

Stormwater Runoff Analysis

"985 Aquidneck Avenue"

Assessor's Map 113, Lot 208
985 Aquidneck Avenue
Middletown, RI 02842

Prepared For

Seascape Holdings LLC
1 Trimble Road
Middletown, RI 02842



Rev. April 2024



TABLE OF CONTENTS

1.0	PROJECT NARRATIVE.....	3
1.1	SITE INFORMATION	3
1.2	EXISTING IMPROVEMENTS AND SITE CONDITIONS	3
1.3	PROTECTED FEATURES	3
1.4	SITE TERRAIN AND SOILS.....	3
1.5	PROPOSED IMPROVEMENTS	4
2.0	PROPOSED ALTERATIONS AND STORMWATER CONSIDERATIONS	5
2.1	STORMWATER SYSTEM OBJECTIVES.....	5
2.2	REDEVELOPMENT SITE	5
2.3	MINIMUM STORMWATER MANAGEMENT STANDARDS	5
2.3.1	MINIMUM STANDARD 1: LID SITE PLANNING AND DESIGN STRATEGIES.....	5
2.3.2	MINIMUM STANDARD 2: GROUNDWATER RECHARGE	5
2.3.3	MINIMUM STANDARD 3: WATER QUALITY	5
2.3.4	MINIMUM STANDARD 4: CONVEYANCE AND NATURAL CHANNEL PROTECTION	6
2.3.5	MINIMUM STANDARD 5: OVERBANK FLOOD PROTECTION	6
2.3.6	MINIMUM STANDARD 6: REDEVELOPMENT AND INFILL PROJECTS.....	6
2.3.7	MINIMUM STANDARD 7: POLLUTION PREVENTION	6
2.3.8	MINIMUM STANDARD 8: LAND USES WITH HIGHER POTENTIAL POLLUTANT LOADS.....	6
2.3.9	MINIMUM STANDARD 9: ILLICIT DISCHARGES	6
2.3.10	MINIMUM STANDARD 10: SOILS EROSION AND SEDIMENT CONTROL.....	6
2.3.11	MINIMUM STANDARD 11: STORMWATER MANAGEMENT OPERATIONS AND MAINTENANCE	6
2.4	OVERALL STORMWATER DESIGN FUNCTION	7
3.0	DESIGN MODELING METHODOLOGY	7
3.1	ANALYSIS DESIGN POINTS AND OFF-SITE CONTRIBUTIONS	7
4.0	STORMWATER RUNOFF COMPARISONS.....	8
4.1	SUMMARY OF STORMWATER CALCULATIONS	8
5.0	LIMITATIONS AND SPECIAL TERMS AND CONDITIONS	9



**Northeast Engineers
& Consultants, Inc.**
"A Knowledge Corporation"®

APPENDIX A FIGURES

APPENDIX B WATERSHED MAPS

APPENDIX C EXISTING CONDITIONS HYDROCAD

APPENDIX D PROPOSED CONDITIONS HYDROCAD

APPENDIX E SUPPLEMENTARY CALCULATIONS

APPENDIX F SOIL EVALUATIONS

1.0 PROJECT NARRATIVE

1.1 SITE INFORMATION

City / Town:	Middletown, Rhode Island
Adjacent Roadways:	Aquidneck Avenue (State) and Trimble Road (Municipal)
Lot(s) identification:	A.P. 113 Lot 208
Zoning District:	LBA (Traffic Sensitive Limited Business)
Current Use:	Commercial
Site Area:	0.43 Acres
FEMA Zone and Map:	Zone "X"

1.2 EXISTING IMPROVEMENTS AND SITE CONDITIONS

The existing Site includes a single parcel which contains one single commercial structure and fronts on two roadways, one of which is state maintained. The 1,500 square foot footprint commercial structure fronts Aquidneck Avenue and contains three garage bays and office space. The structure is accessed via a wide curb cut along the Trimble Road which leads to a gravel parking area which occupies most of the property. Several container units are scattered throughout the property. Perimeter groundcover consists of grasses and landscaping. The structure is served by municipal water and sewer.

1.3 PROTECTED FEATURES

There are no features protected by the state located on the property.

1.4 SITE TERRAIN AND SOILS

In general, the site slopes from the east towards Aquidneck Avenue. No portion of the property slopes towards Trimble Road. Slopes vary between 3% and 12%. The soil type on site is mapped as UD (Udorthents – human transported material) by the USDA Natural Resource Conservation Service. A Class IV soil evaluation performed on the property revealed a depth to the seasonal high-water table of 40 inches.



1.5 PROPOSED IMPROVEMENTS

The applicant intends to construct a 2,420 square foot garage at the rear of the property. The gravel parking area will be paved. The overall parking surface will be reduced in size. The remaining gravel will be removed and the surfaces loamed and seeded. These additional pervious surfaces will compensate for the additional runoff generated by the proposed pavement. A small sand filter is proposed near the front of the property to provide water quality treatment for the proposed building. The existing structure is to remain unchanged. The existing access from Trimble Road shall also remain.

2.0 PROPOSED ALTERATIONS AND STORMWATER CONSIDERATIONS

2.1 STORMWATER SYSTEM OBJECTIVES

The objectives of the project stormwater system are to accomplish the following:

- Provide water quality treatment and groundwater recharge for new rooftop stormwater runoff in accordance with the Rhode Island Stormwater Design and Installation Rules (250-RICR-150-10-8), hereafter abbreviated as the "Rules".
- Maintain the overall drainage patterns from the site to the extent practicable.
- Ensure no increase in peak runoff to the downstream design points.
- Ensure no increase in total 24-hour volume runoff to the downstream DOT right of way.

2.2 REDEVELOPMENT SITE

While the existing site lot coverage consists of more than 40% impervious, this project does not qualify as a "redevelopment site" per section 8.12 of the Rules as less than 10,000 square feet of impervious surfaces are proposed to be disturbed.

2.3 MINIMUM STORMWATER MANAGEMENT STANDARDS

2.3.1 MINIMUM STANDARD 1: LID SITE PLANNING AND DESIGN STRATEGIES

The proposed development utilizes LID designs conforming to the Rules. These elements are located immediately downstream of the new improvements and will directly treat the newly generated runoff with minimal interception of on-site clean runoff.

2.3.2 MINIMUM STANDARD 2: GROUNDWATER RECHARGE

An infiltrating sand filter will provide the necessary groundwater recharge for the proposed garage. Per the calculations provided in Appendix E, a total of **50** cubic feet of recharge is required for the proposed garage. The sand filter will provide a minimum of **155** cubic feet of recharge, equivalent to the design water quality volume.

2.3.3 MINIMUM STANDARD 3: WATER QUALITY

An infiltrating sand filter will provide the necessary water quality for the proposed garage. Per the calculations provided in Appendix E, a total of **202** cubic feet of water quality volume is required for the proposed garage. As required by the Rules, the sand filter will provide **155** cubic feet of volume, equivalent to 75% of the design water quality volume. The new pavement proposed to replace the compacted gravel parking lot represents the re-development of less than 10,000 square feet. Per section 8.12 of the Rules, no water quality or recharge is required for this work.



2.3.4 MINIMUM STANDARD 4: CONVEYANCE AND NATURAL CHANNEL PROTECTION

This standard may be waived for facilities with less than one acre of imperious area.

