

Stormwater Runoff Analysis

“Valley Crossing”

Assessor’s Map 107NE, Lot 402B
0 Valley Road
Middletown, RI

Prepared For

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1.0 PROJECT NARRATIVE

1.1 SITE INFORMATION

City / Town:	Middletown, Rhode Island
Adjacent Roadways:	Valley Road (RI State Roadway)
Lot(s) identification:	A.P. 107NE Lot 402B
Zoning District:	LBA (Limited Business – Traffic Sensitive)
Current Use:	Vacant
Site Area:	2.25 Acres
FEMA Zone and Map:	Zone "X (Panel 44005C0093J)

1.2 EXISTING IMPROVEMENTS AND SITE CONDITIONS

The Site includes a single parcel which was formerly Parcel "B" of a three-lot subdivision of Lot 402 completed in 2021. The Site is, and has historically been, a vacant property. The Site fronts on Valley Road (RI RT 214), a state maintained right of way. The Site also has a small amount of frontage at the rear of the lot on Bristol Road, a town-maintained roadway. There is no formal access to the Site from either roadway. The Site abuts vacant commercial properties to the north and south, both of which also front on Valley Road. To the rear and northeast of the Site lies small residential properties zoned R20 (high density residential). Ground cover on the Site is limited to grasses, with larger shrub vegetation along the perimeter edges. Municipal sewer and water mains are available to the rear of the Site in Bristol Road. Overhead electrical and communication services are available on the east side of Valley Road. There are no stormwater quality or control devices located on the property. The frontage along Valley Road includes a bituminous concrete sidewalk with precast concrete curbing. Both the sidewalk and the curbing are in poor condition.

1.3 PROTECTED FEATURES

A small area of freshwater wetlands is located in the northeast corner of the property. These wetlands were delineated by Natural Resource Services, Inc. in January of 2019. There is no perimeter wetland associated with this small area of wetlands. The property is located in the Town of Middletown Watershed Protection District Zone 2. The ultimate receiving waterbody for the property is Bailey's Brook (WB ID RI0007035R-01). This waterway has been assessed with a TMDL for bacteria (enterococcus).

1.4 SITE TERRAIN AND SOILS

In general, the site slopes from upland residential properties to the northeast down towards Valley Road and then northwest towards the vacant abutting property. Only a small portion of the property slopes towards the state-maintained sidewalk. Slopes vary between 3% and 8%. No portion of the property has slopes approaching or exceeding 15%. The soil types on site are mapped as PmA and PmB (Pittstown silt loams) by the USDA Natural Resource Conservation Service. These silt loams are type C hydrologic soils common to Aquidneck Island. Class IV soil evaluations performed in the area of development revealed **sandy loams** near the surface with **silty loams** below. The depths to seasonal high groundwater were assessed between 18 to 60 inches below grade.

1.5 PROPOSED IMPROVEMENTS

The applicant intends to construct a medical office on the vacant property. The development will occupy the majority of the Site. A single 15,000 square foot structure is proposed. The site shall be accessed via a new paved driveway from Valley Road. This driveway will require a curb cut, as the Site currently has none. This new curb cut is to be situated sufficiently far from the southern property line so as to provide appropriate sight lines and RIDOT edge clearance. Parking is to be provided surrounding the structure. Vehicle access around the structure is provided for proper circulation. A gated access to Bristol Road is proposed at the rear of the development for emergency vehicles. An enclosed trash area is to be located to the rear of structure. The one-way aisle to the north of the structure will provide the loading zone required by the zoning ordinance. Concrete sidewalks are to run along all sides of the medical office. The proposed lot coverage shall be within the maximum 35% lot coverage allowable by the zoning ordinance.

New public and private utility services will be provided for the site. The water service is proposed from Bristol Road in order to avoid cutting the state roadway and will require the approval of Newport Water. The proposed sewer service will connect to an existing main in Woolsey Road via a pressurized service in the shoulder of Bristol Road. A sewer manhole proposed at the corner of Bristol Road and Woolsey Road will provide the transition from pressurized service to gravity service. This sewer connection will require approval from the Middletown Public Works Department. The proposed electrical service from the overhead lines shall be subject to design and approval by National Grid. As no connections to subsurface utilities in Valley Road are proposed, no RIDOT utility permits are expected to be required.

Stormwater control for this development will be provided by pervious pavement with a deep stone reservoir and a subsurface infiltration system. A vegetated swale along the front of the property will provide conveyance of stormwater from abutting and upstream properties through the property and towards Bailey Brook to the north. Discharge from the pervious pavement subdrains will also be conveyed by this swale. In order to prevent parking lot runoff from entering Valley Road, a trench drain is proposed in the entrance drive. This device is routed back into the site and into the conveyance swale. A second swale is to be provided along the upstream edge of the property to capture and convey stormwater from upstream residential properties. This swale will discharge to the freshwater wetlands on the property. This device is to provide additional stormwater treatment for upstream off-site impervious surfaces in order to offset pollutants generated by the development.

