

## **Soil Textural Classification and Infiltration Rate**

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# Proposed Gooding Avenue Hotel Determining Soil Texture NRCS Soil Survey



DF X - 20250522\_1154411145\_33\_Soil\_Map.pdf

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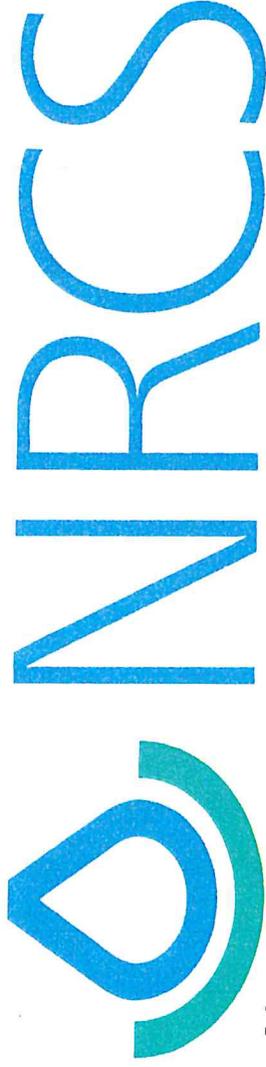
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The map displays an aerial view of a residential area with several streets labeled: Naomi St, Gooding, Dixon Ave, and Dartmouth St. Orange lines delineate soil survey boundaries, with labels NeB, Ur, PmA, Se, PmB, and UD placed within the various zones. A red dot on the map indicates the "Test Pit Location". The map is overlaid with a grid showing coordinates (e.g., 4618200, 4618120, 4618040, 4617960, 4617880) and a scale bar. The interface includes a toolbar with various editing and navigation tools, a search bar, and a status bar at the bottom showing a temperature of 48°F and the time 12:59 PM.

48°F 12:59 PM

Test Pit Location

## Soil Description -Pittstown



Natural Resources Conservation Service

The soil layer is very dark grayish-brown, about 8 inches thick. The subsoil is 20 inches thick, dark yellowish-brown and olive-brown, silt loam that is mottled in the lower part. The substratum is olive-gray, mottled, silt loam to a depth of 60 inches or more.

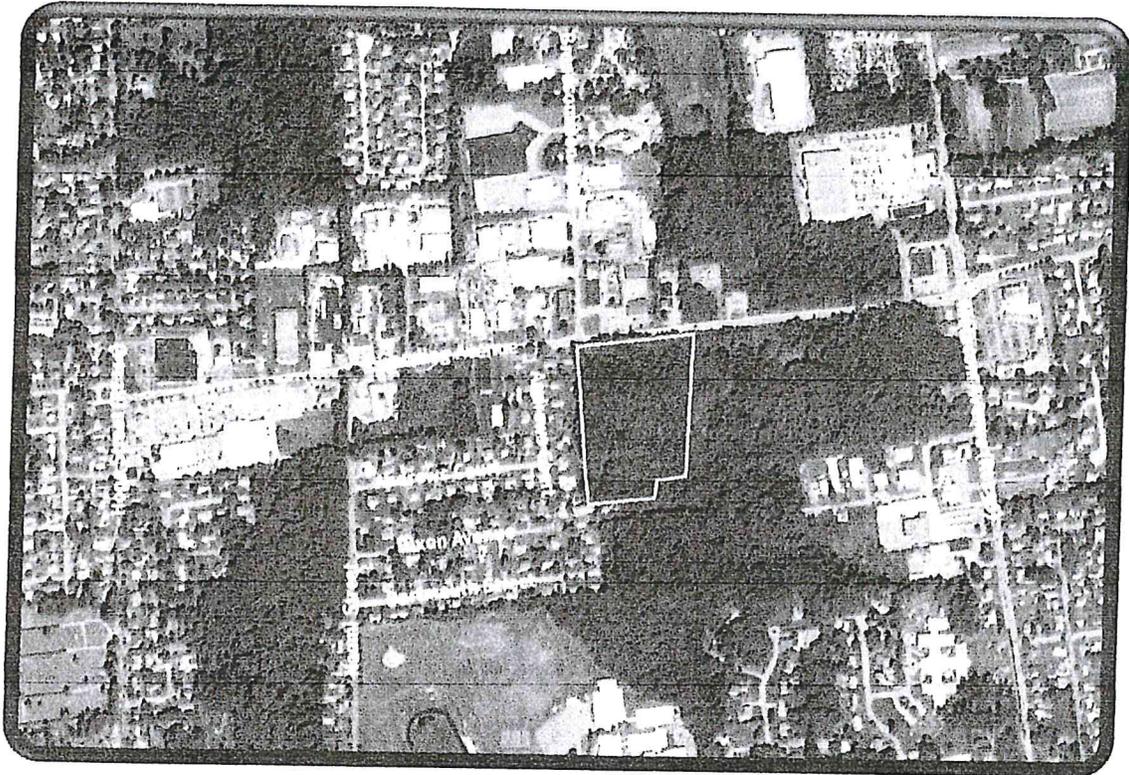
**The permeability of this soil is slow in the substratum**

### 2015 RIGIS Soil Survey Attribute Information

Group 1 includes the Stissing series and the Pittstown series They were included to make the Stissing and Pittstown series consistent with other hardpan soils in RI. Group 1 has a Permeability range of in the B and C horizons of < 0.2 inches per hour



# Stormwater Management Report



## Gooding Avenue Development

Located in Bristol, Rhode Island  
Applicant: Kendan, LLC.

1-19-2018

Revised: 3-27-2025

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## 1.0 Project Description

The purpose of this report is to specify a Storm Water Management System to be implemented at the new project on Gooding Avenue.

The site totals 9.78 acres located on Assessor's Plat 111 Lot 1 in Bristol, Rhode Island. The site is located south of Gooding Avenue near the intersection of Broadcommon Road. A National Forest to the east of the site provides a buffer between the site and Silver Creek.

The proposed development will include a new 13,364 sf hotel building, associated parking and access driveways. The site will be serviced by public water and sewer. Water will be provided by Bristol Country Water Authority and Sewer will be provided by the Town of Bristol.

The stormwater quality will be improved by utilizing Best Management Practices (BMPs) as established by the RISDISM for the treatment of stormwater runoff from the proposed development. BMPs will consist of a sand filter and underground infiltration/detention system. The systems have been designed to meet the RIDEM Stormwater Design and Installations Standards Manual.

## 2.0 Site Conditions

### 2.1 SOILS

There are the following soil types within the analyzed area of the Site as mapped by the NRCS USDA Soil Conservation service:

Soil Symbol	Description	Hydrologic Group
PmA	Pittstown silt loam, 0 to 3 percent slopes	C
PmB	Pittstown silt loam, 3 to 8 percent slopes	C
Se	Stissing silt loam	D

Site specific soil evaluations can be found in Appendix A2.1.

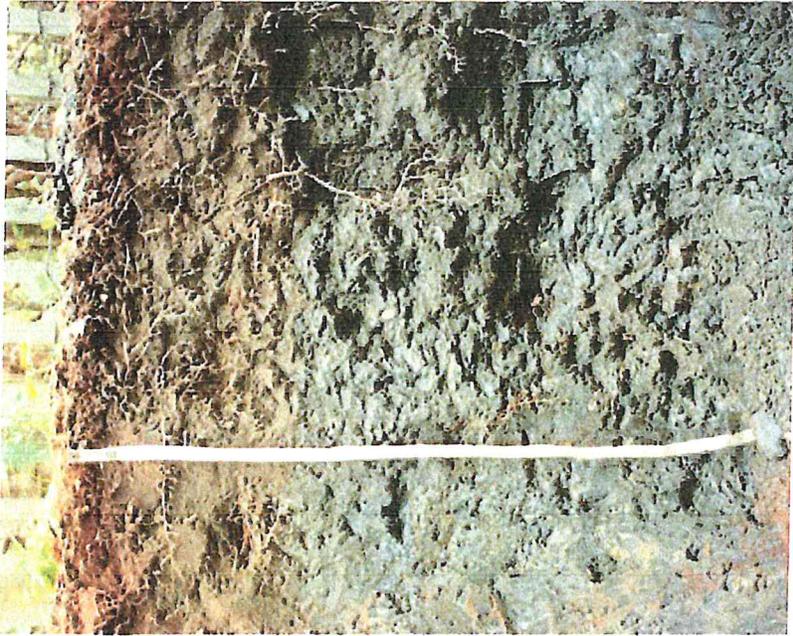
### 2.2 EXISTING SITE CONDITIONS

Currently the site is undeveloped and predominately woods. All stormwater from the site discharges directly to the onsite wetland areas and ultimately to Silver Creek. The site is largely made up of wetland and perimeter wetland areas and is almost entirely Hydrologic Group D soils. Groundwater tables range from 24" to 36" below existing grade. There is an existing sewer easement that bisects the site.