2.3.5 MINIMUM STANDARD 5: OVERBANK FLOOD PROTECTION

The TR-20 HydroCAD model demonstrates that the proposed system will successfully mitigate the 100-year storm event. In these calculations, all pre-development land was characterized as "good condition" as required by this standard. An off-site component of runoff from the adjacent property passes through the development area, which was also modeled as "good condition".

2.3.6 MINIMUM STANDARD 6: REDEVELOPMENT AND INFILL PROJECTS

As indicated in section 2.2 above, this does not qualify as a redevelopment project per section 8.12 of the Rules as less than 10,000 square feet of impervious is proposed to be disturbed.

2.3.7 MINIMUM STANDARD 7: POLLUTION PREVENTION

Source controls and pollution prevention measures will be present during all phases of construction.

2.3.8 MINIMUM STANDARD 8: LAND USES WITH HIGHER POTENTIAL POLLUTANT LOADS

The use of this property does not qualify as a LUHPPL and does not require any specific source controls, limited BMPs, or and additional state permitting.

2.3.9 MINIMUM STANDARD 9: ILLICIT DISCHARGES

Neither the using use nor any proposed uses will include any discharges considered to be "illicit" per this section of the Rules.

2.3.10 MINIMUM STANDARD 10: SOILS EROSION AND SEDIMENT CONTROL

Soil erosion and sediment control measures will be implemented during all phases of construction.

2.3.11 MINIMUM STANDARD 11: STORMWATER MANAGEMENT OPERATIONS AND MAINTENANCE

Long term maintenance requirements for the sand filter are provided on the proposed development plans.

2.4 OVERALL STORMWATER DESIGN FUNCTION

The overall design goal is to provide a reduction in peak rate of runoff and total volume runoff, and will meet the 11 minimum standards established in the Rules. The existing drainage patterns across the site will be minimally impacted. There will be no negative impacts to the receiving state right of way.

3.0 DESIGN MODELING METHODOLOGY

Runoff and routing calculations have been performed for the watershed areas affected by the proposed development under existing and proposed development conditions scenarios. Time of concentration and runoff curve number calculations have been performed using the method described in NRCS Technical Release 55 – Urban Hydrology for Small Watersheds. The TR-20 based HydroCAD modeling software has been utilized to perform the more complex runoff and routing calculations, most of which are beyond the scope of the TR-55 method.

Design rainfall events have been modeled using the Soil Conservation Service (SCS) Type III hydrograph for 24-hour duration storms. The rainfall depth for each return period is taken from Section 8.6 of the Rules. This Section split the state into five regions for rainfall frequency based on county. The project site is located in the **Newport** County region. The rainfall frequency values required by the Rules and used in this drainage analysis are listed in the table below.

Rainfall Frequency Values for Newport County Rhode Island with 24-Hour Storm Duration					
RIDEM Stormwater Design and Installation Rules (250-RICR-150-10-8)					
Frequency	1-Yr	2-Yr	10-Yr	25-Yr	100-Yr
Inches of Rainfall	2.8	3.3	4.9	6.1	8.6

The existing and proposed conditions runoff calculations were analyzed and the proposed site configuration was designed to mitigate the peak runoff for the 1, 2, 10, 25, and 100-year 24-hour design storms. The proposed layout effectively mitigates runoff from developed areas of the site before allowing it to discharge in a non-erosive manner to downstream areas in accordance with the Rules.

3.1 ANALYSIS DESIGN POINTS AND OFF-SITE CONTRIBUTIONS

The proposed development contributes stormwater runoff to the following design points. These design points provide a direct comparison for pre-construction and post-construction runoff flows and runoff volumes.

1. Aquidneck Avenue

The following off-site areas contribute surface stormwater runoff to these design points. This runoff either drains through the project area or contributes in some manner which directly affects the design calculations. These areas are:

1. Upstream properties to the east

Watershed maps for both the existing and proposed conditions can be found in Appendix B. These maps demonstrate the areas of the site which contribute to each of the design points and indicate the general pattern of surface flow.

4.0 STORMWATER RUNOFF COMPARISONS

Analysis of the existing and proposed runoff during design storms demonstrates that there will no increase in the peak runoff or total volume runoff to the downstream design points as a result of the development. Comparisons of the runoff at the design points are given below in Section 4.1. The runoff volumes given have been evaluated over a 24-hour period. All of the HydroCAD modeling worksheets are attached in Appendix C and D.

4.1 SUMMARY OF STORMWATER CALCULATIONS

Table 4.1.1 Comparison of Runoff Values at Aquidneck Avenue (102 vs. 202)

Storm Return Period	Existing Conditions Peak Runoff (cfs)	Proposed Conditions Peak Runoff (cfs)	Existing Conditions 24-hr Volume Runoff (af)	Proposed Conditions Volume 24-hr Runoff (af)
1-year	0.94	0.90	0.065	0.062
2-year	1.17	1.13	0.081	0.078
10-year	1.91	1.87	0.136	0.132
25-year	2.47	2.43	0.178	0.174
100-year	3.61	3.57	0.266	0.261