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 stormwater runoff in accordance with the Rhode Island Stormwater Design and Installation Standards Manual.
- Convey stormwater from upland residential properties through the property.
- Maintain the overall drainage patterns from the site to the extent practicable.
- Ensure no increase in peak runoff to the downstream DOT right of way.
- Ensure no increase in total 24-hour volume runoff to the downstream DOT right of way.

2.2 REDEVELOPMENT SITE

As the existing site lot coverage consists of much less than 40% impervious and there are no existing impervious surfaces to be redeveloped, this project does not qualify as a "redevelopment site" per section 3.2.6 of the RISDISM.

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 RISDISM. 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

This standard shall be met by infiltrating stormwater runoff in the subsurface infiltration chambers. A total of **0.34 acres** of impervious rooftop requires recharge. This equates to a total of **313** cubic feet of recharge volume based on the underlying hydrologic soil type. Per the HydroCAD analysis of the 1.2-inch WQ storm (split pervious method) a total of **348** cubic feet of recharge is provided. The pervious pavement will provide an additional **3,484** cubic feet of recharge. Refer to Appendix E for complete calculations.

2.3.3 MINIMUM STANDARD 3: WATER QUALITY

This standard shall be partially met by infiltrating rooftop runoff in a subsurface infiltration system comprised of 24 Stormtech SC310 chambers. A total of **0.344 acres** of rooftop requiring water quality is proposed. This equates to a total of **1,250** cubic feet of water quality volume. Per the HydroCAD analysis of the WQ storm (split pervious method) the entirety of the rooftop runoff is infiltrated by the stormwater system.

The various stone layers within the pervious pavement system provides water quality for these surfaces. A total of **3,255** cubic feet is required and provided by the system. In addition, **3,484** cubic feet of

stormwater is infiltrated in a WQ storm. As shown in the WQ storm analysis, this is the entire complement of the WQ storm volume. Refer to Appendix F for the water quality storm calculations.

Additional water quality is provided by a wet swale for upland offsite single family residential properties. A total of **900** cubic feet of water quality volume is provided by this device. A total of **28,017** square feet of abutting residential neighborhoods drains to the wet swale. These areas are approximately **38%** impervious yielding a total of **10,646** square feet of off-site impervious. This wet swale is sufficient to provide the required **892** cubic feet of water quality volume. Refer to Appendix E for complete calculations.

2.3.4 MINIMUM STANDARD 4: CONVEYANCE AND NATURAL CHANNEL PROTECTION

This standard may be waived for facilities with less than one acre of impervious area. Given that the majority of the proposed pavement is pervious, the development area for the medical office and associated access includes less than one acre of impervious.

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 upstream residential properties passes through the development area, which was also modeled as "good condition". The modeling also demonstrates that the structures and stormwater devices will safely pass the 100-year storm event without flooding or breaching.

2.3.6 MINIMUM STANDARD 6: REDEVELOPMENT AND INFILL PROJECTS

As stated in section 2.2 above, this project does not qualify as a re-development project.

2.3.7 MINIMUM STANDARD 7: POLLUTION PREVENTION

Source controls and pollution prevention measures will be present during all phases of construction. A separate stormwater pollution prevention plan (Soil Erosion and Sediment Control Narrative) has been prepared.

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 Manual.

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. A SESC plan has been provided in the permitting plan set and a separate Soil Erosion and Sediment Control Narrative has been prepared.

2.3.11 MINIMUM STANDARD 11: STORMWATER MANAGEMENT OPERATIONS AND MAINTENANCE

An Operations and Maintenance (O&M) Document has been prepared. This document satisfies the minimum requirements of this standard.

2.4 OVERALL STORMWATER DESIGN FUNCTION

The overall design of the stormwater system is to provide a reduction in peak rate of runoff and total volume runoff, and will meet the 11 minimum standards established in the RISDISM. All proposed stormwater devices are to be situated downstream of the proposed improvements or offsite impervious areas and upstream of the existing receiving points for the runoff from this catchment. The existing drainage patterns across the site will be minimally impacted. There will be no negative impact to the receiving state right of way.

2.5 POLLUTANT LOADING CALCLUATION

The downstream receiving water body, Bailey's Brook, has a TMDL for bacteria (enterococcus). A pollutant loading analysis (PLA) was performed for the development. Refer to the water quality calculations for the determination of the removal rate for the wet swale which is intended to treat runoff from upland residential properties. This calculation, and the PLA, are located in Appendix E.

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 the RISDISM. This guidance document splits the state into five regions for rainfall frequency based on county. The project site is located in the **Newport** County region defined in the RISDISM. The rainfall frequency values recommended by RIDEM 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 <i>Stormwater Design and Installation Standards manual 3/15</i>					
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 stormwater system was designed to mitigate the peak runoff for the 1, 2, 10, 25, and 100-year 24-hour design storms. The resulting design effectively mitigates and treats runoff from newly developed areas of the site before allowing it to discharge in a non-erosive manner to downstream areas in accordance with the RISDISM.