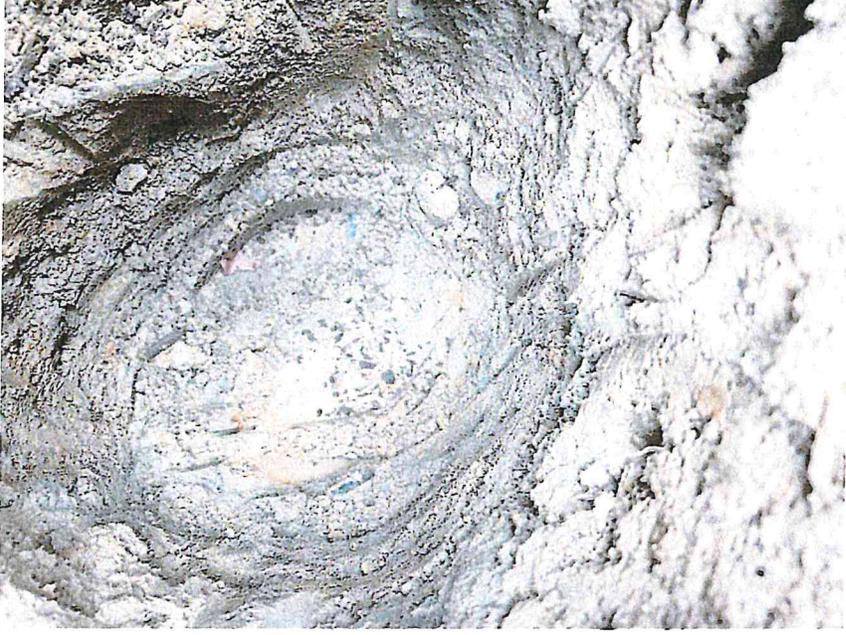
The entire site slopes diagonally from the higher elevation at the northwest corner along Gooding Avenue to the southeast with all existing slopes < 15%. Stormwater from the site flows overland following the existing slopes. Gooding Avenue has curbing along both sides of the road and a closed drainage network that prevents stormwater from Gooding Avenue from flowing onto the site. However,

## Pittstown Soil Sample

**RAISE  
THE  
RED FLAG**



Soil Profile Soil Survey of RI



Soil profile was collected from an undisturbed area of property at 20 Dixon Ave. This area is identified as (Pm) Pittstown soils by NRCS. See the previous slide for the location.

# Proposed Gooding Avenue Hotel Restricted Infiltration



Soil Mottled blue and organ color



Restricted infiltration water is retained in the test hole

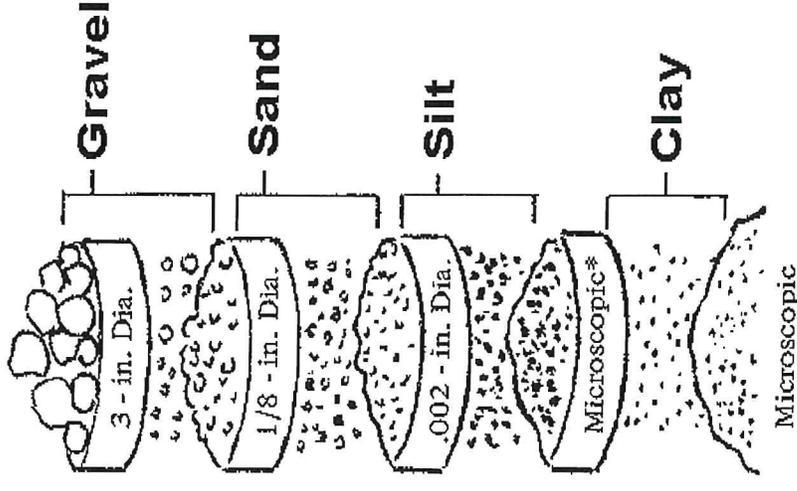
# Proposed Gooding Avenue Hotel

## Determining Soil Texture

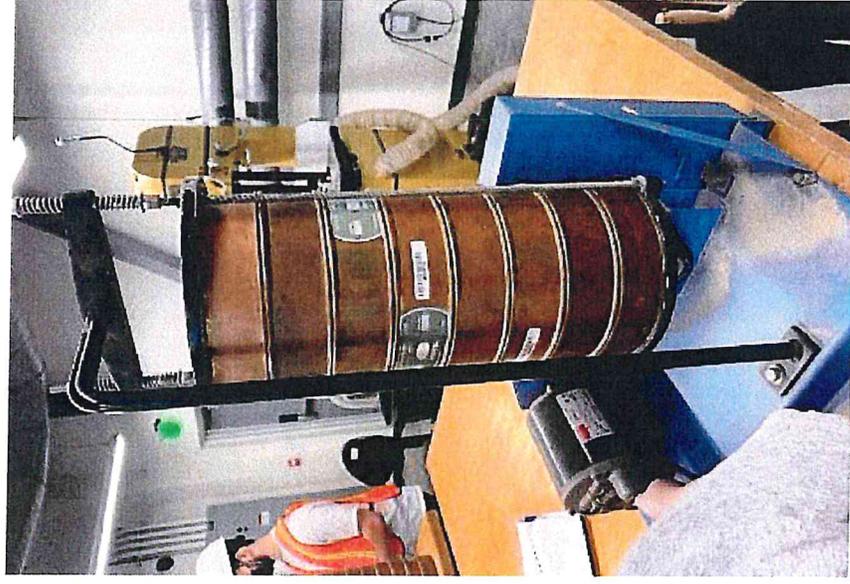
### Sieve Analysis



- A sieve analysis is used to separate soils into different grain sizes.
  - Coarse-grained
  - Fine-grained
- Based on the
  - size of soil particles
  - distribution and characteristics
  - moisture content



# Proposed Gooding Avenue Hotel Recommended Procedure



Sieve Stack

Weigh each sieve that is to be used

Select the test sample that is representative of the soil to be tested

Weigh the oven-dry sample to be tested

Sieve the soil through a nest of sieves for at least 10 minutes

Weigh each sieve with the soil retained on it



Soil Shaker (sieves placed inside)

# Proposed Gooding Avenue Hotel Recommended Procedure

**RAISE  
THE  
RED FLAG**



Sieves used in the analysis



Weighing of the sieve and soil retained  
On 3/8 inch sieve opening

# Proposed Gooding Avenue Hotel

## Determining Soil Texture

### Sieve Analysis Results



US Sieve Opening Size (inches)	Sieve Weight (grams)		Sieve & Sample (grams)		Mass Retained (grams)		Cumulative Mass Retained (grams)		Cumulative Mass Passed (grams)		Sieve Weight Retained (%)		Percent Finer (%)
	Weight (grams)		Sample (grams)		Retained (grams)		Retained (grams)		Passed (grams)		Retained (%)		
#3/8	520.77		517.17		3.60		3.60		356.71		1%		99%
#4	505.28		490.81		14.47		18.07		342.24		5%		95%
#10	481.74		474.53		7.21		25.28		335.03		7%		93%
#20	391.07		370.36		20.71		45.99		314.32		13%		87%
#40	357.59		331.46		26.13		72.12		288.19		20%		80%
#60	348.32		330.31		18.01		90.13		270.18		25%		75%
#100	323.44		305.41		18.03		108.16		252.15		30%		70%
#200	252.29		216.33		35.96		144.12		216.19		40%		60%

