression\ Storage$$

$$= 1.7 - 0.1 = 1.6 \text{ inches}$$

and the runoff from the landscape area is estimated to be

$$Runoff_{landscape} = 95th\ Rainfall - Depression\ Storage - Infiltration\ Losses$$

$$= 1.7 - 0.2 - 9.74 = 0 \text{ inches (i.e. no runoff since the result is a negative number)}$$

Selection & Sizing of the Onsite Management Practice

A bioretention area will be employed to capture the excess runoff resulting from the 95th percentile rainfall event. The bioretention area is designed to infiltrate 100% of the runoff from the 95th percentile storm, 1.7".

RIDEM Standards

The stormwater management system is designed to meet the 11 Minimum Standards of the RISDISM. The following sections describe the approach to meeting the requirements for each Minimum Standard.

Minimum Standard 1: LID Site Planning and Design Strategies

Low impact design (LID) strategies were implemented wherever possible. The project limits avoided the steep, natural vegetation to the east of the project area to preserve the natural area and minimize clearing and grading. Runoff is proposed to be treated as close to the point of generation as feasible.

Minimum Standard 2: Groundwater Recharge

Minimum Standard 2 is met by providing a bioretention area that infiltrates the proposed roof and patio runoff. The building addition includes a roof overhang, which extends about 12 feet off the edge of the building. Although the ground beneath the overhang is part concrete walk and part grassed area, the area of the roof overhang is included in the total roof area runoff calculations.

The bioretention area has been designed in accordance with RIDEM Standards to promote the settling of total suspended solids and infiltrate the required recharge volume. Runoff from the roof and patio that enters the bioretention area will first be pretreated through a deep sump catch basin. It will then flow to the bioretention area, which is made up of filter media with a mulch upper layer and a raised catch basin. The bioretention area outlet is raised to store the water quality volume for 24-hours while it slowly drains through the surrounding soils following the storm event. In larger storm events, the stormwater will overflow through the catch basin and discharge to the drainage system in Air Force Drive.

Minimum Standard 3: Water Quality

The proposed bioretention area, described in Minimum Standard 2, is designed to provide water quality treatment to runoff collected from the roof and the patio. It is designed in accordance with the RISDISM requirements to remove total suspended solids and other pollutants from the stormwater runoff.

The construction of the building addition results in a net increase in impervious area of the project. The bioretention area was sized to handle runoff from the roof area and patio, which accounts for 94% of the proposed impervious areas for the project. During a large storm, the bioretention area will overflow to a raised catch basin outlet control structure that is connected to the drain line in Air Force Drive.

Minimum Standard 4: Conveyance and Natural Channel Protection

New stormwater piping was designed to convey runoff from the 25-year design storm event in accordance with general engineering practice.

Minimum Standard 5: Overbank Flood Protection

The existing and proposed hydrology was evaluated to determine the distribution of stormwater runoff to the drain system in Air Force Drive. The table below provides a summary of the peak flow rates for the existing and proposed conditions within the project area.

Table 1: Peak Flow Rate (CFS)

Design Storm	**Existing (cfs)**	**Proposed (cfs)**	**Change**
10-Year	0.00	0.00	0.00
25-Year	0.02	0.00	-0.02
50-Year	0.06	0.15	0.09
100-Year	0.13	0.42	0.29

The stormwater management system was designed to reduce flows offsite up to the 25-year design storm. Steep slopes and other site constraints limited the space to implement stormwater BMP's. The bioretention area was designed to provide overbank flood protection to the maximum extent feasible.

Minimum Standard 6: Redevelopment and Infill Projects

The project does not qualify as a Redevelopment Project per Section 3.2.6 of the RISDISM. This minimum standard is not applicable.

Minimum Standard 7: Pollution Prevention

A Pollution Prevention plan is provided in Appendix C.

Minimum Standard 8: Land Uses with a Higher Potential Pollutant Load (LUHPPL)

This minimum standard is not applicable to the project as the land use is not considered a LUHPPL.

Minimum Standard 9: Illicit Discharges

There are no illicit discharges proposed to the stormwater management system in accordance with State regulations.

Minimum Standard 10: Construction Erosion and Sedimentation Control

A Soil Erosion and Sediment Control Plan was prepared as a separate document and demonstrates which practices will be used to minimize land disturbing and conveyance.

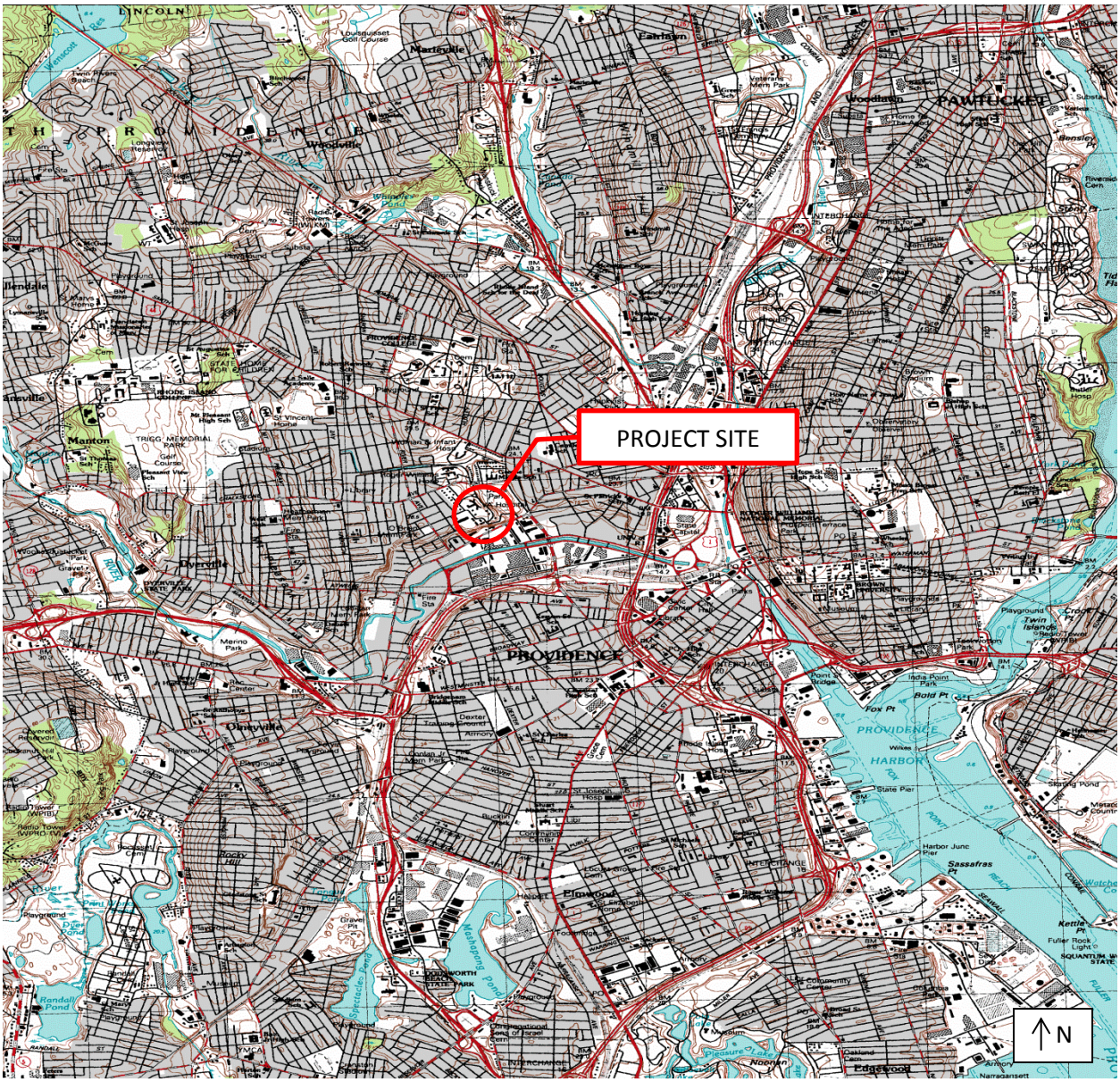
Minimum Standard 11: Stormwater Management System Operation and Maintenance (O&M)