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. Valley Road
2. Northwesterly Abutter

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 of the stormwater system and has been included in the design calculations. These areas are:

1. Upstream residential properties
2. Vacant commercial property to the south

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 or piped runoff 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 and 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 Appendices C and D.

4.1 SUMMARY OF STORMWATER CALCULATIONS

Table 4.1.1 Comparison of Runoff Values at Valley Road (101 vs. 201)

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	0.09	0.10	0.006	0.007
2-year	0.11	0.13	0.007	0.009
10-year	0.18	0.21	0.012	0.015
25-year	0.23	0.26	0.016	0.019
100-year	0.33	0.39	0.024	0.029

Table 4.1.2 Comparison of Runoff Values at Northwest Abutter (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	7.31	6.59	0.807	0.724
2-year	10.17	9.30	1.100	1.008
10-year	20.25	18.55	2.147	2.028
25-year	28.30	25.72	2.999	2.861
100-year	45.51	40.21	4.865	4.693

5.0 STORMWATER BMPS

5.1 PERVIOUS PAVEMENT

Description

Pervious pavement consists of a porous paved surface course that is underlain by washed, uniformly graded aggregates and filter stone, and finally a lined stone reservoir. Stormwater enters through the pores in the pavement and is stored in the voids that exist in the layer of aggregate until it can percolate through the filter stone and into the stone reservoir. Stormwater treatment is provided by the filtering stone media. Treated stormwater percolates into the native sand material below the device. A system of underdrains in the stone reservoir meters high flow stormwater out of the system.

5.2 INFILTRATION CHAMBERS

Description

Subsurface infiltration chambers allow for temporary storage and infiltration into underlying soil, effectively providing water quality and groundwater recharge. An overflow structure meters high flow from the subsurface chambers which regulates peak runoff.

The stormwater design for this development includes the following infiltrating subsurface chambers:

- | | |
|--------------------------------------|--|
| 1. Location: | Under the sidewalk at the front of the structure |
| Subwatershed served: | 202E |
| Chamber type: | Stormtech SC310 |
| Number of chambers: | 24 chambers |
| Pretreatment device: | none required (rooftop runoff only) |
| Infiltration rate and determination: | 0.27 in/hr |
| Separation to groundwater: | 3 feet |

5.3 WET SWALE

Description:

The wet swale intercepts surface runoff and convey stormwater towards water quality features or away from sensitive areas. The wet swale is located at or within the water table and is planted with wetland grasses or other plantings. The wet swale is intended to have permanent ponding areas designed to provide water quality treatment via root uptake and particle settlement.

The stormwater design for this development includes the following swales:

- | | |
|----------------------------------|----------------------------------|
| 1. Location: | Downstream of offsite residences |
| Subwatershed served: | 202B |
| Surface: (grass or stone lined): | Planted |
| Discharge location: | Onsite freshwater wetlands |