Sample Total Weight 360.31 grams

# Proposed Gooding Avenue Hotel

## Determining Soil Texture

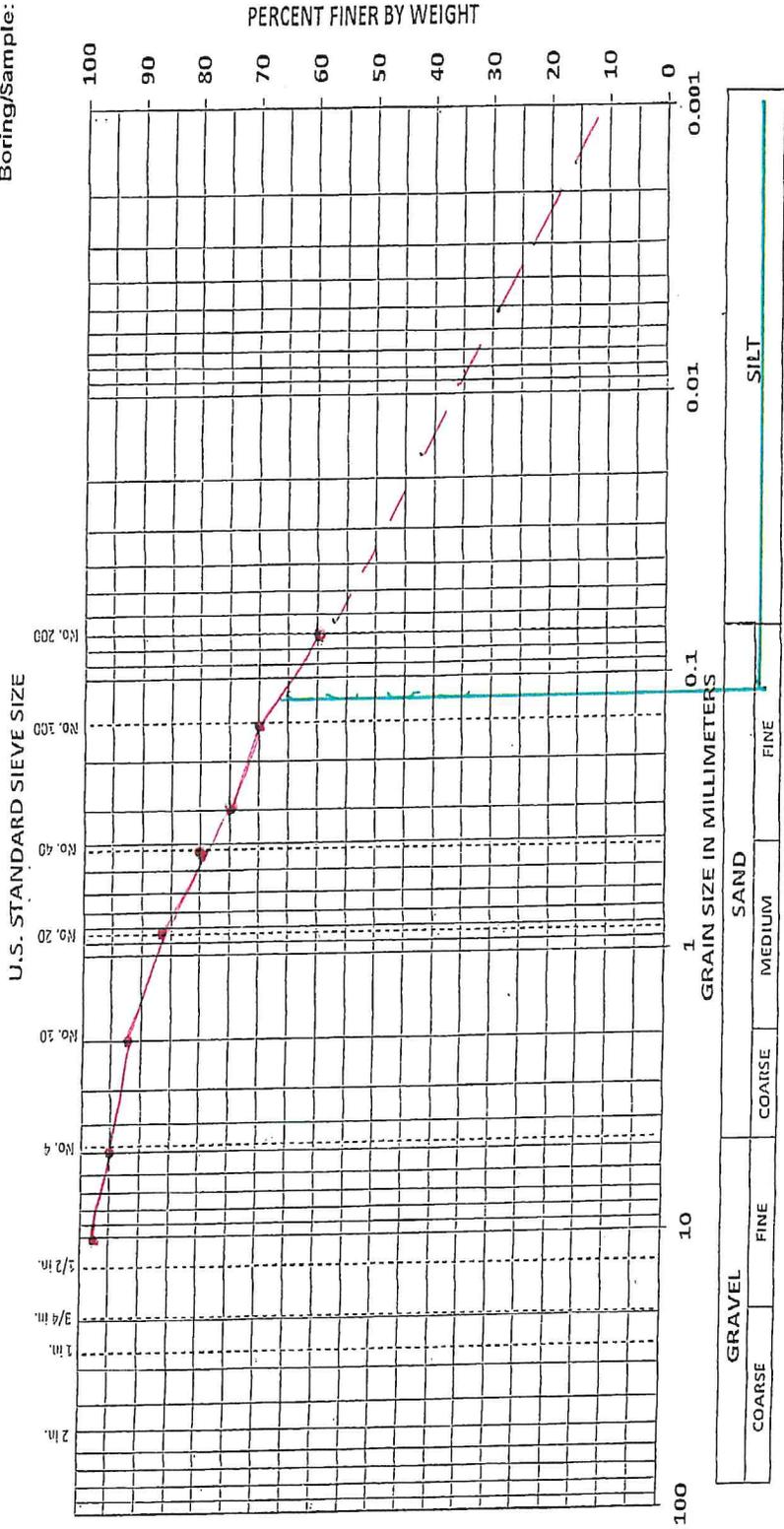
### Sieve Analysis Results



Project:  
Job. No.:

#### GRADATION TEST

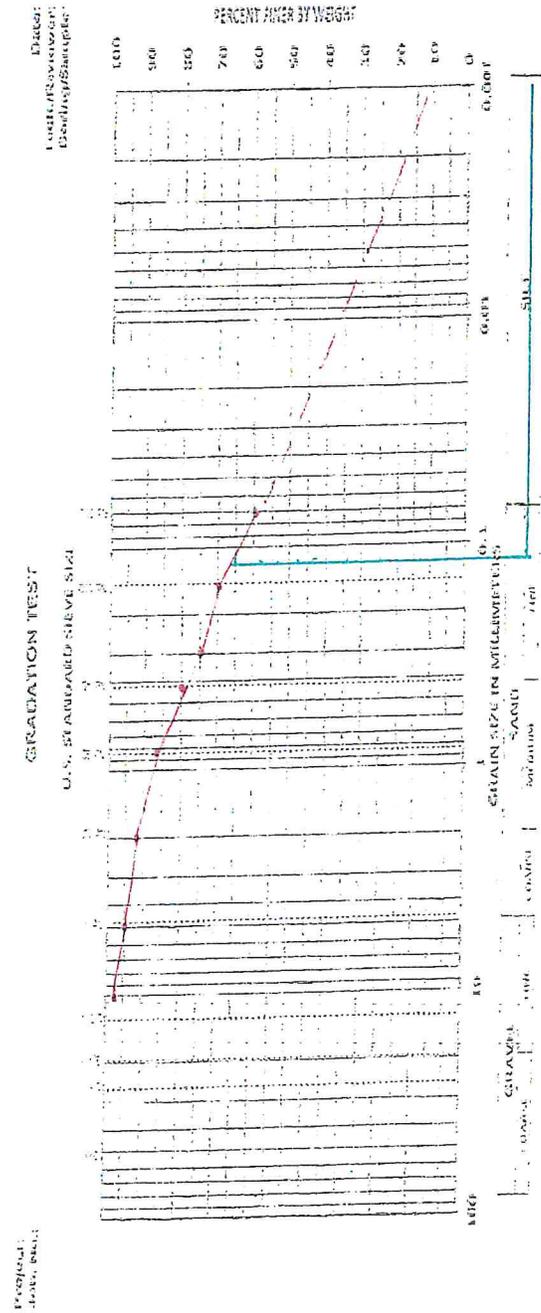
Date:  
Tech./Reviewer:  
Boring/Sample:



# Sieve Analysis Results show the soil to be Silt Loam, with 60% being classified as silt or clay



US Sieve Opening Size (inches)	Sieve & Sample Weight (grams)	Mass Retained (grams)	Cumulative Mass		Percent Finer (%)
			Retained (grams)	Passed (grams)	
#3/8	520.77	3.60	3.60	356.71	1%
#4	505.28	14.47	18.07	342.24	5%
#10	481.74	7.21	25.28	335.03	7%
#20	391.07	20.71	45.99	314.32	13%
#40	357.59	26.13	72.12	288.19	20%
#60	348.32	18.01	90.13	270.18	25%
#100	323.44	18.03	108.16	252.15	30%
#200	252.29	35.96	144.12	216.19	40%
Sample Total Weight 360.31 grams					60%