The stormwater management O&M plan was prepared to address routine upkeep tasks for maintaining the stormwater management system. The O&M plan is provided in Appendix C.

Conclusion

In conclusion, the proposed stormwater management system meets the requirements of the Energy Independence and Security Act Section 438 and where technically feasible, the Rhode Island Department of Environmental Management. The stormwater management system has been designed to promote infiltration and to improve the overall water quality to downstream resources and offsite areas.

APPENDIX A



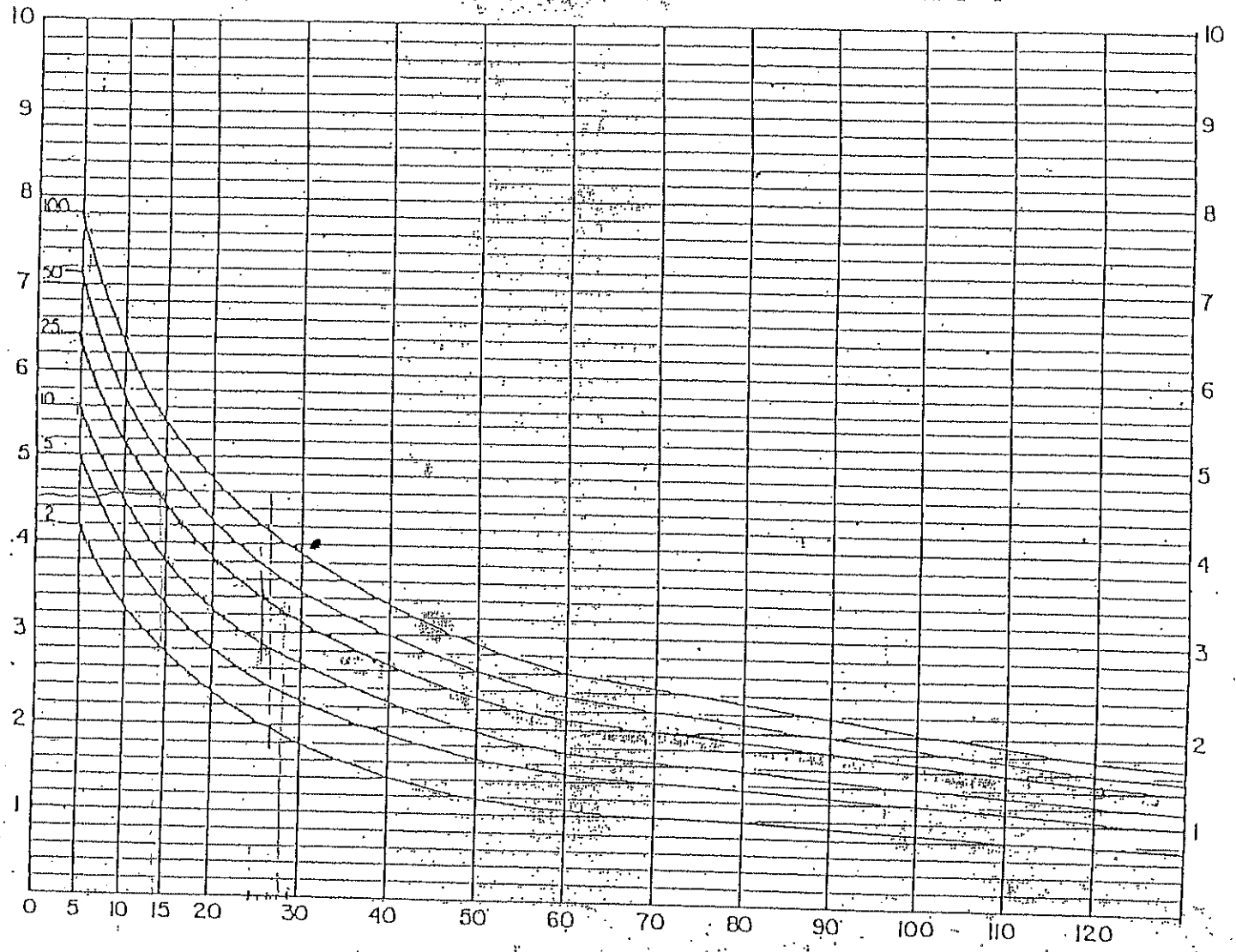
SITE LOCATION MAP

Providence Veterans Affairs Medical Center
Building 35 Addition for Research
830 Chalkstone Avenue
Providence, RI

PARE
PARE CORPORATION
ENGINEERS - SCIENTISTS - PLANNERS
8 BLACKSTONE VALLEY PLACE
LINCOLN, RI 02865
401-334-4100

INTENSITY CURVES FOR STORMS

PROVIDENCE R.I. AND VICINITY



BASED ON NWS HYDRO 35
& TECH. PAPER NO. 40

3.0 STORMWATER MANAGEMENT STANDARDS AND PERFORMANCE CRITERIA

3.1 OVERVIEW

Rhode Island has seen an increase in commercial and residential development over the last several decades. Controlling stormwater from development sites is a priority with regards to impacts to receiving water bodies. This chapter presents performance standards and criteria for all new and redevelopment projects in the State of Rhode Island. Project applicants are required to meet the eleven minimum standards, as well as comply with specific criteria for the site planning process, groundwater recharge, water quality, channel protection, and peak flow control requirements. In the case of restoration or retrofitting, deviation from these standards may be appropriate at the discretion of the approving agency. All applicable development proposals must include a stormwater management site plan for review by State and local government. A plan must address all of the above minimum standards through compliance with the requirements of this manual (see checklist in Appendix A of this document).