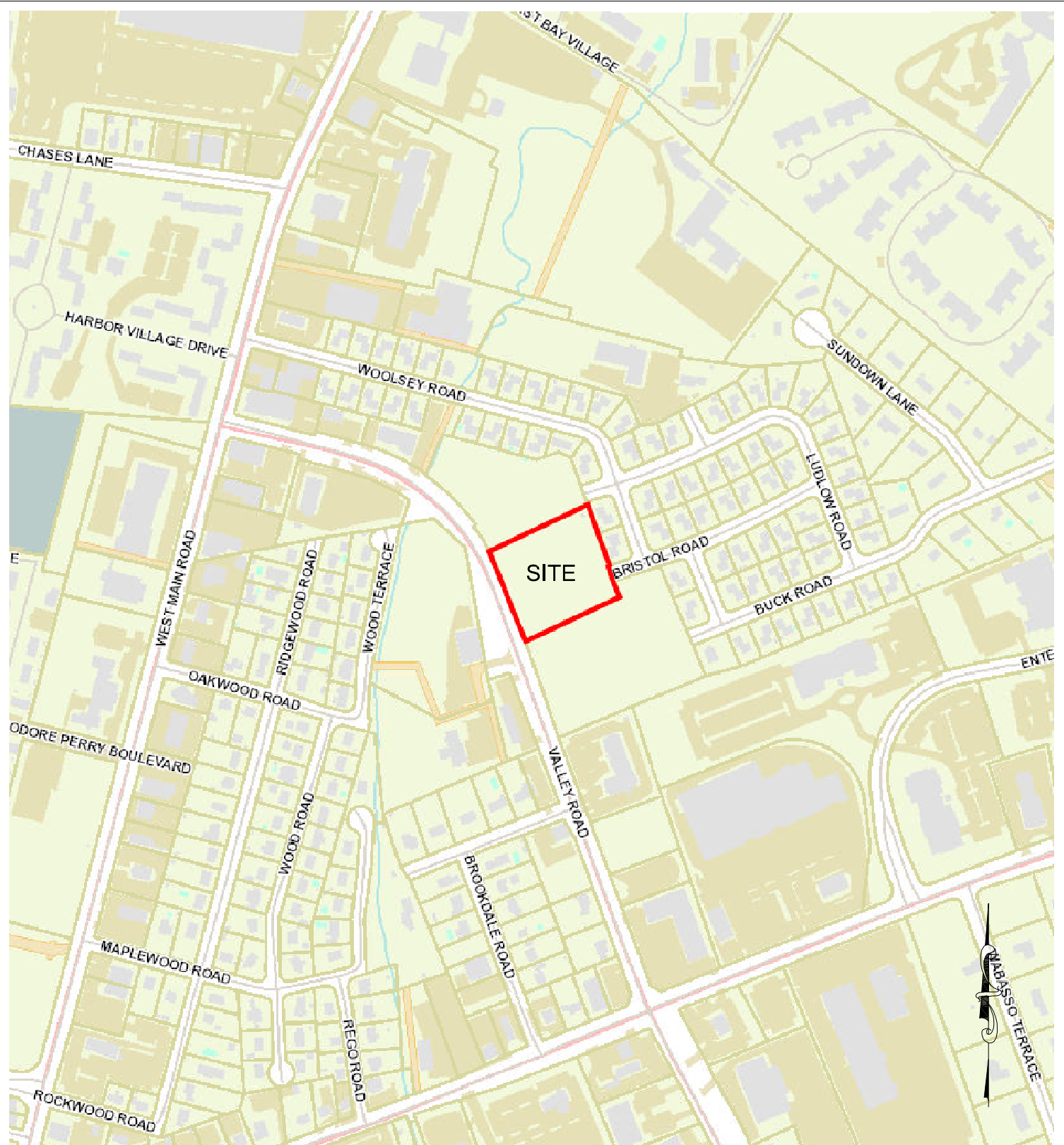


6.0 LIMITATIONS AND SPECIAL TERMS AND CONDITIONS

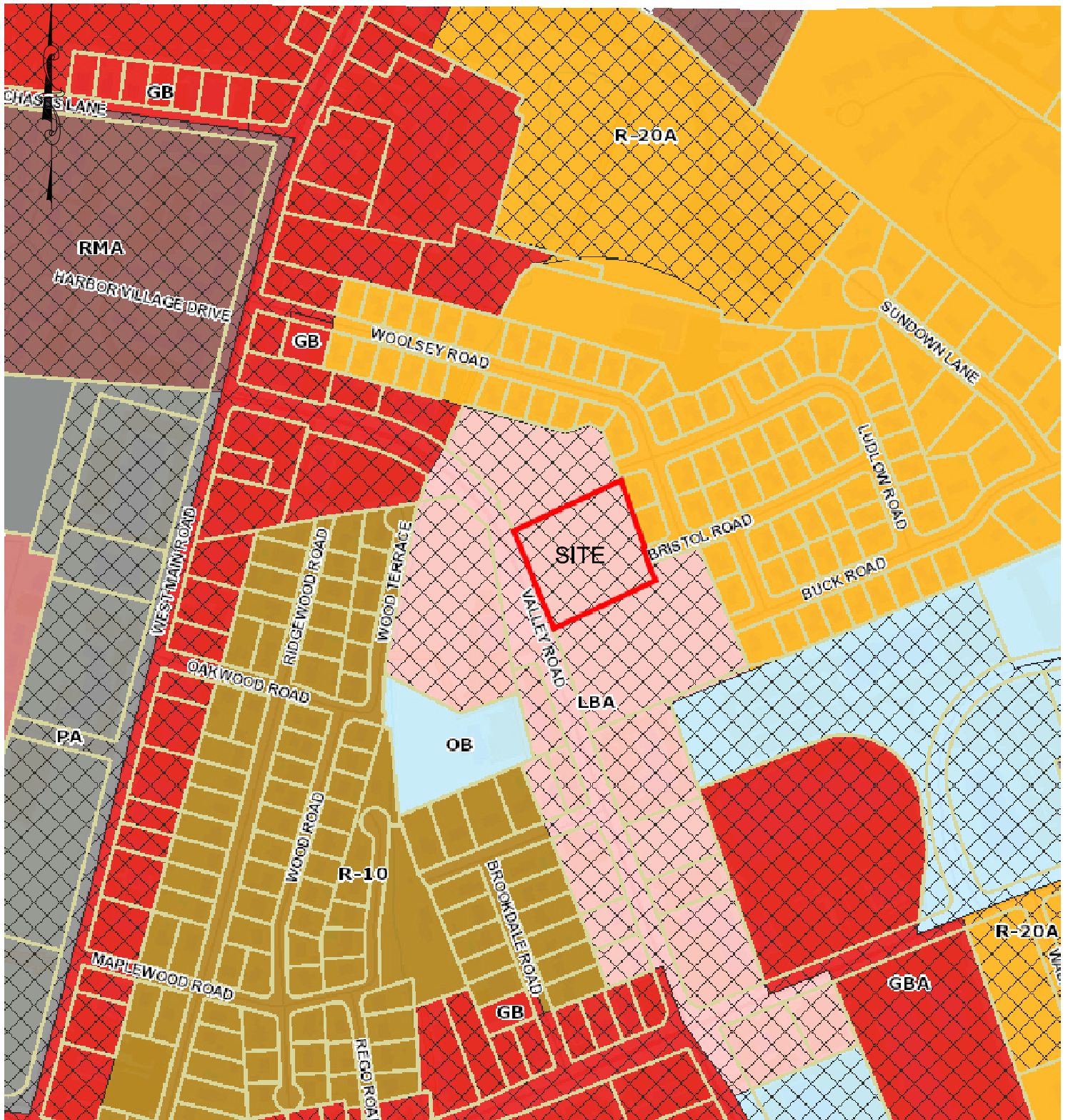
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2. Any additional research conducted should