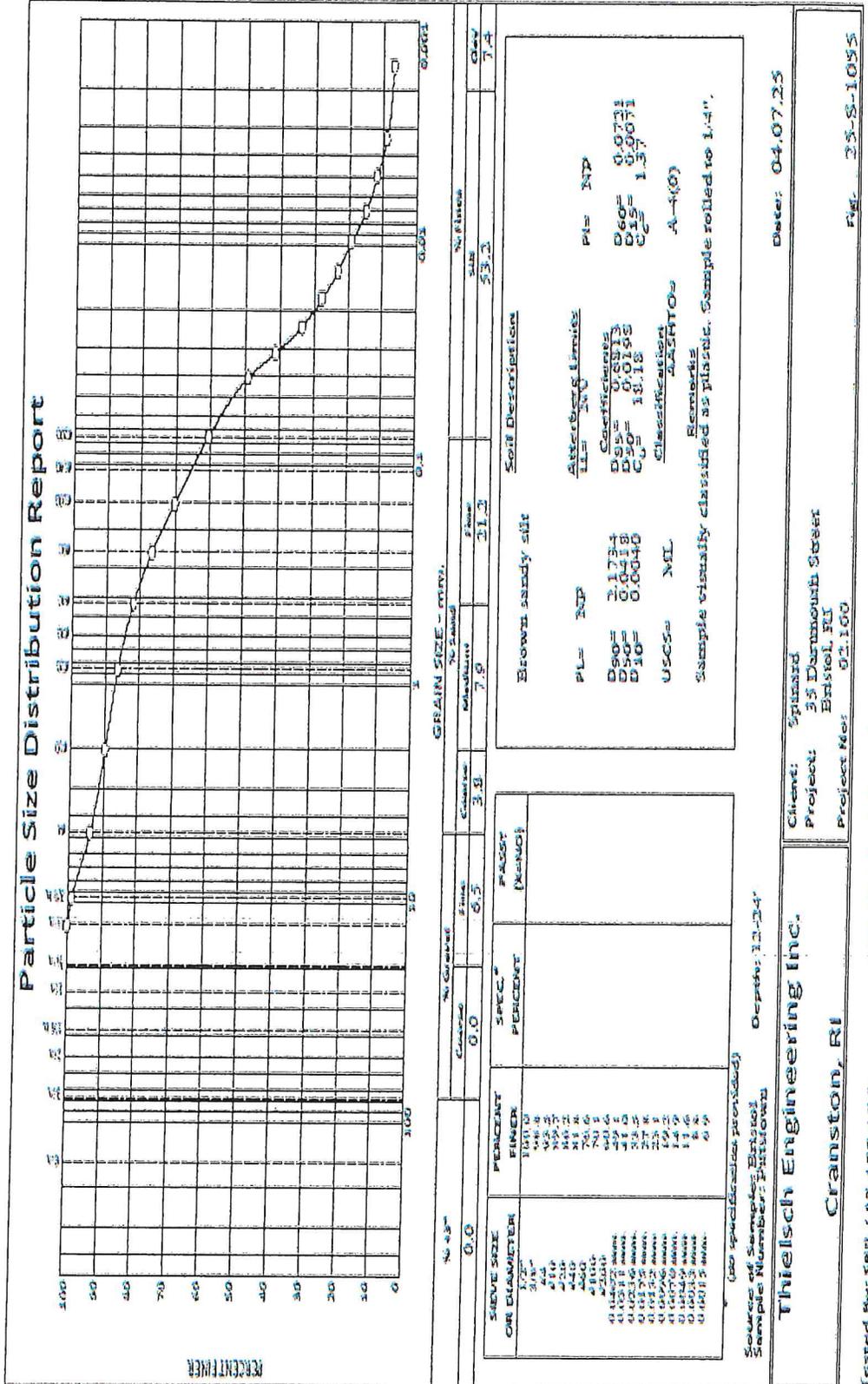


# Certified Lab Sieve Analysis Results confirm that the soil is Silt Loam



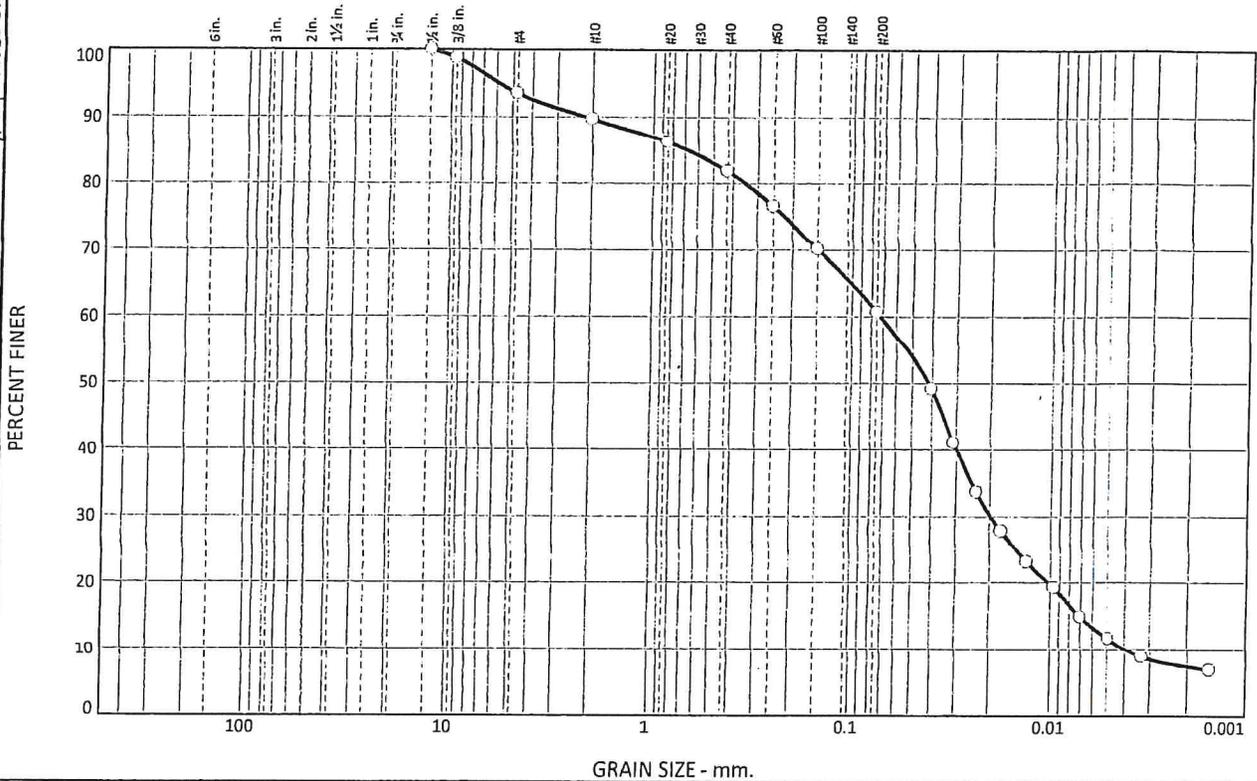
**Lab results classified the soil as ML Silty Loam**

This report is for the exclusive use of the client for whom they were obtained. This report only refers to items tested and/or tested. No warranty expressed or implied is made.



These results are for the exclusive use of the client for whom they were obtained. This report only relates to items inspected and/or tested. No warranty, expressed or implied, is made.

## Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	6.5	3.8	7.9	21.2	53.2	7.4

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	98.8		
#4	93.5		
#10	89.7		
#20	86.2		
#40	81.8		
#60	76.6		
#100	70.1		
#200	60.6		
0.0402 mm.	49.1		
0.0311 mm.	41.0		
0.0236 mm.	33.5		
0.0175 mm.	27.8		
0.0132 mm.	23.1		
0.0096 mm.	19.2		
0.0070 mm.	14.9		
0.0049 mm.	11.6		
0.0033 mm.	8.8		
0.0015 mm.	6.9		

\* (no specification provided)

**Soil Description**

Brown sandy silt

**Atterberg Limits**

PL= NP      LL= NV      PI= NP

**Coefficients**

D<sub>90</sub>= 2.1734      D<sub>85</sub>= 0.6813      D<sub>60</sub>= 0.0721  
D<sub>50</sub>= 0.0418      D<sub>30</sub>= 0.0198      D<sub>15</sub>= 0.0071  
D<sub>10</sub>= 0.0040      C<sub>u</sub>= 18.18      C<sub>c</sub>= 1.37

**Classification**

USCS= ML      AASHTO= A-4(0)

**Remarks**

Sample visually classified as plastic. Sample rolled to 1/4".

Source of Sample: Bristol  
Sample Number: Pittstown

Date: 04.07.25

<b>Thielsch Engineering Inc.</b>  <b>Cranston, RI</b>	<b>Client:</b> Spinard <b>Project:</b> 35 Dartmouth Street Bristol, RI <b>Project No:</b> 02.100
<b>Fig.</b> 25-S-1055	

Tested By: SBR / AB / RR / BG

Checked By: Rebecca Roth

# Proposed Gooding Avenue Hotel

## USCS Soil Classification



SOIL CLASSIFICATION CHART

MAJOR DIVISIONS		SYMBOLS		TYPICAL DESCRIPTIONS
		GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINING NO. 40 SIEVE		GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF MATERIALS SMALLER THAN NO. 200 SIEVE		GM	SILTY GRAVELS, GRAVEL-SAND MIXTURES
	MORE THAN 50% OF MATERIALS SMALLER THAN NO. 40 SIEVE		GC	CLAYEY GRAVELS, GRAVEL-SAND MIXTURES
FINE GRAINED SOILS	SAND AND SANDY SOILS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 40 SIEVE		SP	POORLY GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF MATERIALS SMALLER THAN NO. 200 SIEVE		SM	SILTY SANDS, SAND-SILT MIXTURES
	MORE THAN 50% OF MATERIALS SMALLER THAN NO. 40 SIEVE		SC	CLAYEY SANDS, SAND-CLAY MIXTURES
EXISTING FILL	SILTS AND CLAYS		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY SILTS, SANDY CLAYS
	MORE THAN 50% OF MATERIALS SMALLER THAN NO. 200 SIEVE		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	MORE THAN 50% OF MATERIALS SMALLER THAN NO. 40 SIEVE		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	MORE THAN 50% OF MATERIALS SMALLER THAN NO. 200 SIEVE		MH	INORGANIC SILTS, MICACEOUS OR SILT-ORGANIC FINE SAND OR SILTY SOILS
EXISTING FILL	SILTS AND CLAYS		CH	INORGANIC CLAYS OF HIGH PLASTICITY
	EXISTING FILL		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
EXISTING FILL			FILL	EXISTING FILL MATERIALS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

Letter	Definition
G	gravel
S	sand
M	silt
C	clay
O	organic

Lab results classified the soil as ML

Inorganic Silts and Very Fine Sand, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts

# Proposed Gooding Avenue Hotel

## *Infiltration Feasibility & Rate*

Rhode Island Stormwater Design and Installation Standards Manual



### 5.3.1 Feasibility

#### Required Elements

- To be suitable for infiltration, underlying soils shall have an in-situ infiltration rate of at least 0.5 inches per hour, as initially determined from NRCS soil textural
- Soils shall also have a clay content of less than 20% and a silt content of less than 60%.
- All infiltration systems shall be designed to fully de-water the entire  $WQ_v$  within 48 hours after the storm event.

Table 5-3 Design Infiltration Rates for Different Soil Textures (Rawls et al., 1982)

USDA Soil Texture	Design Infiltration Rate ( $f_c$ ) (in/hr)	Design Infiltration Rate ( $f_c$ ) (ft/min)
Sand	8.27	0.0115
Loamy Sand	2.41	0.0033
Sandy Loam	1.02	0.0014
Loam	0.52	0.0007
Silt Loam	0.27	0.0004

Infiltration Rate Should be 0.27in/hr for Silt Loam, not 0.5 in/hr (much higher) (Sandy Loam) Used by Applicant



RIDEM Table 5-3 Design Infiltration Rates for Different Soil Textures  
Silt Loom 0.27 in/hr infiltration rate

SITC classified the soil as silt loam, and DEM accepted this infiltration rate, but did not allow it to be used for infiltration BMPs