All of the minimum standards contribute to protecting the water and habitat quality of receiving waters from the negative impacts of stormwater runoff. This is achieved by using a combination of both structural controls and non-structural practices (such as LID) as part of an effective stormwater management system. In general, when a project's stormwater management system is designed, installed, and maintained in accordance with the requirements of this manual, its runoff impacts will be presumed to be in compliance with applicable state regulatory standards and requirements. In some cases, the permitting agency may require that an applicant prepare and submit a pollutant loading analysis developed in accordance with the provisions of Appendix H in order to ascertain compliance.

This manual often refers to storm events of various kinds. Unless otherwise noted, all storm events are 24 hours in duration and utilize NRCS Type III precipitation distribution. Rainfall amounts for Rhode Island for various return frequencies are provided in Table 3-1 and shall be used for design unless otherwise specified.

Table 3-1 Design Rainfall Amounts for Rhode Island

RI County	24-hour (Type III) Rainfall Amount (inches)*						
	1-Year	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Providence County	2.7	3.3	4.1	4.9	6.1	7.3	8.7
Bristol County	2.8	3.3	4.1	4.9	6.1	7.3	8.6
Newport County	2.8	3.3	4.1	4.9	6.1	7.3	8.6

MAP SCALE 1" = 500'

250 0 500 1000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0308H

FIRM

FLOOD INSURANCE RATE MAP

PROVIDENCE COUNTY, RHODE ISLAND (ALL JURISDICTIONS)

PANEL 308 OF 451

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PROVIDENCE, CITY OF	445406	0308	H

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
44007C0308H

MAP REVISED
APRIL 18, 2011

Federal Emergency Management Agency

Hydrologic Soil Group—State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties
Survey Area Data: Version 12, Dec 18, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 21, 2013—Sep 7, 2013

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties (RI600)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
MU	Merrimac-Urban land complex	A	6.8	100.0%
Totals for Area of Interest			**6.8**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX B

PARE CORPORATION

PROJECT VAMC Neuro Addition		PROJECT NUMBER	14173.00
SUBJECT Recharge Volume			
COMPUTATIONS BY	VAH	DATE	2/25/2015
CHECK BY	JDG	DATE	2/25/2015

Recharge Volume Calculations

Required Recharge Volume

The Required Recharge Volume equals the depth of runoff, corresponding to the soil type, times the impervious areas covering that soil type at the post-development site per the Rhode Island Stormwater Design and Installation Standards Manual.

Required Recharge Volume = Target Depth Factor (F) x Impervious Area

Impervious Area within Hydrologic Group "A" Soils =	4,500	SF of proposed impervious surfaces within LOD
F (from RISDISM) =	0.60	inches
Recharge Volume =	225	cf
Total Required Recharge Volume =	**225**	**cf**

Proposed BMP's

A bioretention area will be employed.

BMP's Area Volume

	Impervious Area (sf)	Volume (cf)
Bioretention Area 1 =	4,483	1,235
	4,483	**1,235**

Total Provided Recharge Volume	**1,235**	**cf**
Total Required Recharge Volume (Rv) =	225	cf

PARE CORPORATION

PROJECT VAMC Neuro		PROJECT NUMBER	14173.00
SUBJECT Bioretention Area			
COMPUTATIONS B'	VAH	DATE	2/25/2015
CHECK BY	JDG	DATE	2/25/2015

Bioretention Area Calculations

Bioretention Area (BIO) No. 1

Total Contributing Area to BMP =	4,483	SF
Total Impervious Area to BMP =	4,483	SF

Cell Volume shall be larger of Recharge Volume and Water Quality Volume

Recharge Volume

Impervious Area within Hydrologic Group "A" Soils =	4,483	SF
F (from RI Stormwater Design & Installation Standards Man. Table 3-4) =	0.60	inches
Required Recharge Volume =	224	cf

Water Quality Volume (WQV)

WQV = Impervious Area x 1.0 inches =	374	CF
75% WQV (Including Pretreatment) =	280	CF
Required WQV Volume =	**280**	**CF**
Provided Water Quality Volume =	**545**	CF @ Elev. 62.5 (Rim Elev. Of Outlet CB)
Volume provided in Bioretention Media =	**690**	CF in 36" of media with a 0.33 Void Ratio
Total Volume Provided =	**1,235**	**CF**

Area

Af=WQv (df)/[(k)(hf+df)(tf)] *(From 5.5.4)*

Area Required =	110	SF
Area Provided =	**545**	**SF**

Sediment Forebay

Pretreatment Volume

Pretreatment Volume = 25% WQV =	93	CF
Pretreatment Volume Provided =	**A deep sump catch basin is provided for pretreatment**	

Drawdown within 72 hours

Time = (Provided Volume) / (K x Bottom Area)

Provided Volume =	**1,235**	**CF**	
K = saturated hydraulic conductivity =	**1.00**	**FT/DAY (from Section 5.5.4 of the RI Stormwater & Installation Standards Manual)**	
Bottom Area (Average) =	**545**	**SF**	
Time (hrs) =	**54**	**hrs**	**< 72 hrs**

APPENDIX C

STORMWATER OPERATION AND MAINTENANCE PLAN

1. OPERATION AND MAINTENANCE

Following construction, the completion of the inspection and maintenance requirements below shall be the responsibility of the Property Owner (See OM-1).

1. Trash, litter, sediment and other debris shall be removed from any stormwater facility (including catch basins, manholes, bioretention areas, inlet, and outlet structures) at least twice a year, preferably spring and fall, at the cost of the Owner.

2. The parking lot and entry drives shall be swept by the Owner as early as possible every spring and once in the fall to remove sediments.

3. All sediments removed shall be disposed of at an approved and permitted location.

4. All cleaning and maintenance of the drainage system BMP shall be the responsibility of the property owner. See additional inspection, maintenance, and repair notes for the stormwater system.

Bioretention Area Inspection, Maintenance, and Repair Notes

1. The bioretention area shall be inspected after every major storm of 2.7" or greater for trash, debris, sediment, erosion, standing water, and overall performance. Defects shall be repaired by the Owner.

2. Owner shall mow grass within bioretention area twice annually, once in late spring and once in early fall. The vegetation shall not exceed 18" in height.

3. Owner shall re-mulch bioretention areas in spring every year.

4. In spring, owner shall trim vegetation and remove dead vegetation from the bioretention area.

5. Remove accumulated sediment from the bioretention cells twice annually in late spring or early fall if sediment exceeds 1" in the bioretention area.