be reviewed by Northeast Engineers & Consultants, Inc., such that the conclusions presented herein may be modified.
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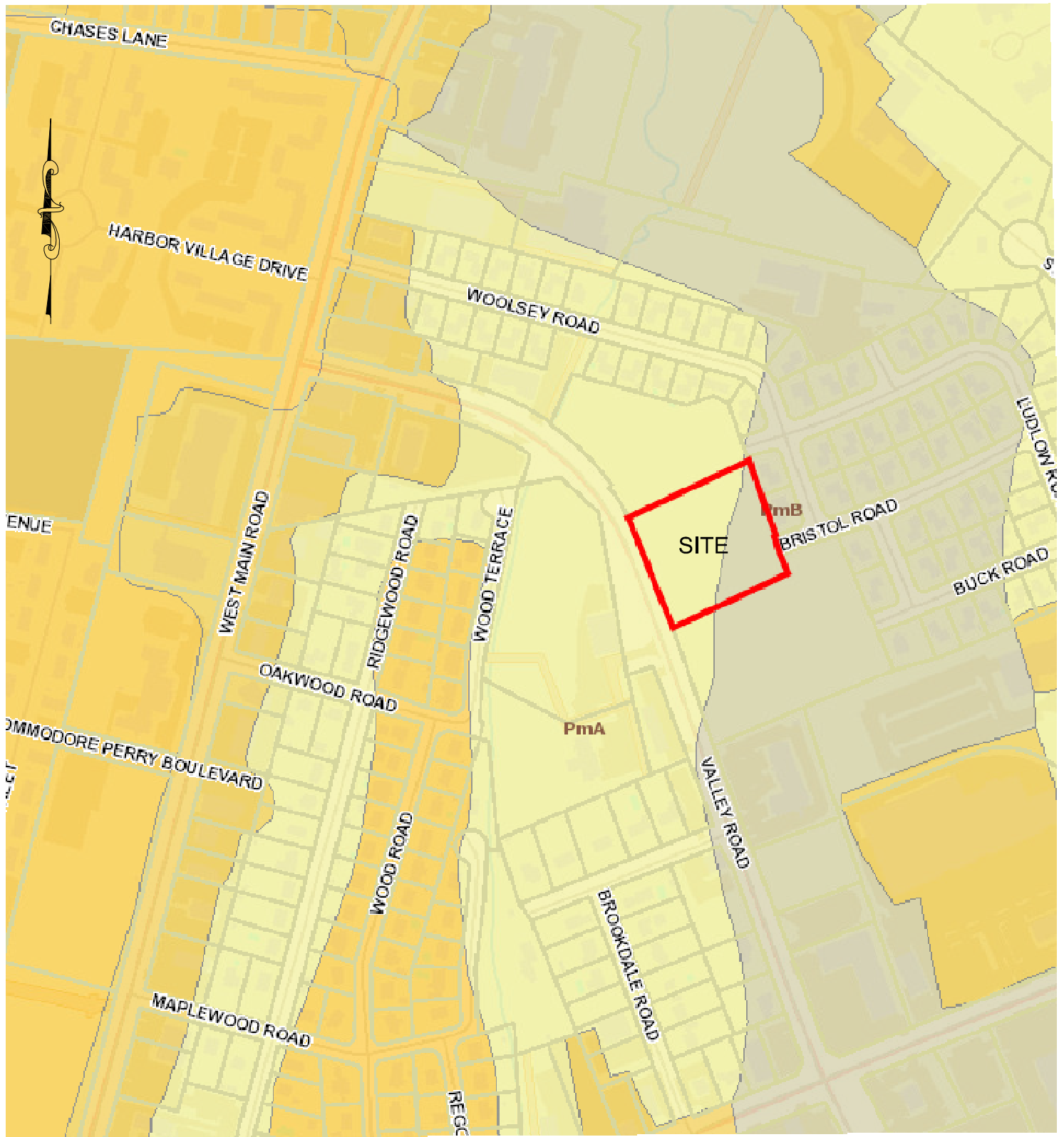
APPENDIX A FIGURES