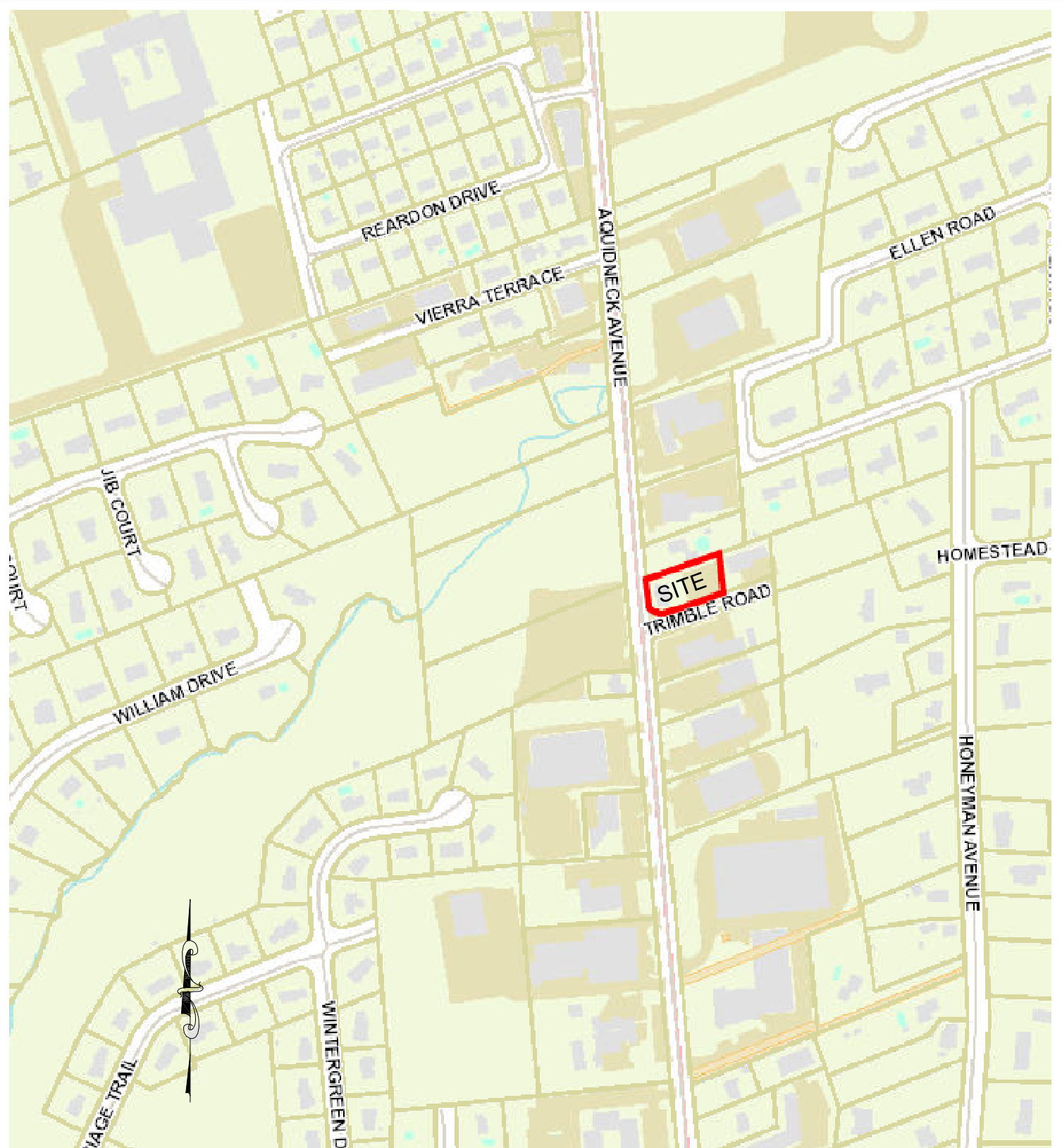


5.0 LIMITATIONS AND SPECIAL TERMS AND CONDITIONS

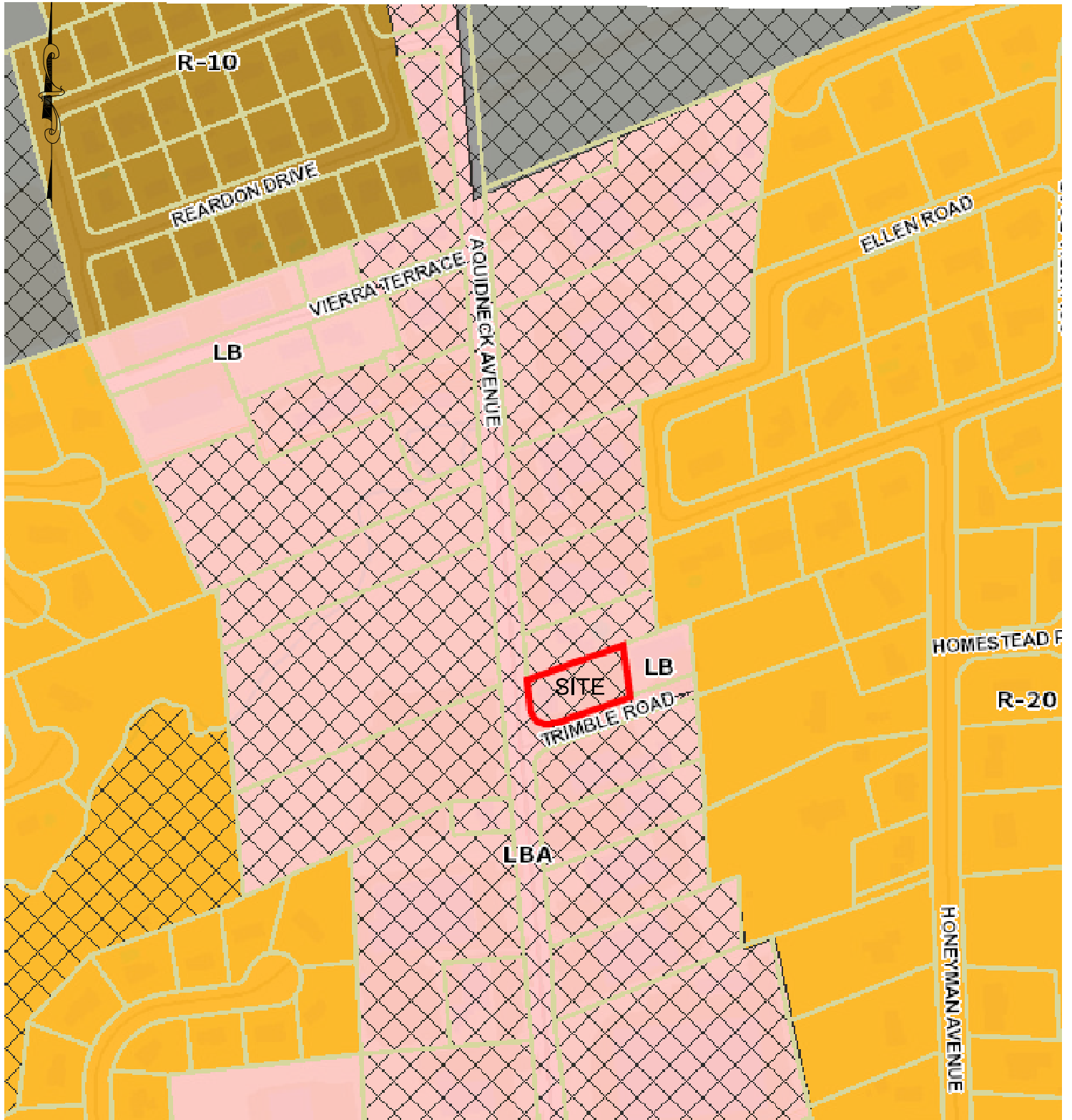
1. NE&C's evaluation was performed in accordance with generally accepted practices of other consultants undertaking similar studies at the same time and in the same geographical area, and NE&C observed the degree of care and skill generally exercised by other consultants under similar circumstances and conditions. No warranty expressed or implied is made.
2. Any additional research conducted should be reviewed by Northeast Engineers & Consultants, Inc., such that the conclusions presented herein may be modified.
3. All observations documented in this report were performed under the existing conditions at the time of the assessment.
4. This report has been prepared on the behalf of and is for the exclusive use of the Client. This report and findings contained herein shall not, in whole or in part be disseminated or conveyed to any party, nor used by any other party in whole or in part, without the written consent of NE&C.