6. If ponding exceeds 48 hours, the owner shall remove all discolored material and re-mulch filter surface.

7. Following the first 6 months after construction, the owner shall inspect filter practices after the first two storms of 1" of greater.

LONG TERM POLLUTION PREVENTION PLAN

1. POLLUTION PREVENTION AND SOURCE CONTROLS

In addition, the following site specific controls and performance procedures shall be followed. From *Appendix G: Pollution Prevention and Source Controls* from the *Rhode Island Stormwater Design and Installation Standards Manual* (See Attachment)

G.2 General Pollution Prevention Design Features
G.3 Solid Waste Containment
G.4 Roads and Parking Area Management
G.4.1 Street and Parking Lot Sweeping
G.4.2 Deicing and Salt Storage
G.4.4 Driveway and Parking Lot Sealants
G.5 Hazardous Materials Containment
G.7 Lawn, Garden and Landscape Management

APPENDIX G: POLLUTION PREVENTION AND SOURCE CONTROLS

G.1 Overview

Pollution prevention techniques must, to the extent practicable, be incorporated into all site designs, especially at commercial and light industrial sites, to minimize the potential impact those activities may have on stormwater runoff quality. Preventative source controls must also be applied in residential development, particularly in preventing floatables (trash and debris) from entering storm sewer drainage systems.

G.2 General Pollution Prevention Design Features

Inlets to stormwater management systems should incorporate trash racks wherever practicable. Storm drain marking (e.g., stenciling) to discourage dumping must also be provided at each inlet. Maintenance plans must include a schedule for regular maintenance and inspection of trash racks.

G.3 Solid Waste Containment

Proper containment of solid waste will prevent it from entering drainage systems and polluting waterways. At a minimum, apply the following pollution prevention practices:

- Trash and recycling receptacles must be provided with regular collection at all sites;
- Industrial and commercial sites must include regular street sweeping (at least annually) in their maintenance plans; and
- Pet waste stations that provide bags and waste containers are recommended at all residential developments and must be provided at multiunit dwellings, such as apartments, town houses, and condominiums.

G.4 Roads and Parking Area Management

Roads and parking areas constitute a large portion of Rhode Island's impervious surfaces and are often directly connected to storm drain systems. These impervious areas contribute relatively high concentrations of a wide variety of pollutants, including sediment, nutrients, metals, and volatile organic compounds (VOCs), among other constituents. The discussion below addresses guidance requirements related to road and parking area management:

G.4.1 Street and Parking Lot Sweeping

Street sweeping helps to remove sediment and debris from paved surfaces, reducing potential pollutant transport to waterbodies. Street and parking lot sweeping may also reduce the need for maintenance of pretreatment devices, such catch basins and forebays that precede WVTSs or bioretention areas.

Street sweeping is a requirement for municipalities pursuant to Phase II of the RIPDES Stormwater Regulations and is also recommended for private entities. Currently, available street sweeping technology is not considered to meet the water quality treatment standard and should not be relied on for TSS removal, but does help as a pretreatment practice.

Debris collected from some streets and parking lots (e.g., LUHPPLs) may be regulated as a hazardous waste. For these cases, debris must be disposed of in accordance with appropriate practice and applicable regulatory standards. Appendix A of the *Rules and Regulations for Composting Facilities and Solid Waste Management Facilities,* which is entitled "Management of Street Sweepings in Rhode Island," should be reviewed. For further information, contact the DEM Office of Waste Management.

G.4.2 Deicing and Salt Storage

Deicing and sanding operations are often necessary for safety during winter storms; however, the materials used create water quality problems. Use deicing chemicals and sand judiciously. Consider the information in Table G-1 when selecting a deicer.

Table G-1 Comparison of Environmental Effects of Common Roadway Deicers

Media	Sodium Chloride ($NaCl$)	Calcium Chloride ($CaCl_2$)	Calcium magnesium acetate (CMA) ($CaMgC_2H_3O_2$)	Sand (SiO_2)
Soils	Cl complexes release heavy metals; Na can breakdown soil structure and reduce permeability	Ca can exchange with heavy metals, increase soil aeration and permeability.	Ca and Mg can exchange with heavy metals.	Gradually will accumulate on soil.
Vegetation	Salt spray/splash can cause leaf scorch and browning or dieback of new plant growth up to 50 feet from road; osmotic stress can result from salt uptake; grass is more tolerant than trees and woody plants.		Little effect.	Accumulates on and around low vegetation.
Groundwater	Mobile Na and Cl ions readily reach groundwater, and concentration levels can temporarily increase in areas of low flow during spring thaws. Ca and Mg can release heavy metals from soil.			No known effect.
Surface Water	Can cause density stratification in small lakes having closed basins, potentially leading to anoxia in lake bottoms; often contain nitrogen, phosphorus, and trace metals as impurities, often in concentrations greater than 5 ppm.		Depletes dissolved oxygen in small lakes and streams when degrading.	Accumulated sand alters stream geometry and habitat

Media	Sodium Chloride (NaCl)	Calcium Chloride ($CaCl_2$)	Calcium magnesium acetate (CMA) ($CaMgC_2H_3O_2$)	Sand (SiO_2)
Aquatic Biota	Little effect in large or flowing bodies at current road salting amounts; small streams that are end points for runoff can receive harmful concentrations of Cl; Cl from NaCl generally not toxic until it reaches levels of 1,000-36,000 ppm.		Can cause oxygen depletion.	Accumulation of particles to stream bottoms degrades habitat, clogs gills.

Source: Adapted from Ohrel, 2000

Sand and deicing chemicals should be stored under cover so as to prevent their exposure to stormwater; the DEM Groundwater Quality Rules require that deicer materials be covered in areas where the groundwater is classified GAA or GA. Table G-2 provides recommendations appropriate for storage and use of deicers. Storage of these materials may be regulated as an industrial activity. Contact DEM's Stormwater Program in the Office of Water Resources for further information.

Table G-2 Recommendations to Reduce Deicer Impacts

Activity	Recommendation
Storage	• Salt storage piles should be completely covered, ideally by a roof, and at a minimum, by a weighted tarp, and stored on impervious surfaces. The DEM Groundwater Quality Rules require that deicer materials be covered in areas where the groundwater is classified GAA or GA. • Runoff should be contained in appropriate areas. • Spills should be cleaned up after loading operations. The material may be directed to a sand pile or returned to salt piles. • Avoid storage in drinking water supply areas, water supply aquifer recharge areas, and public wellhead protection areas.
Application	• Application rate of deicing materials should be tailored to road conditions (i.e., high versus low volume roads). • Trucks should be equipped with sensors that automatically control the deicer spread rate. • Drivers and handlers of salt and other deicers should receive training to improve efficiency, reduce losses, and raise awareness of environmental impacts.