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Issued for:	PERMITTING			Drawing Number:	FIG 1		Project Number:	18225.5	



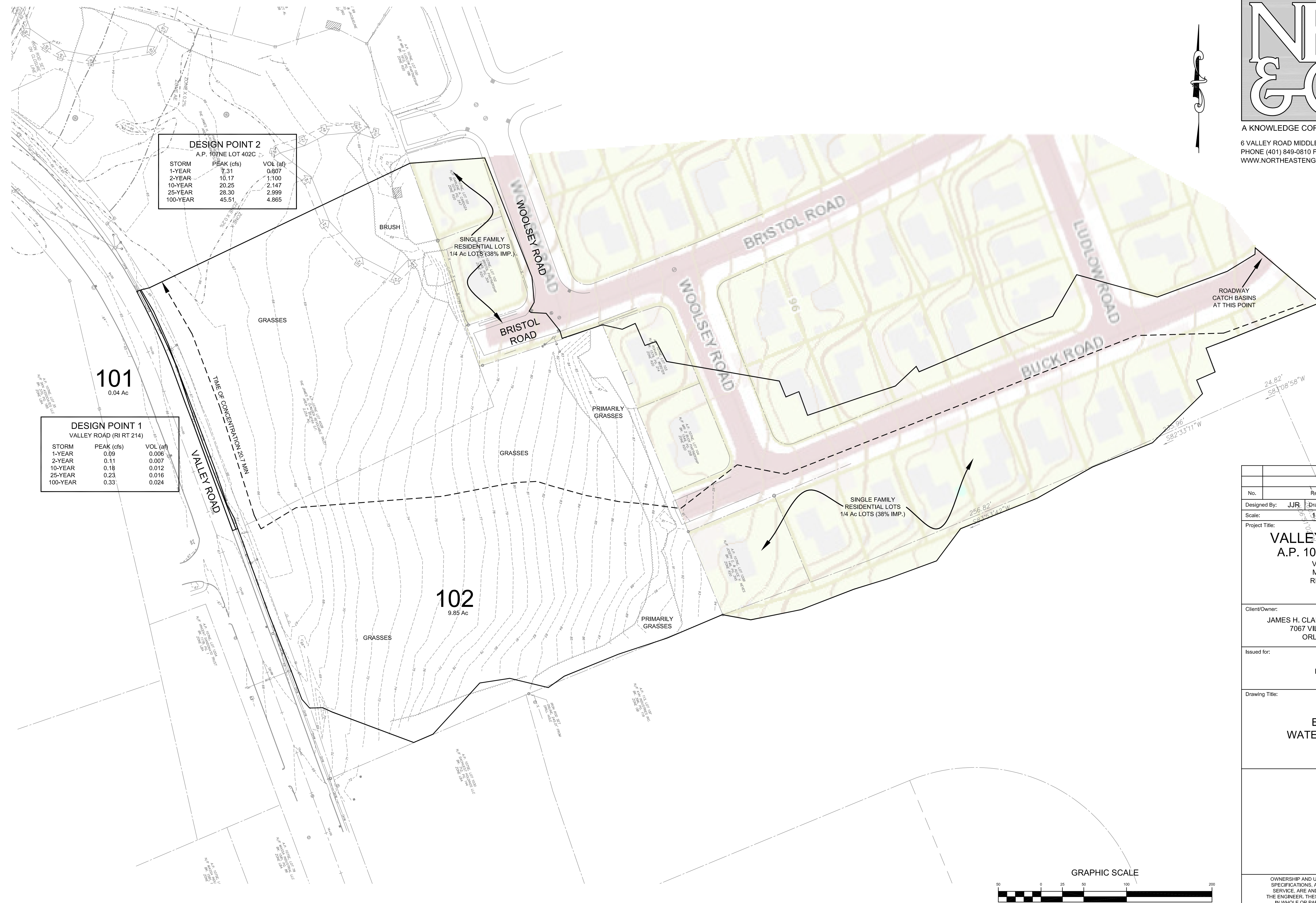
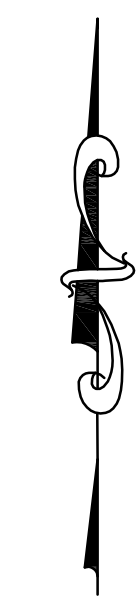
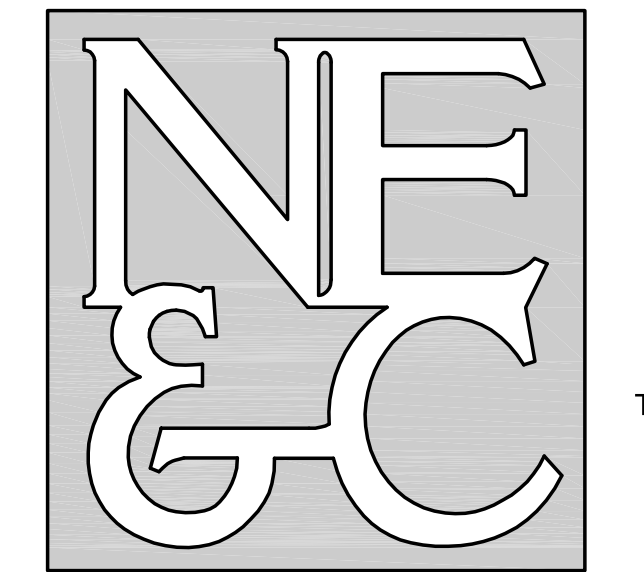
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VALLEY CROSSING MIDDLETOWN, RHODE ISLAND				ZONING MAP					
Issued for:			Drawing Number:			Project Number:			
PERMITTING			FIG 2			18225.5			