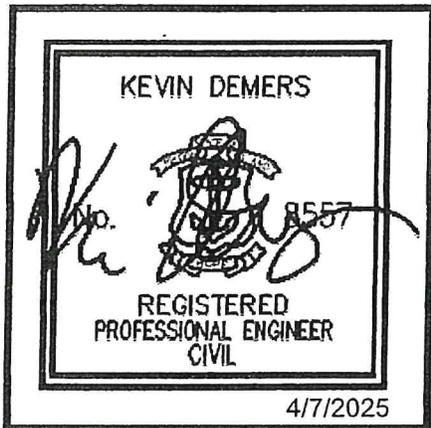
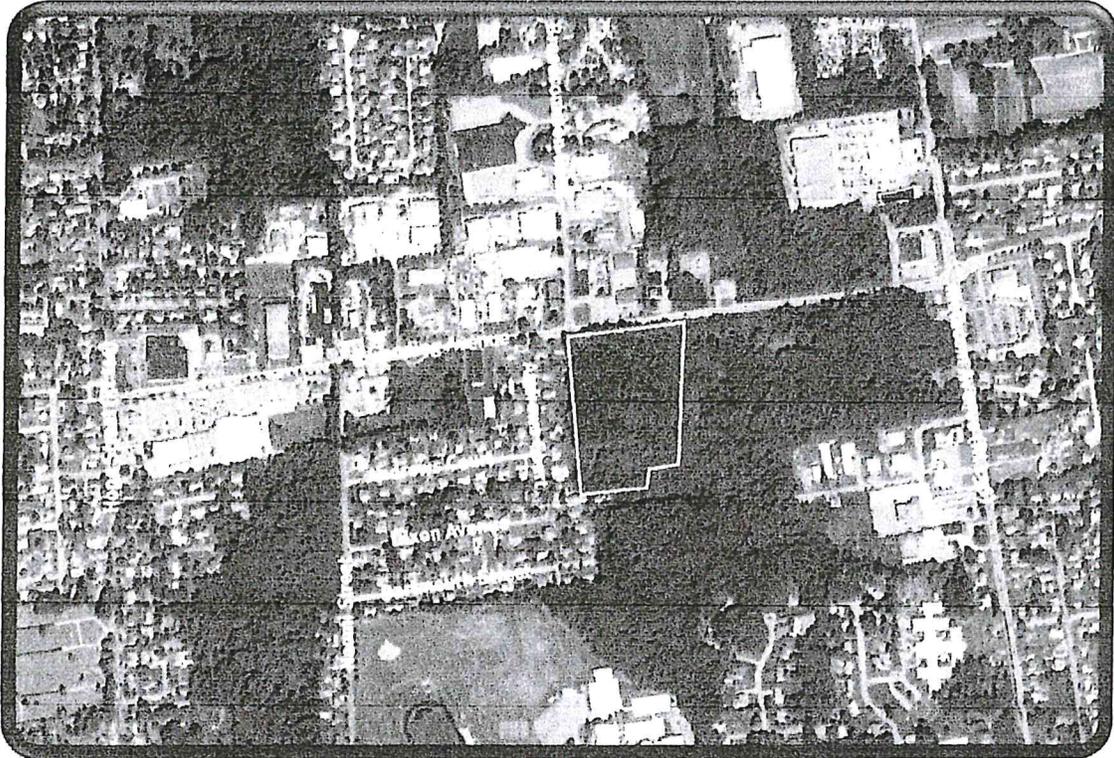
“With respect to the proposed underground retention/ detention system, because the infiltration rate is slower than the minimal standard of 0.5 inches per hour, this proposed BMP cannot be considered an acceptable infiltration practice. With respect to the proposed isolator Row-TM portion of this proposed BMP, it cannot be considered to be an acceptable water quality BMP for full treatment of water quality volume. This is because the Isolator Row-TM practice relies on infiltration as an integral part of its system. Without an acceptable infiltration rate of at least 0.5 inches per hour it is not considered to be a valid water quality BMP” (RI DEM Engineering Review of SITEC Proposed Hotel Facility 6/10/2015)

Pare Corporation used an infiltration rate of 0.27 in/h based on the results of many test pits that showed Pittstoen soils.

“The bottom of the underground infiltration system is set in native soils... Considering the presence of silt loam, an infiltration rate of 0.27 was used...” (Mt. Hope High School Stormwater Management, p.15, June 2025)



# Stormwater Management Report



## Gooding Avenue Development

Located in Bristol, Rhode Island

Applicant: Kendan, LLC.

1-19-2018

Revised: 3-27-2025

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### 3.5 Minimum Standard 5: Overbank Flood Protection & Downstream Analysis

#### 3.5.1 Method of Analysis

USDA Soil Conservation Service Method as defined by Technical Release No. 20 (TR-20) determines Stormwater runoff rate and volume. Type III rainfall distribution is utilized. Time of concentration is determined using Technical Release No 55 (TR-55) methodology, through the computer program *HydroCAD ver. 10.0* by Applied Microcomputer Systems.

Soil evaluations have been performed by SITEC, Inc. The existing soil has a texture of sandy loam. Due to the presence of wetland areas and HSG D soils, the soils have been modeled as a loam texture for a more conservative approach. Based on table 5.3 of the RIDISM an infiltration rate of 0.52 in/hr has been used in HydroCAD.

The drainage system has been designed to mitigate all stormwater flows for the 1 through 100 year storm events. The emergency outlets have been sized to handle the 100 year storm event.

#### 3.5.2 Design Storm

Analysis of 1-year, 10-year, 25-year, and 100-year frequency storms are included. The following 24-hour rainfall intensities are obtained from the Rhode Island Stormwater Design and Installation Standards Manual, Table 3-1 for Bristol County.

1 year =	2.8 inches
10 year =	4.9 inches
25 year =	6.1 inches
100 year=	8.6 inches

#### 3.5.3 Design Point Breakdown

The site is analyzed as one watershed area. In the pre development stage there is 1 subcatchment. In the post development stage there are 3 subcatchments. The watershed will demonstrate zero increase in runoff rate due to the proposed development. A description of each subcatchment is summarized as follows:

##### Design Point #1: Wetland

Watershed #1 flows to Design Point- 1 (DP-1). The design point is the on-site wetland.

In pre development conditions there is only one watershed to the Design Point. Pre-01 (10) contains the entire site and some off-site areas. Stormwater reaches DP-1 (11) via overland flow. Pre-01 is predominately woods with some grass areas along Gooding Avenue. The watershed also includes two residential homes with driveways along Gooding Avenue to the west of the site. A Tc value of 14.6 minutes was used.

In post development conditions there are 3 sub watersheds:

Post-01 (100) contains all undetained areas surrounding the proposed development. These areas will either be grass or undisturbed areas from pre-conditions. Stormwater will reach the design point via overland flow as in existing conditions. Some stormwater will be directed around the proposed

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Test Pits to Determine Groundwater

John Keegan RI Soil Evaluator D-4008  
 12/12/14

<u>TestPit#</u>	<u>Depth</u>	<u>Horizon</u>	<u>Texture</u>	<u>Color</u>	<u>REDOX</u>	<u>Depth</u>
1	0"-12"	Ap	SL	10YR 3/2		
	12"-20"	Bw1	SL	2.5Y4/4		
	20"- 24"	Bw2	SL	5Y4/3	m2p 10YR4/4	24"
	24"-72"	Cd	SL	5Y 5/1	m3p 10YR4/4	36"

Till becomes denser and rocky with depth  
 Hole is dry

<u>TestPit#</u>	<u>Depth</u>	<u>Horizon</u>	<u>Texture</u>	<u>Color</u>	<u>REDOX</u>	<u>Depth</u>
2	0"-12"	Ap	SL	10YR 3/2		
	12"-20"	Bw1	SL	2.5Y4/4		
	20"- 30"	Bw2	SL	5Y4/3	m2p 10YR4/4	30"
	30"-77"	Cd	SL	5Y 5/1	m3p 10YR4/4	32"

Till becomes denser and rocky with depth  
 Hole is dry

<u>TestPit#</u>	<u>Depth</u>	<u>Horizon</u>	<u>Texture</u>	<u>Color</u>	<u>REDOX</u>	<u>Depth</u>
3	0"-12"	Ap	SL	10YR 3/2		
	12"-20"	Bw1	SL	2.5Y4/4		
	20"- 30"	Bw2	SL	5Y4/3	m2p 10YR4/4	28"
	30"-72"	Cd	SL	5Y 5/1	m3p 10YR4/4	32"

Till becomes denser and rocky with depth  
 Hole is dry

<u>TestPit#</u>	<u>Depth</u>	<u>Horizon</u>	<u>Texture</u>	<u>Color</u>	<u>REDOX</u>	<u>Depth</u>
4	0"-12"	Ap	SL	10YR 3/2		
	12"-20"	Bw1	SL	2.5Y4/4		
	20"- 30"	Bw2	SL	5Y4/3	m2p 10YR4/4	30"
	30"-72"	Cd	SL	5Y 5/1	m3p 10YR4/4	32"

Till becomes denser and rocky with depth  
 Hole is dry

<u>TestPit#</u>	<u>Depth</u>	<u>Horizon</u>	<u>Texture</u>	<u>Color</u>	<u>REDOX</u>	<u>Depth</u>
5	0"-12"	Ap	SL	10YR 3/2		
	12"-20"	Bw1	SL	2.5Y4/4		
	20"- 30"	Bw2	SL	5Y4/3	m2p 10YR4/4	28"
	30"-60"	Cd	SL	5Y 5/1	m3p 10YR4/4	32"