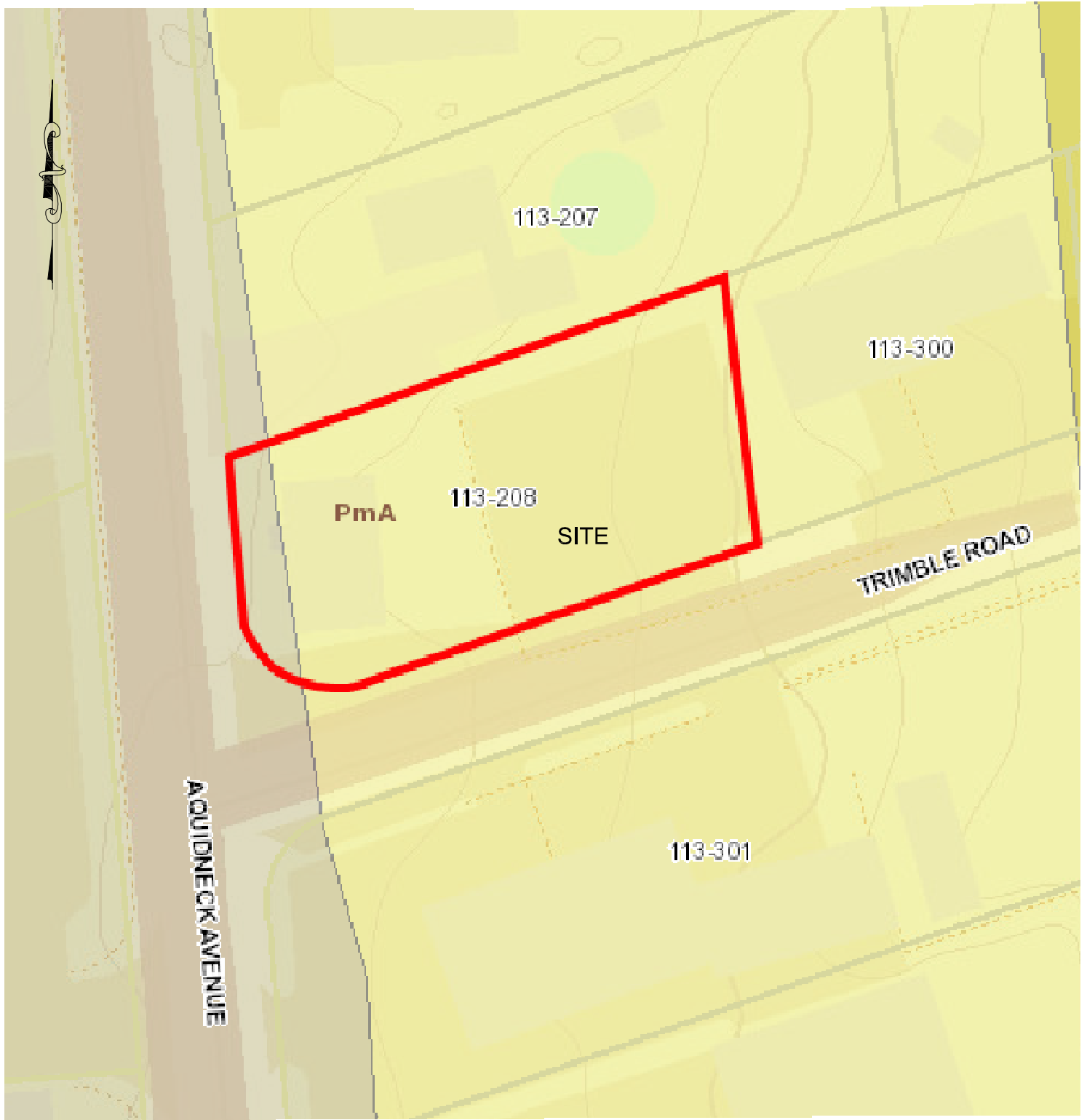
APPENDIX A FIGURES



Scale:	NTS	Date:	11JUL23	Designed By:	JJR	Drawn By:	JJR	Checked By:	GES
Project Title:				Drawing Title:					
985 AQUIDNECK AVENUE MIDDLETOWN, RHODE ISLAND				LOCUS MAP					
Issued for:			Drawing Number:			Project Number:			
PERMITTING			FIG 1			22099.0			



Scale:	NTS	Date:	11JUL23	Designed By:	JJR	Drawn By:	JJR	Checked By:	GES
Project Title:				Drawing Title:					
985 AQUIDNECK AVENUE MIDDLETOWN, RHODE ISLAND				ZONING MAP					
Issued for:			Drawing Number:			Project Number:			
PERMITTING			FIG 2			22099.0			



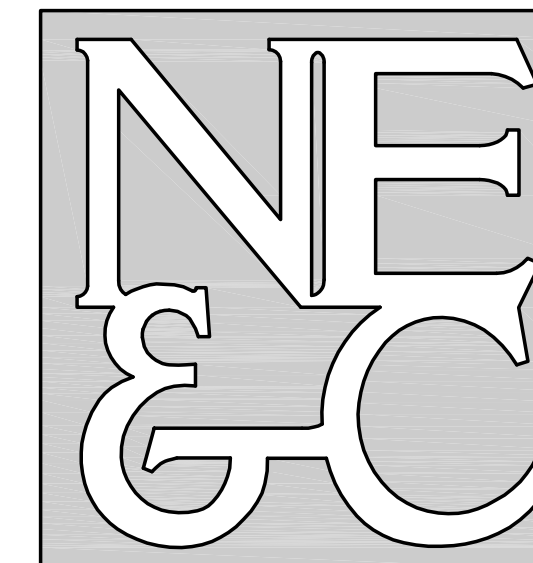
Scale:	NTS	Date:	11JUL23	Designed By:	JJR	Drawn By:	JJR	Checked By:	GES
Project Title:				Drawing Title:					
985 AQUIDNECK AVENUE MIDDLETOWN, RHODE ISLAND				SOILS MAP					
Issued for:				Drawing Number:			Project Number:		
PERMITTING				FIG 3			22099.0		



APPENDIX B WATERSHED MAPS



NORTHEAST ENGINEERS & CONSULTANTS, INC.