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VALLEY CROSSING MIDDLETOWN, RHODE ISLAND				SOILS MAP					
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PERMITTING				FIG 3		18225.5			



APPENDIX B WATERSHED MAPS



DESIGN POINT 2
A.P. 107NE LOT 402C

STORM	PEAK (cfs)	VOL (af)
1-YEAR	7.31	0.807
2-YEAR	10.17	1.100
10-YEAR	20.25	2.147
25-YEAR	28.30	2.999
100-YEAR	45.51	4.865

DESIGN POINT 1
VALLEY ROAD (RI RT 214)

STORM	PEAK (cfs)	VOL (af)
1-YEAR	0.09	0.006
2-YEAR	0.11	0.007
10-YEAR	0.18	0.012
25-YEAR	0.23	0.016
100-YEAR	0.33	0.024

No.	Revision	Date	App.

Designed By: **JJR** Drawn by: **JR** Checked by: **GES**
Scale: **1"=50'** Date: **07JUN22**

Project Title:
VALLEY CROSSING
A.P. 107NE LOT 402B
VALLEY ROAD
MIDDLETOWN
RHODE ISLAND

Client/Owner:
JAMES H. CLAUSEN REVOCABLE TRUST
7067 VILLA ESTELLE DRIVE
ORLANDO, FL 32819

Issued for:
PERMITTING

Drawing Title:
EXISTING WATERSHED PLAN

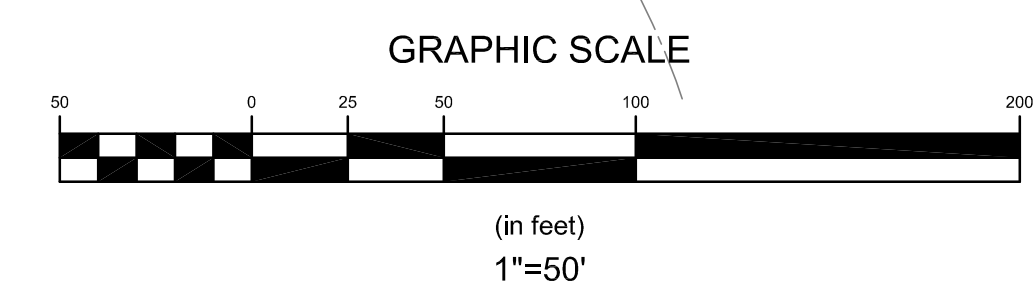
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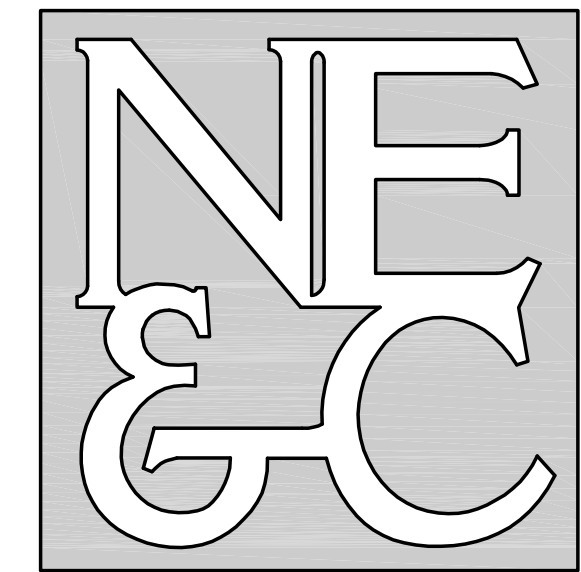
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Project Number:
18225.5