Activity	Recommendation
Other	• Identify ecosystems such as wetlands that may be sensitive to salt. • Use calcium chloride and CMA in sensitive ecosystem areas. • To avoid over-application and excessive expense, choose deicing agents that perform most efficiently according to pavement temperature. • Monitor the deicer market for new products and technology.

Source: Adapted from Ohrel, 2000.

G.4.3 Snow Disposal

Improper snow disposal can be a threat to public health and the environment. Disposal should consider site selection, site preparation and maintenance, and emergency snow disposal locations and procedures. Refer to DEM's Snow Disposal Policy for more details on these topics, which are summarized below.

G.4.3.1 Site Selection

The key to selecting effective snow disposal sites is to locate them adjacent to or on pervious surfaces in upland areas away from water resources and wells. At these locations, snow meltwater can filter in to the soil, leaving behind sand and debris, which can be removed in the springtime. When selecting a site for snow disposal, adhere to the following guidelines:

- Avoid dumping snow into any waterbody, including rivers, reservoirs, ponds, lakes, wetlands, bays, or the ocean. In addition to water quality impacts and flooding, snow disposed of in open water can cause navigational hazards when it freezes.
- Do not dump snow within a Wellhead Protection Area (WHPA) of a public water supply well, or within 200 feet of a private well, where road salt may contaminate water supplies.
- Avoid dumping snow in sanitary landfills and gravel pits. Snow meltwater will create more contaminated leachate in landfills posing a greater risk to groundwater. In gravel pits, there is little opportunity for pollutants to be filtered out of the meltwater because groundwater is close to the land surface.
- Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage swales or ditches. Snow combined with sand and debris may block a storm drainage system, causing localized flooding. In addition, a high volume of sand, sediment, and litter released from melting snow may be quickly transported through the drainage system into surface water.

G.4.3.2 Site Selection Procedures

It is important that the municipal Department of Public Works or Highway Department, and other appropriate municipal offices work together to select appropriate snow disposal sites. The following steps should be taken:

- Estimate how much snow disposal capacity is needed for the season so that an adequate number of disposal sites can be selected and prepared;
- Identify sites that could potentially be used for snow disposal such as municipal open space (e.g., parking lots or parks);
- Sites located in upland locations that are not likely to impact sensitive environmental resources should be selected first; and
- If more storage space is needed, prioritize the sites with the least environmental impact (using the site selection criteria and the online Environmental Resource Map as a guide).

Environmental Resource Map

An interactive map containing a wide variety of GIS data layers of interest to local planning or zoning board members, consultants, or anyone else needing a general mapping of soils, wetlands, land use patterns, regulatory overlay districts and other environmental information can be accessed via the internet at the following address: http://www.state.ri.us/dem/maps/index.htm.

This interactive map can be used to identify publicly owned open spaces and approximate locations of sensitive environmental resources (locations should be field verified where possible).

G.4.3.3 Site Preparation and Maintenance

In addition to carefully selecting disposal sites before the winter begins, it is important to prepare and maintain these sites to maximize their effectiveness. The following maintenance measures should be undertaken for all snow disposal sites:

- A silt fence or equivalent barrier should be placed securely on the down-gradient side of the snow disposal site;
- To filter pollutants out of the meltwater, a 50-foot vegetative buffer strip should be maintained during the growth season between the disposal site and adjacent waterbodies;
- Debris should be cleared from the site prior to using the site for snow disposal; and
- Debris should be cleared from the site and properly disposed of at the end of the snow season.

G.4.3.4 Emergency Snow Disposal

Under normal winter conditions, storage, and disposal of snow should be done

exclusively in upland areas, not in or adjacent to waterbodies or wetlands. However, under extraordinary conditions when upland snow storage options are exhausted, it may be necessary to dispose of snow near or in certain waterbodies. The following guidance does not constitute a Clean Water Act permit for such disposal. However, in an emergency situation, DEM is unlikely to pursue an enforcement action for snow disposal by governmental entities into or near certain waters if conducted in accordance with the conditions identified below.

As mentioned earlier, it is important to estimate the amount of snow disposal capacity you will need so that an adequate number of upland disposal sites can be selected and prepared. If despite your planning, designated upland disposal sites have been exhausted, snow may be disposed of at other locations that meet the criteria in Section G.4.3.2.

Under extraordinary conditions, when all upland snow disposal options are exhausted, disposal of snow that is not obviously contaminated with road salt, sand, and other pollutants may be allowed near (within 50 feet of) or in certain waterbodies under certain conditions. In these dire situations, notify the DEM – Office of Water Resources, RIPDES Program at 222-4700 (or 222-3070 after normal business hours) before disposing of snow in a waterbody. If upland disposal is not available, and snow needs to be removed/relocated for safety reasons, then as a last resort waterways may be used in accordance with the following conditions:

- Dispose of snow in open water with adequate flow and mixing to prevent ice dams from forming;
- Do not dispose of snow in coastal or freshwater wetlands, eelgrass beds, vegetated shallows, vernal pools, shellfish beds, mudflats, outstanding resource waters, drinking water reservoirs and their tributaries, Wellhead Protection Areas (WHPAs), or other areas designated by the State as being environmentally sensitive;
- In coastal communities, preference should be given to disposal in salt water if it is available;
- Do not dispose of snow where trucks may cause shoreline damage or streambank damage or erosion; and
- Consult with appropriate municipal officials to ensure that snow disposal in water complies with local ordinances and bylaws.

G.4.4 Driveway and Parking Lot Sealants

Driveway and parking lot sealants are a major source of polycyclic aromatic hydrocarbons (PAHs) in our environment. There are two types of sealant: asphalt based and coal-tar based. Both types of sealant contain PAHs, but the coal-tar based sealants have a far higher concentration of PAHs (as much as 70 times higher than asphalt based). As the sealants wear down, small particles of sealant are washed off by stormwater into surface waters. PAHs have been found to be toxic to aquatic life, with bottom dwelling organisms most at risk since PAHs tend to attach to sediment

rather than dissolve in water. Also, in recognition of the human health effects of PAHs, DEM has adopted the US EPA water column human health criteria for PAHs in the DEM Water Quality Regulations. Because of the high concentrations of PAHs in coal-tar based sealants, DEM recommends that coal-tar based sealants not be used. For more information, see: US Geological Survey Fact Sheet 2005-3147, "Parking Lot Sealcoat: A Major Source of Polycyclic Aromatic Hydrocarbons (PAHs) in Urban and Suburban Environments."