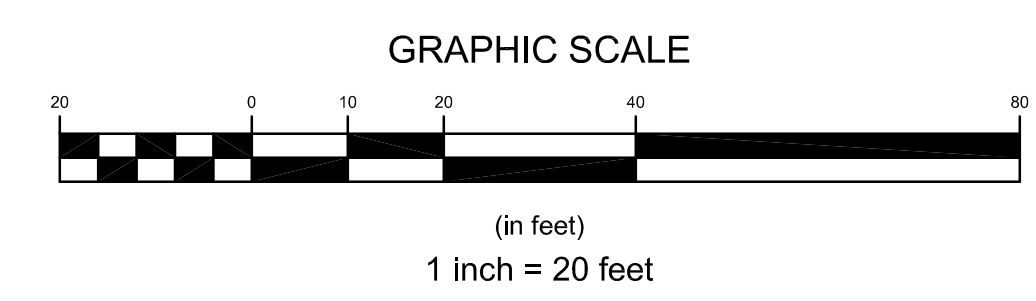
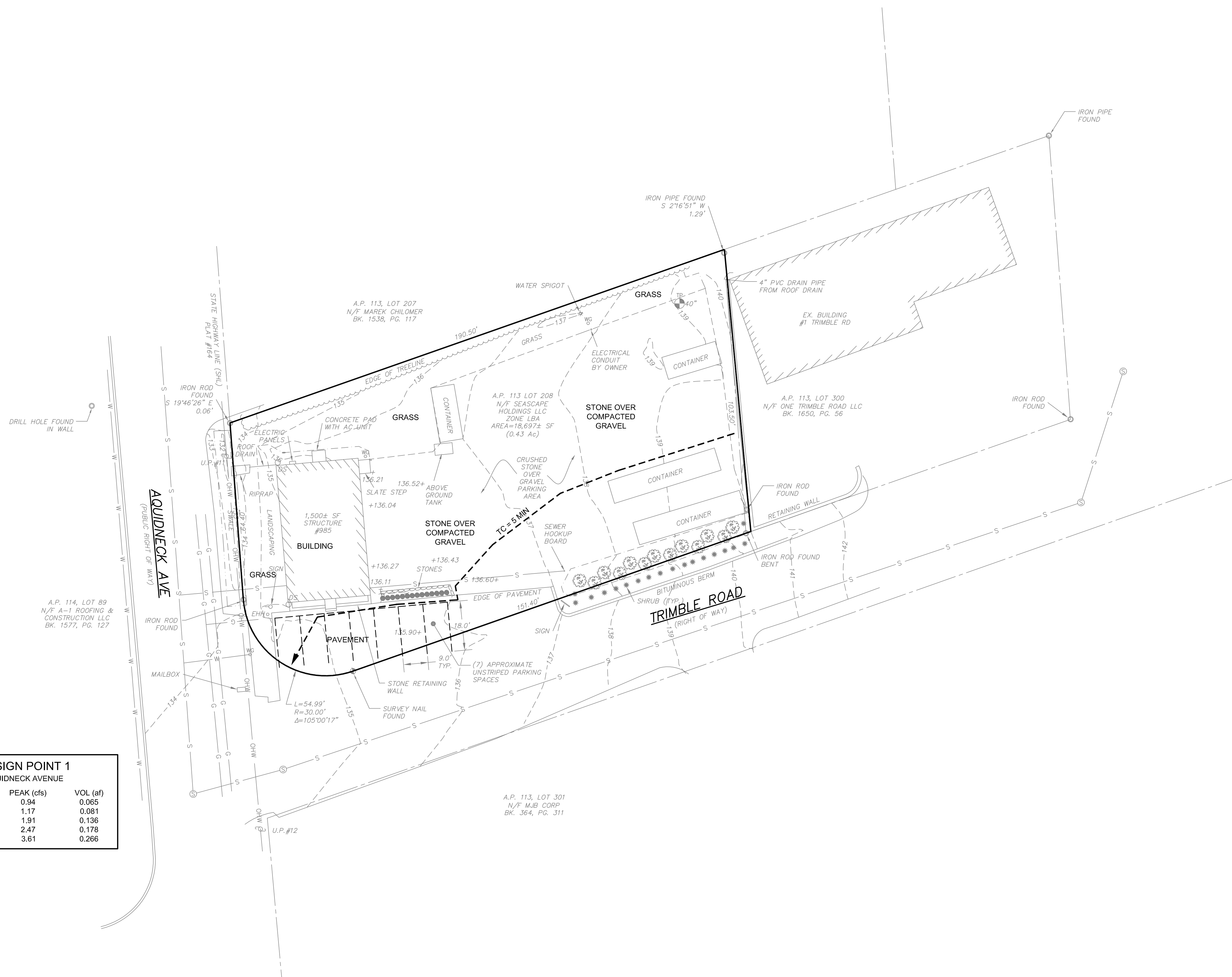


SITE/CIVIL
LAND PLANNING
WATERFRONT
SURVEYING
GEOTECHNICAL
ENVIRONMENTAL
TRANSPORTATION
STRUCTURAL

A KNOWLEDGE CORPORATION®

6 VALLEY ROAD MIDDLETOWN RHODE ISLAND 02842
PHONE (401) 849-0810 FAX (401) 846-4169
WWW.NORTHEASTENGINEERS.COM

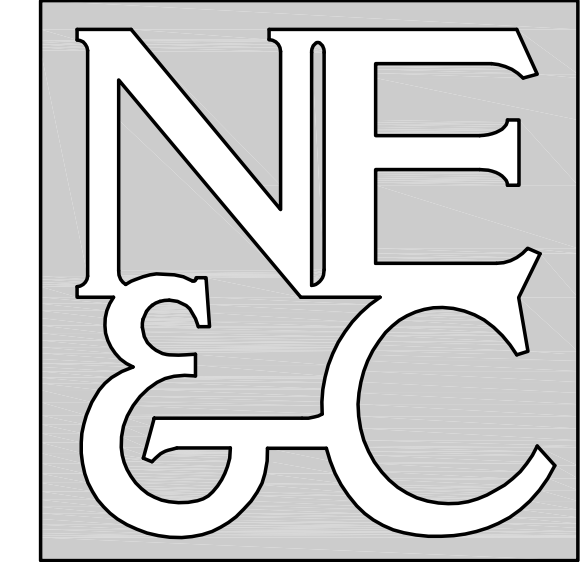
DESIGN POINT 1 AQUIDNECK AVENUE		
STORM	PEAK (cfs)	VOL (af)
1-YEAR	0.94	0.065
2-YEAR	1.17	0.081
10-YEAR	1.91	0.136
25-YEAR	2.47	0.178
100-YEAR	3.61	0.266



No.	Revision	Date	App.
Designed By:	JJR	Drawn by:	JJR
Checked by:	GES	Date:	12JUL23
Project Title:			
A.P. 113 LOT 208 985 AQUIDNECK AVENUE MIDDLETOWN, RHODE ISLAND			
Client/Owner:			
SEASCAPE HOLDINGS LLC 1 TRIMBLE ROAD MIDDLETOWN, RI 02842			
Issued for:			
PERMITTING			
Drawing Title:			
EXISTING WATERSHED			
Drawing Number:		W-1	
Sheet		1 of 1	
Project Number:		22099.0	
Survey Index:		-	
OWNERSHIP AND USE OF DOCUMENTS: DRAWINGS AND SPECIFICATIONS, AS INSTRUMENTS OF PROFESSIONAL SERVICE, ARE AND SHALL REMAIN THE PROPERTY OF THE ENGINEER. THESE DOCUMENTS ARE NOT TO BE USED, IN WHOLE OR PART, FOR ANY OTHER PROJECTS OR PURPOSES, OR BY ANY OTHER PARTIES, THAN THOSE PROPERLY AUTHORIZED BY CONTRACT, WITHOUT THE EXPRESS AUTHORIZATION OF THE ENGINEER.			



NORTHEAST ENGINEERS & CONSULTANTS, INC.