Till becomes denser and rocky with depth  
 Hole is dry

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<u>TestPit#</u>	<u>Depth</u>	<u>Horizon</u>	<u>Texture</u>	<u>Color</u>	<u>REDOX</u>	<u>Depth</u>
6	0"-12"	Ap	SL	10YR 3/2		
	12"-20"	Bw1	SL	2.5Y4/4		
	20"- 36"	Bw2	SL	5Y4/3	m2p 10YR4/4	36"
	36"-77"	Cd	SL	5Y 5/1	m3p 10YR4/4	38"

Sandy lenses and Mixing at 30"  
 Till becomes denser and rocky with depth  
 Hole is dry

<u>TestPit#</u>	<u>Depth</u>	<u>Horizon</u>	<u>Texture</u>	<u>Color</u>	<u>REDOX</u>	<u>Depth</u>
7	0"-12"	Ap	SL	10YR 3/2		
	12"-20"	Bw1	SL	2.5Y4/4		
	20"- 36"	Bw2	SL	5Y4/3	m2p 10YR4/4	36"
	36"-72"	Cd	SL	5Y 5/1	m3p 10YR4/4	38"

Till becomes denser and rocky with depth  
 Hole is dry



RHODE ISLAND AND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT  
 OFFICE OF WATER RESOURCES  
 STORMWATER ENGINEERING REVIEW  
 REQUEST FOR ADDITIONAL INFORMATION

Date 6/10/2015

Reviewer Nicholas A Pisani, P.E

*Nicholas A. Pisani P.E*

Application Number	FWW#	15-0033
	WQC#	
	GWD/UIC#	001650
	RIPDES#	RIR101247
	OTHER	

Applicant Name KenDan, LLC

Project Name Proposed Hotel Facility

Plans and Analysis Reviewed Plans and Reports received by DEM on 3/04/2015 and revised plans and report received 5/28/2015

Engineering Review conducted with Checklist rev date 2/20/2014

**Interim Review Findings**

- 1) **Drainage Issues-** Drainage design with respect to mitigation of peak runoff discharge rates may not function as modeled because the proposed detention storage is assumed to be empty at the start of storm Due to slow infiltration rates and potential for clogging a more conservative assumption of assuming the basins are full at the start of storm event would better address the mitigation of peak runoff discharge rates Final review to be completed upon receipt of responses to the issues explained in the comments below
- 2) **Floodplain Issues-** Not indicated as being within an area of 100-year floodplain

**Interim Technical Justification** If the site plans for the proposed development include a BMP that does not fully comply with all the applicable design requirements of the RISDISM, then please note below

- 1) NA

**Review Comments**

- (1) Table A 2-1 Best Management Practices in the Appendix A checklist is incomplete Specifically
  - o The detention ponds and the storage within the underground retention / detention practice need to be listed for their function in management of peak runoff discharge rates (overbank protection or  $Q_p$ )
  - o The table needs to address what BMPs will provide channel protection volume storage

(2) With respect to the proposed underground "Retention / Detention System" because the infiltration rate is slower than the minimum standard of 0.5 inches per hour, this proposed BMP cannot be considered as an acceptable infiltration practice With respect to the proposed Isolator Row-TM portion of this proposed BMP, it cannot be considered to be an acceptable water quality BMP for full treatment of the water quality volume This is because the Isolator Row-TM practice relies on infiltration as an integral part of its function Without an acceptable infiltration rate of at least 0.5 inches per hour, it is not considered to be a valid water quality BMP It can only be credited as a pretreatment device However, because the Rhode Island Stormwater Design and Installation Manual (RISDISM) does not require pretreatment for roof runoff, its use is therefore



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considered to be unnecessary. Therefore, the proposed underground practice can only be considered to be acceptable as a detention practice. Please revise the design so as to provide an alternate water quality management practice to provide the required water quality treatment for the proposed rooftop impervious area. One option might be to provide adequate sizing of the down-gradient water quality BMP (the MWS-L water quality treatment unit) so as to also accommodate the water quality volume from the contributing rooftop impervious area.

- (3) Please include an appropriate and representative level of infiltration value for the expected small (sub-standard) amount of infiltration to the groundwater from the proposed underground retention / detention practice. If none is anticipated, then please revise the submitted routing analysis so as to utilize an initial water level equal to the inlet of the lowest surface water outlet. Please note that no water quality credit is allowed for any minor amount of infiltration estimated, because the design does not provide the minimum 0.5 inches per hour infiltration rate.
- (4) Please explain the basis of the waiver of the channel protection volume. Please note that in the initial submittal it was indicated that the 1-year storm flow was 0.47 cfs. This does not appear to be an accurate statement. Please note that the inflow volume to each basin must be less than 2 cfs for the automatic waiver to be applicable. Therefore, please redesign the site detention practices to provide extended detention of the channel protection volume such that the average release rate of the total runoff volume in the 1-year 24-hour storm event is calculated by dividing this total runoff volume by 24 hours (86,400 seconds). Also, please provide the CPv for the underground practice. Given the indicated soil and the presumptive rate of 0.27 in/hr, the infiltration of the 2' in the sump will take about 88.9 hours. Based on this, the volume in this sump may not be completely empty prior to the next storm. Therefore please revise the analysis so as to assume an initial water level equal to the elevation of the lowest surface outlet elevation. If it is not possible to revise the design for the channel protection volume and its associated restricted release rate, please explain why this cannot be accomplished and provide a technical justification as to why the channel protection standard would not need to be applied. Please note that the proposed design concept presents a special problem with respect to the discharge of the channel protection volume. Specifically, please note that any flow release as part of the channel protection volume release flow must first have its water quality volume fraction acceptably treated by an acceptable water quality treatment practice prior to being discharged to the any receiving wetland.
- (5) The submitted analysis indicates that both of the proposed detention ponds will have their bottom elevations situated below the lowest outlet weir. This creates a sump which needs to be addressed in the submitted analysis of each pond. Please specifically address the expected pre-storm pond water level in narrative and in the accompanying drainage analysis. If the pond is expected to be full at the start of the design storm event, each of the analyses will need to indicate an existing water level assumption of the pond being full to the level of the crest elevation of the lowest outlet weir. (Please note that with the potential for long term clogging of the bottoms of these basins, any slow infiltration may be lost and the basins may tend to act as wet basins. Therefore, at least from a peak flow management perspective, it would be appropriate to be conservative in the modeling of the basins and assume that they will be full at the start of the storm event.) If the soils will allow for infiltration of the volume within each sump, the analysis will need to account for the infiltration rate of the soils present at the



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bottom of each detention pond. Please provide a revised hydrologic analysis for the proposed project after making any pertinent revisions. Provide analysis for the 1, 10, and 100-year 24-hour Type III storm events, as well as the 1 2" 24-hour Type III storm water quality event (using the split pervious / impervious flow option for this 1 2" event only)

- (6) Please provide a diagram with flow direction arrows to depict the flow path through the proposed MWS-L units in both the water quality flow event and in a larger storm event, such as the 10-year storm
- (7) Please address how the revision to include an initial water level in the detention ponds will affect the design flows to the proposed MWS-L water quality treatment units. With the ponds being full between storm events, a greater outflow rates in the 1 2" storm events can be expected. Please demonstrate that the outflow for each of the proposed detention basins in the 1 2" storm event will not exceed the capacity of the proposed MWS-L water quality treatment units. If the ponds are not expected to be full at the start of the design storm event, please address whether the water quality volume will actually reach the proposed MWS units, as opposed to very slowly infiltrating into the slowly-infiltrating soils with less than a 3' separation to groundwater. Please address any associated water quality impacts from the exfiltrated flow. Please note that it does not appear that exfiltration through the bottom of each detention basin will pass through the minimum standard 3' of soil prior to encountering the seasonal high groundwater table
- (8) Please provide detailed calculations which will demonstrate that the proposed MWS-L water quality treatment units have been properly sized so as to accommodate the contributing impervious areas and the flows that will be discharged from the detention basins in the 1 2" storm events. Please specifically demonstrate that the design of each of the proposed MWS-L water quality treatment units will provide sufficient operation head to provide the requisite water quality treatment. Please also address whether or not larger flows that outlet the detention ponds in the larger storm events will automatically bypass the proposed water quality treatment practice
- (9) Please revise the submitted water quality flow analysis from the submitted 1 3" storm event to a 1 2" storm event using the split pervious / impervious option included in the HydroCAD-TM software package. Using this split pervious / impervious option will provide a close approximation to the water quality flow (WQf) referred to in the Rhode Island Stormwater Design and Installation Standards Manual (RISDISM)
- (10) Please explain the operating head indicated for the MWS-L-4-8-V water quality treatment unit. It is indicated as having a 3 4' operating head per the note on the design detail on the cross-section plan. However, the difference in elevation between the inlet weir crest and the outlet pipe invert is 1 87' (69 87' minus 68 00'). Please demonstrate that the proposed design provides a sufficient operating head to provide adequate water quality treatment per manufacturer's specifications
- (11) Please provide a typical structural cross-section of the proposed detention basin fill embankment. Show type of soil material to be used to construct the fill embankment and the method of compaction. Also show that all unsuitable soils (such as organic soils) will be removed and not used as part of the structural



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embankment Provide a typical detail of the detention basin embankment cover protection, be sure to show any erosion protection materials to be used

- (12) With respect to the submitted long term Operation and Maintenance Plan (O & M Plan) please be more specific regarding the mandatory items that will be required as part of the long term O & M of the proposed MWS-L treatment practices Please include an itemized list of all mandatory items
- (13) With respect to the submitted O & M Plan the submitted 8 5" x 11" map is not legible in its depiction of the location of each of the proposed stormwater management "best management practices" (BMPs) to be maintained Please provide a more legible map An 11" x 17" map may be used, if necessary
- (14) With respect to the submitted O & M Plan, at this time please at least provide a draft O & M agreement (Stormwater Facility Maintenance Agreement) between the owner and the RI DEM

214+19 = 233

Item C1.