G.5 Hazardous Materials Containment

As applicable, project proponents must provide a completed Stormwater Pollution Prevention Plan in accordance with the Rhode Island Pollution Discharge Elimination System Regulations. At a minimum, the following practices should be incorporated as part of site design:

- Site designs must incorporate adequate indoor storage of hazardous materials as the primary method for preventing problems related to stormwater;
- Diversion through devices such as curbing and berms should be incorporated wherever stormwater has the potential to runoff into hazardous materials storage areas; and
- Secondary containment must be included wherever spills might occur (e.g., fueling and hazardous materials transfer and loading areas). Oil/grit separators and other manufactured treatment devices may temporarily contain certain spills and contaminated stormwater. However, these devices should be used as backup for tighter containment practices.

G.6 Septic System Management

Approximately one-third of Rhode Islanders use some form of onsite wastewater treatment system (i.e., septic system, cesspool, etc.). When septic systems fail, they may become a major source of pollution to surface and groundwater. Discharge from failed systems is often carried to surface water via stormwater runoff. Stormwater management plans must discuss appropriate operation and management for all onsite wastewater treatment systems (OWTSs) on the project site. Use of regular inspections in accordance with the procedures of *Septic System Checkup: The Rhode Island Manual for Inspections* is recommended.

G.7 Lawn, Garden, and Landscape Management

Lawns are a significant feature of urban landscapes. Estimates of turf and lawn coverage in the United States are as high as 30 million acres, which, if lawns were classified as a crop, would rank as the fifth largest in the country after corn, soybeans, wheat, and hay (Swann and Schueler, 2000). This large area of managed landscape has the potential to contribute to urban runoff pollution due to overfertilization, overwatering, overapplication of pesticides, and direct disposal of lawn clippings, leaves, and trimmings. Also, erosion from bare patches of poorly managed lawns

contribute sediment to watercourses, and disposal of lawn clippings in landfills can reduce the capacity of these facilities to handle other types of waste.

The following standards for grounds management must be incorporated into stormwater management plans:

Lawn conversion - Grasses require more water and attention than alternative groundcovers, flowers, shrubs, or trees. Alternatives to turf are especially recommended for problem areas such as lawn edges, frost pockets, shady spots, steep slopes, and soggy areas. Vegetation that is best suited to the local conditions should be selected.

Soil building - Grounds operation and maintenance should incorporate soil evaluation every 1 to 3 years to determine suitability for supporting a lawn, and to determine how to optimize growing conditions. Consider testing soil characteristics such as pH, fertility, compaction, texture, and earthworm content.

Grass selection - Grass seed is available in a wide range of cultivated varieties, so homeowners, landscapers, and grounds managers are able to choose the grass type that grows well in their particular climate, matches site conditions, and is consistent with the property owner's desired level of maintenance. When choosing ground cover, consideration should be given to seasonal variations in rainfall and temperature. Table G-3 lists turfgrass types and their level of tolerance to drought:

Table G-3 Drought Tolerance of Turfgrass Types

Turfgrass Type	Drought Tolerance
Fine-leaved Fescues Tall Fescue Kentucky Bluegrass Perennial Ryegrass Bentgrasses	High ↓ Low

Mowing and thatch management - To prevent insects and weed problems, property owners should mow high, mow frequently, and keep mower blades sharp. Lawns should not be cut shorter than 2 to 3 inches, because weeds can grow more easily in short grasses. Grass can be cut lower in the spring and fall to stimulate root growth, but not shorter than 1 ½ inches.

Fertilization - If fertilizing is desired, consider the following points:

- Most lawns require little or no fertilizer to remain healthy. Fertilize no more than twice a year - once in May-June, and once in September-October;
- Fertilizers are rated on their labeling by three numbers (e.g., 10-10-10 or

12-4-8), which refer to their Nitrogen (N) – Phosphorus (P) – Potassium (K) concentrations. Fertilize at a rate of no more than ½ pound of nitrogen per 1000 square feet, which can be determined by dividing 50 by the percentage of nitrogen in the fertilizer;

- Apply fertilizer carefully to avoid spreading on impervious surfaces such as paved walkways, patios, driveways, etc., where the nutrient can be easily washed into stormdrains or directly into surface waters;
- To encourage more complete uptake, use slow-release fertilizers that is those that contain 50 percent or more water-insoluble nitrogen (WIN);
- Grass blades retain 30-40 percent of nutrients applied in fertilizers. Reduce fertilizer applications by 30 percent, or eliminate the spring application of fertilizer and leave clippings on the lawn where they will degrade and release stored nutrients back to the soil; and
- Fertilizer should not be applied when rain is expected. Not only does the rain decrease fertilizer effectiveness, it also increases the risk of surface and ground water contamination.

Weed management - A property owner must decide how many weeds can be tolerated before action is taken to eradicate them. To the extent practicable, weeds should be dug or pulled out. If patches of weeds are present, they can be covered for a few days with a black plastic sheet; a technique called solarization. Solarization kills the weeds while leaving the grass intact. If weeds blanket a large enough area, the patch can be covered with clear plastic for several weeks, effectively "cooking" the weeds and their seeds. The bare area left behind after weeding should be reseeded to prevent weeds from growing back. As a last resort, homeowners can use chemical herbicides to spot-treat weeds.

Pest management - Effective pest management begins with maintenance of a healthy, vigorous lawn that is naturally disease resistant. Property owners should monitor plants for obvious damage and check for the presence of pest organisms. Learn to distinguish beneficial insects and arachnids, such as green lacewings, ladybugs, and most spiders, from ones that will damage plants.

When damage is detected or when harmful organisms are present, property owners should determine the level of damage the plant is able to tolerate. No action should be taken if the plant can maintain growth and fertility. If controls are needed, there are a variety of low-impact pest management controls and practices to choose from, including the following:

- Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off a plant with water, or in some cases vacuumed off of larger plants;
- Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used;

- Sprinkling the ground surface with abrasive diatomaceous earth can prevent infestations by soft-bodied insects and slugs. Slugs can also be trapped by falling or crawling into small cups set in the ground flush with the surface and filled with beer;
- In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of. (Pruning equipment should be disinfected with bleach to prevent spreading the disease organism);
- Small mammals and birds can be excluded using fences, netting, tree trunk guards, and, as a last resort, trapping. (In some areas trapping is illegal. Property owners should check local codes if this type of action is desired); and
- Property owners can encourage/attract beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seedhead weevils, and spiders that prey on detrimental pest species. These desirable organisms can be introduced directly or can be attracted to the area by providing food and/or habitat.

If chemical pesticides are used, property owners should try to select the least toxic, water soluble, and volatile pesticides possible. All selected pesticides should be screened for their potential to harm water resources. Although organophosphate pesticides, such as diazinon and chlorpyrifos, are popular because they target a broad range of pests and are less expensive than newer, less toxic pesticides, they rank among the worst killers of wildlife, and often pose the greatest health risk. Synthetic pyrethroids are more selective, and typically much less toxic than organophosphates, yet they can harm beneficial insects. When possible, pesticides that pose the least risk to human health and the environment should be chosen. A list of popular pesticides, along with their uses, their toxicity to humans and wildlife, EPA's toxicity rating, and alternatives to the listed chemicals, is available from *The Audubon Guide to Home Pesticides*, (http://www.audubon.org/bird/pesticides/).