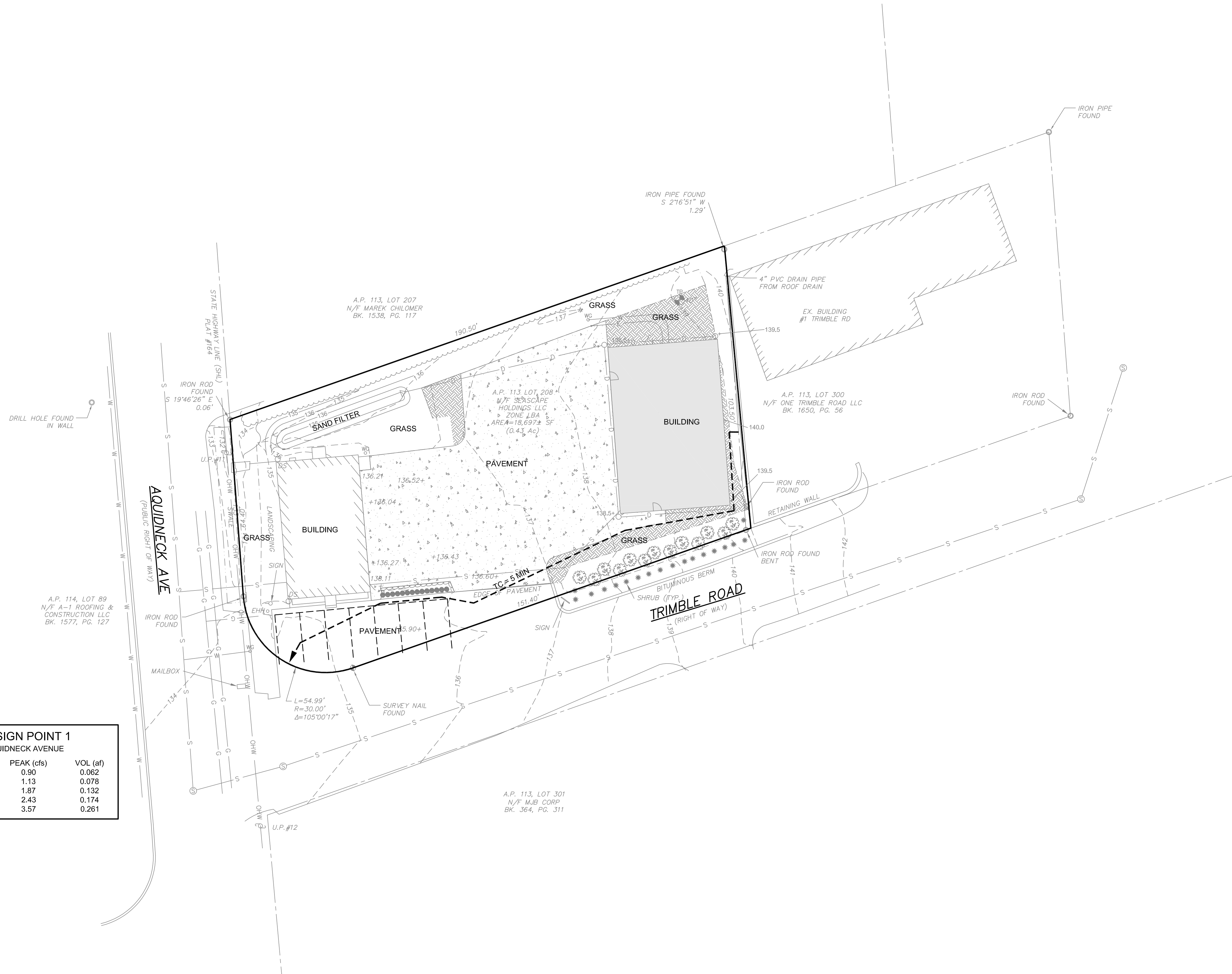


SITE/CIVIL
LAND PLANNING
WATERFRONT
SURVEYING
GEOTECHNICAL
ENVIRONMENTAL
TRANSPORTATION
STRUCTURAL

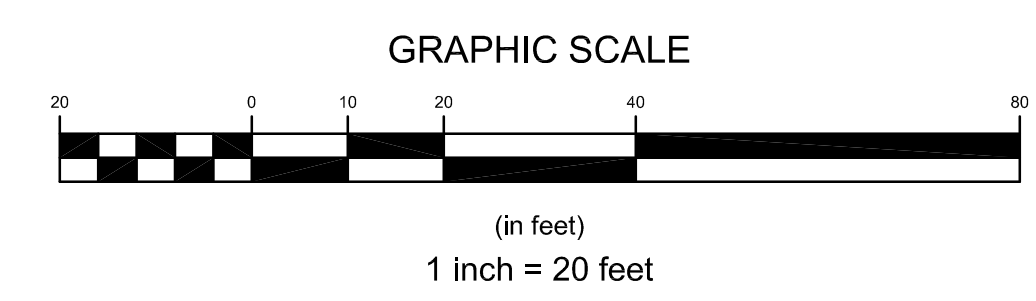
A KNOWLEDGE CORPORATION®

6 VALLEY ROAD MIDDLETOWN RHODE ISLAND 02842
PHONE (401) 849-0810 FAX (401) 846-4169
WWW.NORTHEASTENGINEERS.COM

DESIGN POINT 1 AQUIDNECK AVENUE		
STORM	PEAK (cfs)	VOL (af)
1-YEAR	0.90	0.062
2-YEAR	1.13	0.078
10-YEAR	1.87	0.132
25-YEAR	2.43	0.174
100-YEAR	3.57	0.261

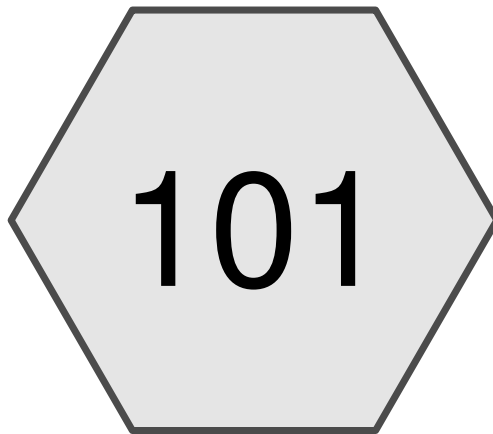


1	REVISED SETBACKS AND BUILDING	4/11/24	
No.	Revision	Date	App.
Designed By:	JJR	Drawn by:	JJR
Checked by:	GES		
Scale:	1"=20'	Date:	12JUL23
Project Title:			
A.P. 113 LOT 208 985 AQUIDNECK AVENUE MIDDLETOWN, RHODE ISLAND			
Client/Owner:			
SEASCAPE HOLDINGS LLC 1 TRIMBLE ROAD MIDDLETOWN, RI 02842			
Issued for:			
PERMITTING			
Drawing Title:			
PROPOSED WATERSHED			
Drawing Number:		W-2	
Sheet		1 of 1	
Project Number:		22099.0	
Survey Index:		-	
<small>OWNERSHIP AND USE OF DOCUMENTS: DRAWINGS AND SPECIFICATIONS, AS INSTRUMENTS OF PROFESSIONAL SERVICE, ARE AND SHALL REMAIN THE PROPERTY OF THE ENGINEER. THESE DOCUMENTS ARE NOT TO BE USED, IN WHOLE OR PART, FOR ANY OTHER PROJECTS OR PURPOSES, OR BY ANY OTHER PARTIES, THAN THOSE PROPERLY AUTHORIZED BY CONTRACT, WITHOUT THE EXPRESS AUTHORIZATION OF THE ENGINEER.</small>			

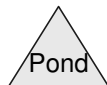
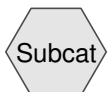




APPENDIX C EXISTING CONDITIONS HYDROCAD



To Aquidneck



22099_2024-04-11

Prepared by Northeast Engineers & Consultants, Inc.
HydroCAD® 10.10-6a s/n 04733 © 2020 HydroCAD Software Solutions LLC

Printed 4/11/2024
Page 2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.123	74	>75% Grass cover, Good, HSG C (101)
0.034	98	Building (101)
0.001	98	Concrete (101)
0.233	95	Gravel (101)
0.039	98	Pavement (101)
0.431	90	TOTAL AREA

Summary for Subcatchment 101: To Aquidneck

Runoff = 0.94 cfs @ 12.07 hrs, Volume= 0.065 af, Depth> 1.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 1-YEAR Rainfall=2.80"

	Area (sf)	CN	Description
*	1,500	98	Building
*	58	98	Concrete
*	1,713	98	Pavement
*	10,157	95	Gravel
	5,360	74	>75% Grass cover, Good, HSG C
	18,788	90	Weighted Average
	15,517		82.59% Pervious Area
	3,271		17.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 101: To Aquidneck

Runoff = 1.17 cfs @ 12.07 hrs, Volume= 0.081 af, Depth> 2.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-YEAR Rainfall=3.30"