# STORMWATER MANAGEMENT REPORT

Pare Project No. 23099:01

**Mt. Hope High School  
199 Chestnut Street  
Bristol, Rhode Island 02809**

**Assessors Map 117, Lot 3, 4, 5, 6, & 7**

Prepared for:

**Bristol Warren Regional  
School District  
235 High Street  
Bristol, RI 02809**

Prepared by:

**Pare Corporation  
8 Blackstone Valley Place  
Lincoln, RI 02865**

**JANUARY 2025  
SUPPLEMENTAL REVISIONS:  
JUNE 2025**



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### ***Bioretention Area with Subdrains***

The bioretention areas have been designed in accordance with RIDEM Standards to promote water quality. The bioretention areas include filter media with a mulch upper layer, vegetated side slopes, a raised outlet, and spillway. Stormwater is piped to the sediment forebay, which provides pretreatment, prior to entering the bioretention area. An impermeable liner with a stone layer and perforated subdrain is placed under the filter media to discharge the treated water for Bioretention Area-02 and Bioretention Area-03. The liner is provided because the minimum separation to groundwater is not provided. The raised outlet is elevated to store the water quality volume for 24-hours while it slowly drains through the subdrain system following the storm event. Any excess stormwater that enters the bioretention area will overflow into the catch basin and discharge into the drainage network.

### ***Bioretention Area with Exfiltration***

The bioretention areas have been designed in accordance with RIDEM Standards to promote water quality. The bioretention areas include filter media with a mulch upper layer, vegetated side slopes, a raised catch basin, and spillway. Stormwater for Bioretention -01 is piped to the sediment forebay, which provides pretreatment, prior to entering the bioretention area. The outlet is elevated to exfiltrate the entire water quality volume through the surrounding soils for Bioretention Area-01. Stormwater for Bioretention -04 is piped to the bioretention area for treatment. Bioretention -04 provides water quality treatment for non-vehicular traveled sidewalks, therefore no pretreatment was provided. The outlet is elevated to exfiltrate the entire water quality volume through the surrounding soils for Bioretention -04. Excess stormwater that enters Bioretention-04 during larger storm events will overflow into the catch basin and discharge into the drainage network. Bioretention Area-01 is designed offline with diversion structures upstream for larger storm events to bypass the BMP.

Per the RISSDISM, exfiltration through the soils observed on-site would be modeled with a Rawls Rate of 1.02 in/hr (C Soils) or 0.27 in/hr (D Soils). In an effort to be conservative, an infiltration rate of 0.27 in/hr was used to model exfiltration from all BMP's that exfiltrate to existing soils.

### ***Sand Filters with Subdrains***

The sand filters have been designed in accordance with RIDEM Standards to promote water quality.. The sand filter includes a vegetated bottom, 36" deep layer of ASTM C-33 sand,



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to provide ground water recharge to the maximum extents practicable within the Silver Creek Watershed to reduce stormwater volume per the Town of Bristol's regulations for projects within Silver Creek.

#### *Underground Infiltration System*

The underground infiltration system (UGIS) has been designed in accordance with RIDEM Standards to promote water quality, and recharge. The UGIS is sized to infiltrate the water quality volume based on upstream impervious areas.

The bottom of the underground infiltration system is set in native soils, and a minimum of 36" from the estimated seasonal high groundwater table. Considering the presence of silt loam, an infiltration rate of 0.27 in/hr was used for conservative measures. A technical justification is requested to permit a stormwater infiltration practice within anticipated 0.27 in/hr soils based on the goal to provide ground water recharge to the maximum extents practicable within the Silver Creek Watershed to reduce stormwater volume per the Town of Bristol's regulations for projects within Silver Creek.

UGIS-01 has been designed to infiltrate the synthetic turf field impervious surface to provide water quality treatment. The synthetic turf field profile includes dual 15" HDPE pipes embedded within crushed stone reservoir to provide storage for the athletic field prior to entering the UGIS system. Larger stormwater events will bypass the UGIS system via a diversion structure upstream of the system. A pretreatment row is not provided for the UGIS system due to the UGIS's design intention to treat only the synthetic turf field with no other contributing drainage areas. Due to the infiltration practice being within 50 feet of a slope greater than 15%, a 40 mil PVC liner is proposed to limit potential for horizontal seepage. The liner will be installed along the southern and western boundaries of the underground system to prevent water seepage against the 3:1 slope.

#### *Wet Swale*

The wet swale along the east parking lot has been designed in accordance with the RISDISM to treat runoff for water quality requirements. The wet swale includes a 12" deep bioretention soil bed with a crushed stone sump. Soil media shall meet the specifications outlined for bioretention media to include a well-aged leaf compost per the RISDISM section 5.7.4. This wet swale also



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includes runoff that flows to the wetland in the southwest corner of the site. A portion of the stormwater runoff directed to the southwest wetland enters an existing detention basin through a piped drainage system and is discharged through an outlet control structure into the southwest wetland.

The Silver Creek East Branch subwatershed (East subwatershed) includes runoff that flows to Silver Creek and the culvert beneath Chestnut Street. The northeast wetland flows into Silver Creek which flows to an existing pond on campus with a controlled outlet dam and two culverts. Stormwater runoff from the East subwatershed enters the stream through overland flow and a piped drainage system. The effective FIRM established in 2014 is the regulatory floodplain information currently available for the project site. Based on this information, compensatory storage calculations and culvert hydrology were assessed using the available published data.

According to the Soil Survey of Rhode Island (US Department of Agriculture Soil Conservation Service 1981), the soils located at the site are a mix of primarily Udorthents-Urban land complex (UD), Urban Land (Ur) and Stissing silt loam (Se). There are less significant sections of Pittstown silt loam (PmA), and Pittstown silt loam (PmB). The soils on-site are in hydrologic soil group C and D and are generally poorly drained.

Test pit labels represent the year excavated and numbering in that year. For example, TP10-02 would be TP-2 from the 2010 test pits. Refer to the updated test pit plan as part of Appendix A of the stormwater report for the note describing the nomenclature used for labeling the test pit data on site.

Ten test pits were excavated on July 18, 2024 to review below grade conditions at the site. Locations can be found on the plan and test pit logs found in Appendix A. The on-site soils generally consist of fill atop a layer of sandy loam atop a layer of silty loam. Fill material from previous grading and site development operations was observed at depths ranging from 6" to 70" throughout the site. Based upon the classification of soils surrounding the site and soil properties observed during the test pit excavations, the on-site soils are modeled within Hydrologic Group "C" in this analysis. The estimated seasonal high groundwater table varies across the site. Redoximorphic features were observed in all of the test pits with depths ranging from 10" to 38" below grade.



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to provide ground water recharge to the maximum extents practicable within the Silver Creek Watershed to reduce stormwater volume per the Town of Bristol's regulations for projects within Silver Creek.

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STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS  
 Department of Environmental Management  
 Office of Water Resources



Site Evaluation Form  
 Part A - Soil Profile Description Application Number N/A

Property Owner: Town of Bristol, Rhode Island  
 Property Location: Mount Hope High School Chestnut Street & Naomi Street Bristol, RI  
 Date of Test Hole: February 22, 2010  
 Soil Evaluator: Site Evaluation -- Robin E Dyer License Number: D3077  
 Weather: Sunny 45°F Shaded: Yes  No  Time: 9:00am

TH-01 Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
A	4"	g	s	10yr3/2					sl	0-m	fr	6
B	9"	c	s	10yr4/2					sl	0-m	fi	8
Cd1	27"	a	s	10yr4/2	10yr7/8 5y7/2	c	2	d	cbsil	0-m	fi	9
Cd2	44"	a	s	N2.5/	10yr7/8 5y7/2	f	1	f	gsil	0-m	fi	9
Cd3	65"			5y3/2	10yr7/8 5y7/2	c	2	f	cbsil	0-m	vfi	9
TH-02 Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
A	8"	g	s	2.5y3/3					sl	0-m	fr	6
B	16"	c	s	10yr5/3	10yr6/8 2.5y7/1	c	2	d	sl	0-m	fi	8
Cd1	40"	a	s	10yr4/4	10yr5/6 2.5y7/2	c	2	f	cbsil	0-m	fi	9
Cd2	74"			10yr4/4	10yr5/6 2.5y7/2	c	1	f	gsil	0-m	fi	9

Soil Class: Pittstown Silt Loam  
 Depth to Groundwater Seepage: TH-01 60" TH-02 57"  
 Estimated Seasonal High Water Table: TH-01 27" TH-02 27"

Total Depth of each Test Hole: TH-01 65" TH-02 74"  
 Depth to Impervious or Limiting Layer: Not encountered  
 Comments: Redox features apparent in between 8" & 27" appear to be a result of slow downward movement of water through soil.



**STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS**  
 Department of Environmental Management  
 Office of Water Resources



**Site Evaluation Form**  
**Part A - Soil Profile Description**      Application Number \_\_\_\_\_

Property Owner: Town of Bristol, Rhode Island  
 Property Location: Mount Hope High School Chestnut Street & Naomi Street Bristol, RI  
 Date of Test Hole: February 22, 2010  
 Soil Evaluator: Site Evaluation - Robin E Dyer      License Number: D3077  
 Weather: Sunny 45°F      Shaded: Yes  No       Time: 10:30am

TH-03 Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
A	4"	g	s	10yr4/3					sl	0-m	fr	6
B	23"	c	s	10yr6/3	10yr6/8 2.5y7/2	c	2	d	sl	0-m	fi	8
Cd1	33"	a	s	10yr4/1	10yr6/8 2.5y7/2	c	2	d	cbsil	0-m	fi	9
Cd2	67"			N2.5/	10yr6/8 2.5y7/2	f	1	f	gsil	0-m	vfi	9
TH-04 Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
A	4"	g	s	10yr4/3					sl	0-m	fr	6
B	12"	c	s	10yr6/3					sl	0-m	fi	8
Cd	69"			10yr6/1	10yr6/8 2.5y7/2	c	2	f	cbsl	0-m	vfi	9

Soil Class: Pittstown Silt Loam      Total Depth of each Test Hole: TH-03 67" TH-04 69"  
 Depth to Groundwater Seepage: TH-03 16" TH-04 52"      Depth to Impervious or Limiting Layer: TH-04 Rippable ledge @24"  
 Estimated Seasonal High Water Table: TH-03 33" TH-04 30"      Comments: Redox features apparent in between 16" & 24" result of slow downward movement of water through soil. Existing pipe adjacent



STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS  
 Department of Environmental Management  
 Office of Water Resources



Site Evaluation Form  
 Part A - Soil Profile Description

Application Number N/A

Property Owner: Town of Bristol, Rhode Island

Property Location: Mount Hope High School Chestnut Street & Naomi Street Bristol, RI

Date of Test Hole: February 22, 2010

Soil Evaluator: Site Evaluation - Robin E Dyer

License Number: D3077

Shaded: Yes  No  Time: 11:15am

Weather: Sunny 45°F

TH-05 Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
A	12"	g	s	10yr4/2					sl	0-m	fr	6
B	24"	c	s	10yr6/3	10yr6/8 2.5y7/2	c	2	d	sl	0-m	fi	8
Cd	67"			2.5y4/3	10yr5/6 2.5y7/1	c	2	d	gsl	0-m	vfi	9
TH-06 Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
A	5"	g	s	N2.5/					sl	0-m	fr	6
B	13"	c	s	10yr4/1	10yr4/3 2.5y7/2	c	1	f	sl	0-m	fri	6
C	38"	a	s	10yr7/3	10yr6/8 2.5y7/2	c	2	d	sil	0-m	fri	7
Cd1	57"			2.5y4/1	10yr6/8 2.5y7/2	c	2	d	gsl	0-m	vfi	9

Soil Class: Pittstown Silt Loam

Depth to Groundwater Seepage: TH-05 45" TH-06 33"

Estimated Seasonal High Water Table: TH-05 12" TH-02 12"

Total Depth of each Test Hole: TH-05 67" TH-06 57"

Depth to Impervious or Limiting Layer: Not encountered

Comments: \_\_\_\_\_

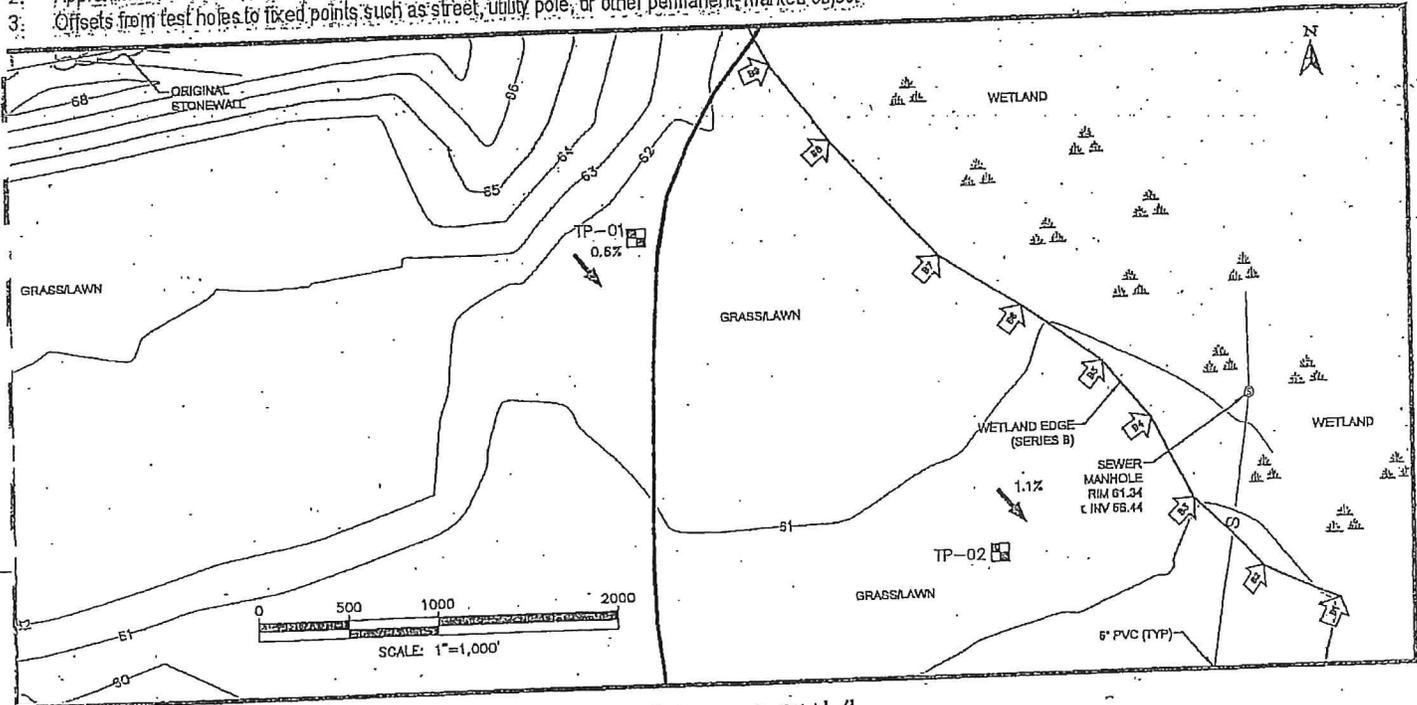
Part B

Site Evaluation - to be completed by Class II or III Designer or Soil Evaluator  
Please use the area below to locate:

1. Test holes
2. Approximate direction of due north
3. Offsets from test holes to fixed points such as street, utility pole, or other permanent, marked object

Key:

- Approximate location of test holes
- Estimated gradient and direction of slope
- Approximate direction of due north



1. Relief and Slope: TH-01 Slope=0.006'/' TH-02 Slope=0.011'/'
2. Presence of any watercourse, wetlands or surface water bodies, within 200 feet of test holes: YES  NO  If yes, locate on above sketch.
3. Presence of existing or proposed private drinking water wells within 200 feet of test holes: YES  NO  If yes, locate on above sketch.
4. Public drinking water wells within 500 feet of test holes: YES  NO  If yes, locate on above sketch.
5. Is site within the watershed of a public drinking water reservoir or other critical area defined in SD 19.00? YES  NO
6. Has soil been excavated from or fill deposited on site? YES  NO  If yes, locate on above sketch.
7. Site's potential for flooding or ponding: NONE  SLIGHT  MODERATE  SEVERE
8. Landscape position: Athletic field
9. Vegetation: Grass
10. Indicate approximate location of property lines and roadways.
11. Additional comments, site constraints or additional information regarding site: The westerly portion of the site adjacent to the existing wetlands falls within a Flood Zone AE with elevations established.  
Ponding occurs within the soil as a result of the poor surface soil conditions.

**Certification**  
The undersigned hereby certifies that all information on this application and accompanying forms, submittals and sketches are true and accurate and that I have been authorized by the owner(s) to conduct these necessary field investigations and submit this request.

Part A prepared by: \_\_\_\_\_ Part B prepared by: Robert P. Nelson License # D3077

Signature: \_\_\_\_\_ License # \_\_\_\_\_ Signature: \_\_\_\_\_ License # \_\_\_\_\_

**FOR OFFICE USE ONLY:**  
Decision: Approved  Disclaimed   
Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Signature Authorized Agent \_\_\_\_\_ Date \_\_\_\_\_