Sensible irrigation - Most New England lawns will survive without irrigation. Grasses will normally go dormant in warm, dry periods (June-September) and resume growth when moister is more plentiful. However, if watering is desired, consider the following points:

Established lawns need no more than one inch of water per week (including precipitation) to prevent dormancy in dry periods. Watering at this rate should wet soil to approximately 4-6 inches and will encourage analogous root growth. If possible, use timers to water before 9:00 a.m., preferably in the early morning to avoid evaporative loss. Use drought-resistant grasses (see "grass selection" above) and cut grass at 2-3 inches to encourage deeper rooting and heartier lawns.

Maintenance Agreement

The Maintenance Agreement below is taken from Appendix E of the Rhode Island Department of Environmental Management's Rhode Island Stormwater Design and Installation Standards Manual Dated December 2010. This agreement shall be reviewed by an attorney prior to being signed and made a legal document.

THIS AGREEMENT, made and entered into this ___ day of _____, 20___, by and between (Insert Full Name of Owner)
_____ hereinafter called the "Landowner", and the State of Rhode Island, hereinafter called the RIDEM
WITNESSETH, that WHEREAS, the Landowner is the owner of certain real property described as (Tax Map/Parcel Identification Number) _____ as recorded by deed in the land records of State of Rhode Island Deed Book _____Page _____, hereinafter called the "Property".

WHEREAS, the Landowner is proceeding to build on and develop the property; and WHEREAS, the Site Plan/Subdivision Plan known as **VAMC Building #35 Addition,** hereinafter called the "Plan", which is expressly made a part hereof, as approved or to be approved by the RIDEM, provides for detention of stormwater within the confines of the property; and WHEREAS, the RIDEM and the Landowner, its successors and assigns, including any homeowners association, agree that the health, safety, and welfare of the residents of State of Rhode Island require that on-site stormwater management facilities be constructed and maintained on the Property; and WHEREAS, the RIDEM requires that on-site stormwater management facilities as shown on the Plan be constructed and adequately maintained by the Landowner, its successors and assigns, including any homeowners association.

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

1. The on-site stormwater management facilities shall be constructed by the Landowner, its successors and assigns, in accordance with the plans and specifications identified in the Plan.

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

3. The Landowner, its successors and assigns, shall inspect the stormwater management facility and submit an inspection report annually. The purpose of the inspection is to assure safe and proper functioning of the facilities. The inspection shall cover the entire facilities, berms, outlet structure, basin areas, access roads, etc. Deficiencies shall be noted in the inspection report.

4. The Landowner, its successors and assigns, hereby grant permission to the RIDEM, its authorized agents and employees, to enter upon the Property and to inspect the stormwater management facilities whenever the RIDEM deems necessary. The purpose of inspection is to follow-up on reported deficiencies and/or to respond to citizen complaints. The RIDEM shall provide the Landowner, its successors and assigns, copies of the inspection findings and a directive to commence with the repairs if necessary.

5. In the event the Landowner, its successors and assigns, fails to maintain the stormwater management facilities in good working condition acceptable to the RIDEM, the RIDEM may enter upon the Property and take whatever steps necessary to correct deficiencies identified in the inspection report and to charge the costs of such repairs to the Landowner, its successors and assigns. This provision shall not be construed to allow the RIDEM to erect any structure of permanent nature on the land of the Landowner outside of the easement for the stormwater management facilities. It is expressly understood and agreed that the RIDEM is under no obligation to routinely maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the RIDEM.

6. The Landowner, its successors and assigns, will perform the work necessary to keep these facilities in good working order as appropriate. In the event a maintenance schedule for the stormwater management facilities (including sediment removal) is outlined on the approved plans, the schedule will be followed.

7. In the event the RIDEM pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like, the Landowner, its successors and assigns, shall reimburse the RIDEM upon demand, within thirty (30) days of receipt thereof for all actual costs incurred by the RIDEM hereunder.

8. This Agreement imposes no liability of any kind whatsoever on the RIDEM and the Landowner agrees to hold the RIDEM harmless from any liability in the event the stormwater management facilities fail to operate properly.

9. This Agreement shall be recorded among the land records of State of Rhode Island and shall constitute a covenant running with the land, and shall be binding on the Landowner, its administrators, executors, assigns, heirs and any other successors in interests, including any homeowners association.

WITNESS the following signatures and seals:

_____
Company/Corporation/Partnership Name (Seal)

By: _____

_____
(Type Name and Title)
The foregoing Agreement was acknowledged before me this ____ day of _____, 20___, by _____.

_____
NOTARY PUBLIC
My Commission Expires: _____
By: _____

_____
(Type Name and Title)
The foregoing Agreement was acknowledged before me this ____ day of _____, 20___, by _____.

_____
NOTARY PUBLIC
My Commission Expires: _____
Approved as to Form:

_____ _____
RIDEM Attorney Date

Bioretention Operation, Maintenance, and Management Inspection Checklist

Project:

Location:

Site Status:

Date:

Time:

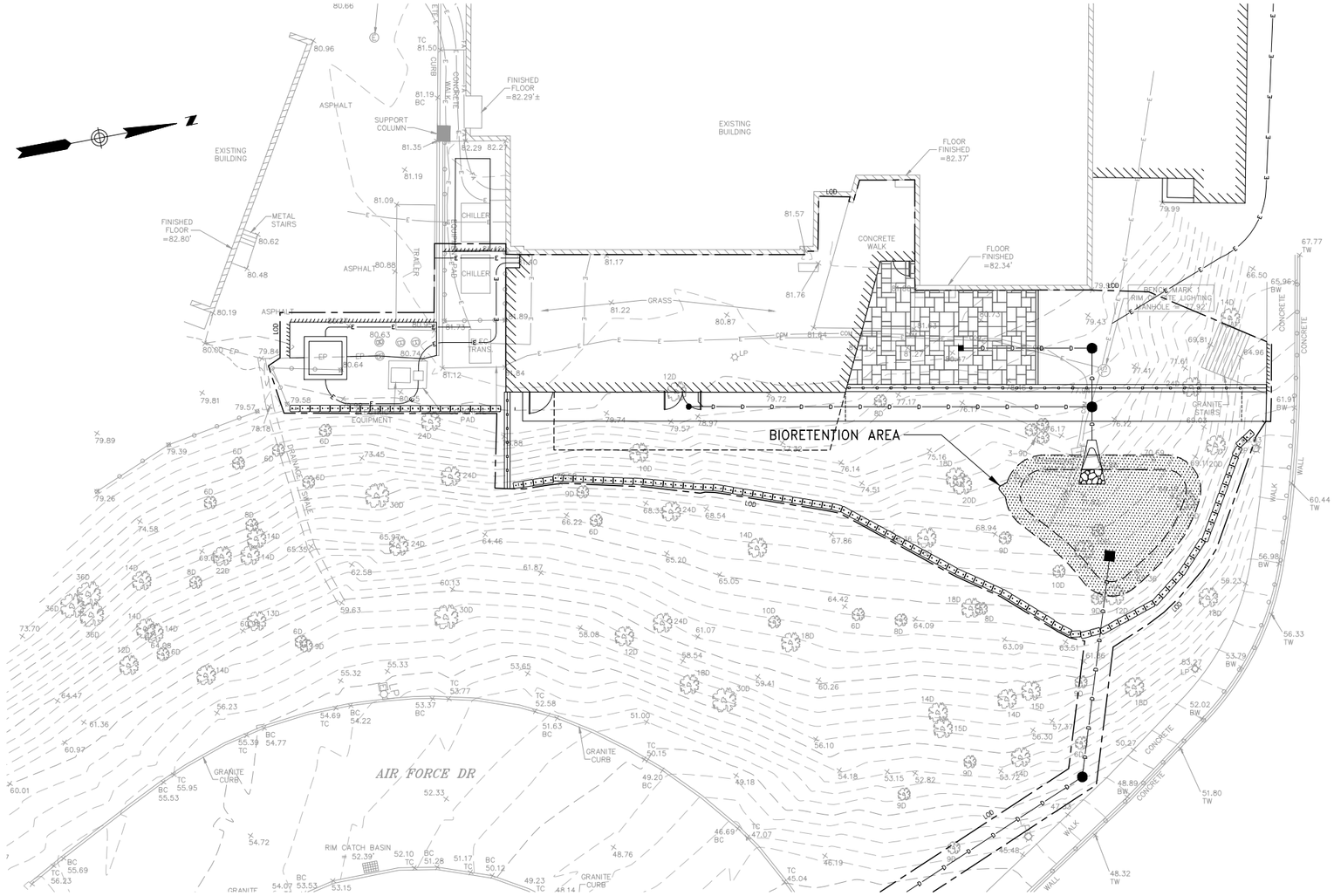
Inspector:

MAINTENANCE ITEM	SATISFACTORY / UNSATISFACTORY	COMMENTS
1. Debris Cleanout (Annual, After Major Storms)		
Bioretention and contributing areas clean of debris		
No dumping of yard wastes into practice		
Litter (branches, etc.) have been removed		
2. Vegetation (Annual, After Major Storms)		
Plant height not less than design water depth		
Fertilized per specifications		
Plant composition according to approved plans		
No placement of inappropriate plants		
Grass height not greater than 10 inches		

MAINTENANCE ITEM	SATISFACTORY / UNSATISFACTORY	COMMENTS
No evidence of erosion		
3. Check Dams/Energy Dissipaters/Sumps (Annual, After Major Storms)		
No evidence of sediment buildup		
Sumps should not be more than 50% full of sediment		
No evidence of erosion at downstream toe of drop structure		
4. Dewatering (Semi-annually)		
Dewaters between storms		
No evidence of standing water		
5. Sediment Deposition (Annual, after Major Storms)		
Swale clean of sediments		
Sediments should not be > 20% of swale design depth		
6. Outlet/Overflow Spillway (Annual, After Major Storms)		
Good condition, no need for repair		
No evidence of erosion		
No evidence of any blockages		
7. Integrity of Filter Bed (Annual, After Major Storms)		
Filter bed has not been blocked or filled inappropriately		

Comments:

Actions to be Taken:



NOTES

1. OPERATION AND MAINTENANCE OF THE STORMWATER MANAGEMENT SYSTEM IS THE RESPONSIBILITY OF THE OWNER:
   RHODE ISLAND DEPARTMENT OF ADMINISTRATION
   DIVISION OF CAPITAL PROJECT AND PROPERTY MANAGEMENT
   ONE CAPITOL HILL, PROVIDENCE, RI 02908
   TEL: (401) 222-8207
2. THE PARKING LOT AND ENTRY DRIVES SHALL BE SWEPT BY THE OWNER ONCE DURING THE MONTH OF APRIL AND ONCE DURING THE MONTH OF OCTOBER TO REMOVE SEDIMENT.
3. TRASH, LITTER, SEDIMENT ADN OTHER DEBRIS SHALL BE REMOVED FROM ANY STORM WATER FACILITY AT LEAST TWICE A YEAR, ONCE DURING THE MONTH OF APRIL AND ONCE IN THE MONTH OF OCTOBER, BY THE OWNER.
4. ALL SEDIMENTS REMOVED SHALL BE DISPOSED OF AT AN APPROVED AND PERMITTED LOCATION.

BIORETENTION AREAS

FOLLOWING STORM EVENTS WITH RAINFALL EXCEEDING 2.7"
- INSPECT BIORETENTION AREA FOR TRASH, DEBRIS, SEDIMENT, EROSION, STANDING WATER, AND OVERALL PERFORMANCE

BI-ANNUALLY
- MOW GRASS WITHIN BIORETENTION AREA ONCE IN LATE SPRING AND ONCE IN EARLY FALL. THE VEGETATION SHALL NOT EXCEED 18" IN HEIGHT.
- REMOVE SEDIMENT ONCE IN LATE SPRING AND ONCE IN EARLY FALL IF IT EXCEEDS 1" IN THE BIORETENTION AREA

ANNUALLY
- RE-MULCH BIORETENTION AREA IN THE SPRING
- REMOVE DEAD VEGETATION AND TRIM VEGETATION IN BIORETENTION AREA IN THE SPRING
- REMOVE SEDIMENT FROM FOREBAY IF DEPTH EXCEEDS ½ DESIGN DEPTH

FOLLOWING FIRST 6 MONTHS AFTER CONSTRUCTION
- INSPECT FILTER PRACTICES AFTER FIRST TWO EVENTS OF 1" OR MORE

IF PONDING EXCEEDS 48 HOURS REMOVE AND REPLACE DISCOLORED SURFACE MATERIAL

FINAL DESIGN DOCUMENTS
FULLY SPRINKLERED

Number	Date	Revision

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BUILDING 35
KEY PLAN
N

Drawing Title: OPERATION & MAINTENANCE PLAN
Designed By: JDG
Checked By: SDL
Approved By: SDL

Project Title: BUILDING 35 ADDITION FOR RESEARCH
Building #
Scale: 1" = 10'
Location

Date: 6/30/2015
VA Project No.: 650-338
Drawing No.: OM-1

Office of Facilities
Department of Veterans Affairs

VA FORM 08-6231