	Area (sf)	CN	Description
*	1,500	98	Building
*	58	98	Concrete
*	1,713	98	Pavement
*	10,157	95	Gravel
	5,360	74	>75% Grass cover, Good, HSG C
	18,788	90	Weighted Average
	15,517		82.59% Pervious Area
	3,271		17.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 101: To Aquidneck

Runoff = 1.91 cfs @ 12.07 hrs, Volume= 0.136 af, Depth> 3.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-YEAR Rainfall=4.90"

	Area (sf)	CN	Description
*	1,500	98	Building
*	58	98	Concrete
*	1,713	98	Pavement
*	10,157	95	Gravel
	5,360	74	>75% Grass cover, Good, HSG C
	18,788	90	Weighted Average
	15,517		82.59% Pervious Area
	3,271		17.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 101: To Aquidneck

Runoff = 2.47 cfs @ 12.07 hrs, Volume= 0.178 af, Depth> 4.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-YEAR Rainfall=6.10"

	Area (sf)	CN	Description
*	1,500	98	Building
*	58	98	Concrete
*	1,713	98	Pavement
*	10,157	95	Gravel
	5,360	74	>75% Grass cover, Good, HSG C
	18,788	90	Weighted Average
	15,517		82.59% Pervious Area
	3,271		17.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 101: To Aquidneck

Runoff = 3.61 cfs @ 12.07 hrs, Volume= 0.266 af, Depth> 7.39"

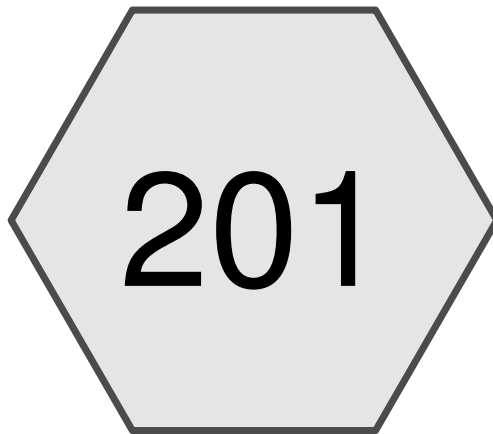
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-YEAR Rainfall=8.60"

	Area (sf)	CN	Description
*	1,500	98	Building
*	58	98	Concrete
*	1,713	98	Pavement
*	10,157	95	Gravel
	5,360	74	>75% Grass cover, Good, HSG C
	18,788	90	Weighted Average
	15,517		82.59% Pervious Area
	3,271		17.41% Impervious Area

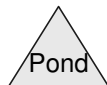
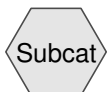
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,



APPENDIX D PROPOSED CONDITIONS HYDROCAD



To Aquidneck



22099_2024-04-11Prepared by Northeast Engineers & Consultants, Inc.
HydroCAD® 10.10-6a s/n 04733 © 2020 HydroCAD Software Solutions LLC

Printed 4/11/2024

Page 2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.124	74	>75% Grass cover, Good, HSG C (201)
0.034	98	Building (201)
0.001	98	Concrete (201)
0.056	98	New Building (201)
0.031	74	New grass (201)
0.039	98	Pavement (201)
0.146	98	Pavement (replacing gravel) (201)
0.431	89	TOTAL AREA

22099_2024-04-11

Prepared by Northeast Engineers & Consultants, Inc.
 HydroCAD® 10.10-6a s/n 04733 © 2020 HydroCAD Software Solutions LLC

985 West Main Road - Proposed Conditions
 Type III 24-hr 1-YEAR Rainfall=2.80"

Printed 4/11/2024

Page 3

Summary for Subcatchment 201: To Aquidneck

Runoff = 0.90 cfs @ 12.07 hrs, Volume= 0.062 af, Depth> 1.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 1-YEAR Rainfall=2.80"

	Area (sf)	CN	Description
*	1,500	98	Building
*	58	98	Concrete
*	1,713	98	Pavement
*	6,339	98	Pavement (replacing gravel)
*	5,413	74	>75% Grass cover, Good, HSG C
*	2,420	98	New Building
*	1,345	74	New grass
	18,788	89	Weighted Average
	6,758		35.97% Pervious Area
	12,030		64.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 201: To Aquidneck

Runoff = 1.13 cfs @ 12.07 hrs, Volume= 0.078 af, Depth> 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2-YEAR Rainfall=3.30"

	Area (sf)	CN	Description
*	1,500	98	Building
*	58	98	Concrete
*	1,713	98	Pavement
*	6,339	98	Pavement (replacing gravel)
	5,413	74	>75% Grass cover, Good, HSG C
*	2,420	98	New Building
*	1,345	74	New grass
	18,788	89	Weighted Average
	6,758		35.97% Pervious Area
	12,030		64.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 201: To Aquidneck

Runoff = 1.87 cfs @ 12.07 hrs, Volume= 0.132 af, Depth> 3.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10-YEAR Rainfall=4.90"

	Area (sf)	CN	Description
*	1,500	98	Building
*	58	98	Concrete
*	1,713	98	Pavement
*	6,339	98	Pavement (replacing gravel)
	5,413	74	>75% Grass cover, Good, HSG C
*	2,420	98	New Building
*	1,345	74	New grass
	18,788	89	Weighted Average
	6,758		35.97% Pervious Area
	12,030		64.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 201: To Aquidneck

Runoff = 2.43 cfs @ 12.07 hrs, Volume= 0.174 af, Depth> 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 25-YEAR Rainfall=6.10"

	Area (sf)	CN	Description
*	1,500	98	Building
*	58	98	Concrete
*	1,713	98	Pavement
*	6,339	98	Pavement (replacing gravel)
*	5,413	74	>75% Grass cover, Good, HSG C
*	2,420	98	New Building
*	1,345	74	New grass
	18,788	89	Weighted Average
	6,758		35.97% Pervious Area
	12,030		64.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Summary for Subcatchment 201: To Aquidneck

Runoff = 3.57 cfs @ 12.07 hrs, Volume= 0.261 af, Depth> 7.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr 100-YEAR Rainfall=8.60"

	Area (sf)	CN	Description
*	1,500	98	Building
*	58	98	Concrete
*	1,713	98	Pavement
*	6,339	98	Pavement (replacing gravel)
*	5,413	74	>75% Grass cover, Good, HSG C
*	2,420	98	New Building
*	1,345	74	New grass
	18,788	89	Weighted Average
	6,758		35.97% Pervious Area
	12,030		64.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,



APPENDIX E SUPPLEMENTARY CALCULATIONS



Minimum Standard 3: Water Quality

Project: 22099.0 985 Aquidneck Avenue, Middletown RI

Water Quality Volume Calculation:

Pavement =	0	sf		
Buildings =	2,420	sf		
Off-site Impervious =	0	sf	Min. WQ _R :	40 cf
Impervious Area:	2,420	sf	WQ _R :	202 cf
Total Disturbed Area:	2,420	sf	WQ _{R75%} :	151 cf

A = Surface area of filter bed (ft ²)	140	ft ²
d _f = Filter bed depth (ft)	1.5	ft
V _R = media void ratio	33%	

Storage Volume in Media:

$$140 \quad \times \quad 1.5 \quad \times \quad 33\% \quad = \quad 69 \text{ cf}$$

Sand Filter SF-1 Total System Volume Calculation:

Per the RISDISM, the storage volume of the system must accommodate 75% of the WQ volume (including pretreatment). The total provided area is this area, plus the storage in the mulch layer plus the area under the outlet.

V _M = storage volume in media	69	cf
A = Surface area of filter bed (ft ²)	140	ft ²
d _M = depth of mulch	0.33	ft
h _o = storage height below outlet	0.50	ft
V _{FB} = Volume of pretreatment	0	cf

Total Storage provided by this BMP:

$$WQ_V = V_M + (A \times d_M \times V_R) + (A \times h_o) + V_{FB} = 155 \text{ cf}$$

Sand Filter SF-1 Minimum Area Calculation:

The minimum area of the filter, according to RISDISM, is calculated using the following equation:

$$A_R = (WQ_V) \times (d_f) / [(k) \times (h_f + d_f) \times (t_f)]$$

Where,	WQ _V = Total Required Water Quality Volume	202	cf
	d _f = Filter bed depth (ft)	1.5	ft
	k = Coefficient of permeability of filter media (ft/day)	3.5	ft/day
	h _f = Average height of water above surface of media	0.415	ft
	t _f = Design filter bed drain time	1.00	days

Therefore, the minimum surface areas is:

A _R =	45	sf	
A =	140	sf	Area is greater and therefore satisfactory.



Minimum Standard 2: Groundwater Recharge
Project: 22099.0 985 Aquidneck Avenue, Middletown RI

HSG	Recharge Factor (F)
A	0.60
B	0.35
C	0.25
D	0.10

Impervious Area: 2,420 sf **F =** 0.25

$$WRec_v = (\text{Impervious Area}) / 12 \times F$$

$$WRec_v = 50 \text{ cf}$$

Volume of Infiltration for a WQ storm*: 155 cf

* WQV of sand filter



APPENDIX F SOIL EVALUATIONS



STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management
Office of Water Resources
Onsite Wastewater Treatment Systems Program



Site Evaluation Form
Part A - Soil Profile Description Application Number Drainage THs

Property Owner: Seascope Holdings LLC
Property Location: 985 Aquidneck Avenue, Middletown (A.P. 113, Lot 208)
Date of Test Hole: September 27, 2022
Soil Evaluator: Daniel Welch License Number: D4094
Weather: Partly Cloudy, 65°F Shaded: Yes No Time: 8:30am

Table with columns: TH Horizon, Depth, Horizon Boundaries (Dist, Topo), Soil Colors (Matrix, Re-Dox Features), Re-Dox (Ab., S., Contr.), Texture, Structure, Consistence, Soil Category. Includes data for horizons HTM, Bw1, Bw2, 2Cd.

TH 1 Soil Class A Total Depth 96" Impervious/Limiting Layer Depth N/R (og) GW Seepage Depth N/A SHWT 24" (og)
TH Soil Class Total Depth Impervious/Limiting Layer Depth (og) GW Seepage Depth SHWT (og)

Comments:

Part B





Site Evaluation – to be completed by Soil Evaluator or Class II or III Designer

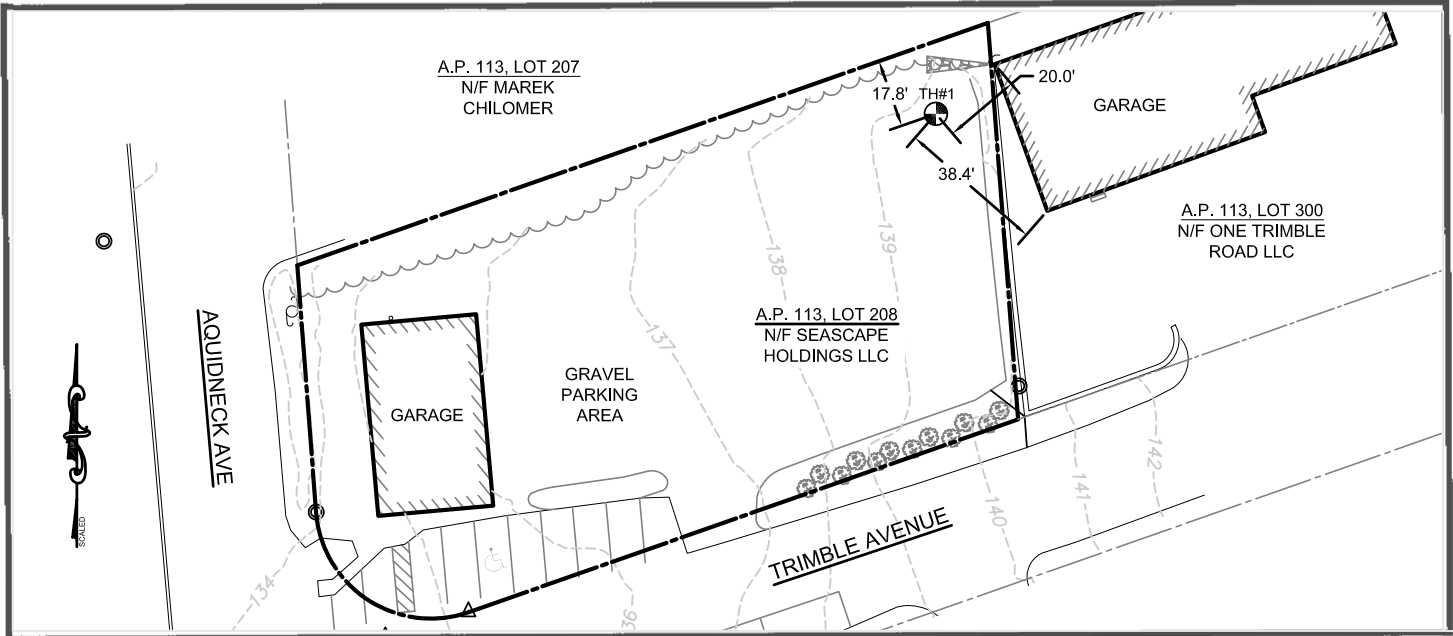
Please use the area below to locate:

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

***OFFSETS MUST BE SHOWN**

Key:

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



1. Relief and Slope: 3-7%
2. Presence of any watercourse, wetlands or surface water bodies, within 200 feet of test holes? If yes, locate on above sketch. NO YES
3. Restrictive Layer or Bedrock within 4' below original ground within 25 feet of test hole? Provide all test hole locations & depths above. NO YES
4. Presence of existing or proposed private drinking water wells within 200 feet of test holes? If yes, locate on above sketch. NO YES
5. Public drinking water wells within 500 feet of test holes? If yes, locate on above sketch. NO YES
6. Is site within the watershed of a public drinking water reservoir or other critical area defined in Rule 6.42? NO YES
7. Has soil been excavated from or fill deposited on site? If yes, locate on above sketch. NO YES
8. Site's potential for flooding or ponding: NONE SLIGHT MODERATE SEVERE
9. Landscape position: Backslope
10. Vegetation: Gravel Parking Area
11. Indicate approximate location of property lines and roadways.
12. Additional comments, site constraints or additional information regarding site: _____

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: Daniel Welch D4094 Part B prepared by: Daniel Welch D4094
Signature License # Signature License #

DO NOT WRITE IN THIS SPACE

Witnessed Soil Evaluation Decision: Concur Inconclusive Disclaim

Unwitnessed Soil Evaluations Decision: Accept Inconclusive Disclaim

Wet Season Determination required Additional Field Review Required

Explanation: _____

 Signature Authorized Agent Date