Survey Index:
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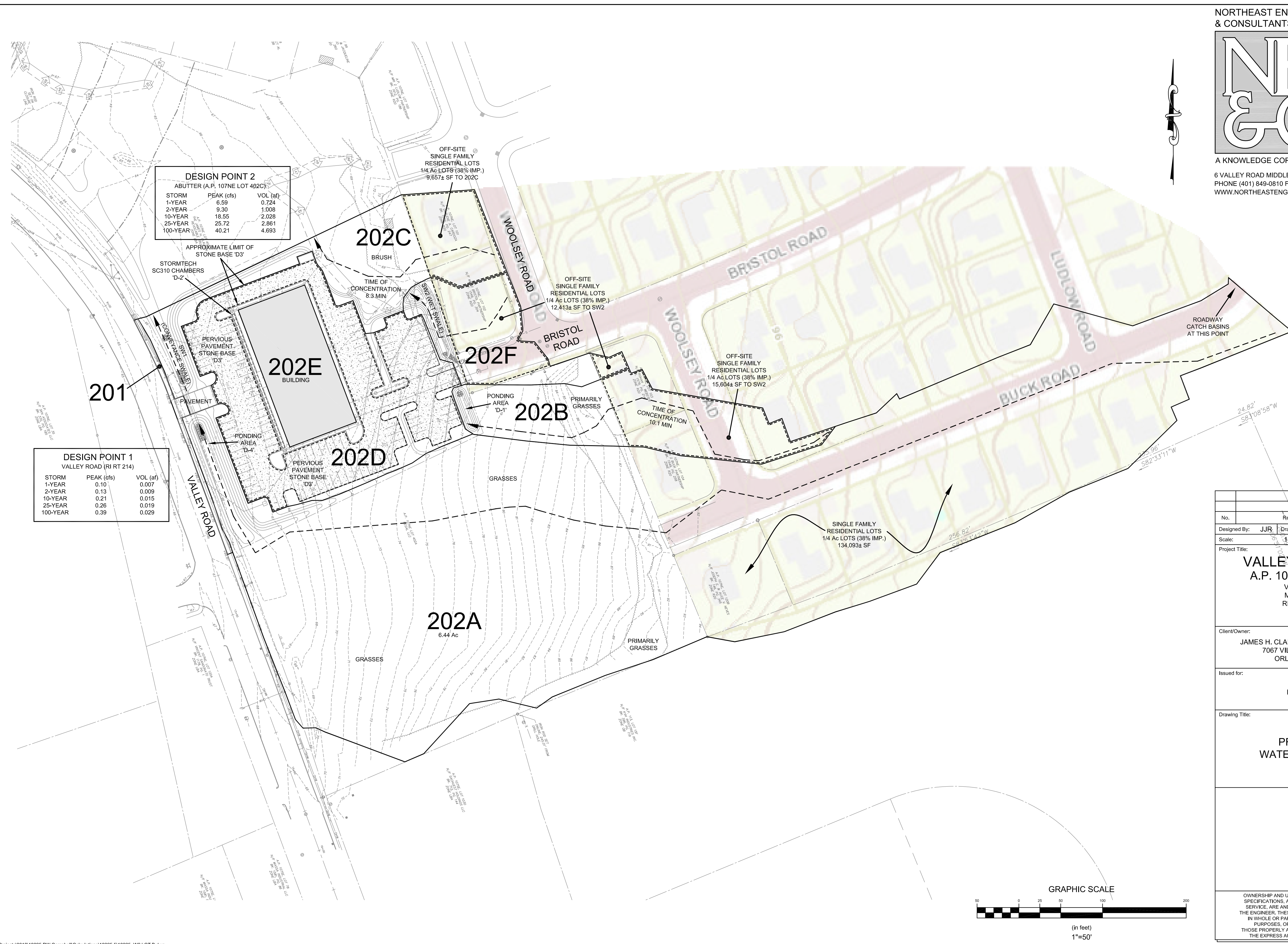
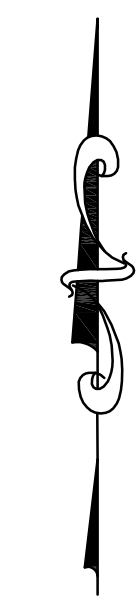
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DESIGN POINT 2
ABUTTER (A.P. 107NE LOT 402C)

STORM	PEAK (cfs)	VOL (af)
1-YEAR	6.59	0.724
2-YEAR	9.30	1.008
10-YEAR	18.55	2.028
25-YEAR	25.72	2.861
100-YEAR	40.21	4.693

DESIGN POINT 1
VALLEY ROAD (RI RT 214)

STORM	PEAK (cfs)	VOL (af)
1-YEAR	0.10	0.007
2-YEAR	0.13	0.009
10-YEAR	0.21	0.015
25-YEAR	0.26	0.019
100-YEAR	0.39	0.029

No.	Revision	Date	App.

Designed By: **JJR** Drawn by: **JR** Checked by: **GES**
Scale: **1"=50'** Date: **23AUG22**

Project Title:
VALLEY CROSSING
A.P. 107NE LOT 402B
VALLEY ROAD
MIDDLETOWN
RHODE ISLAND

Client/Owner:
JAMES H. CLAUSEN REVOCABLE TRUST
7067 VILLA ESTELLE DRIVE
ORLANDO, FL 32819

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PROPOSED WATERSHED PLAN

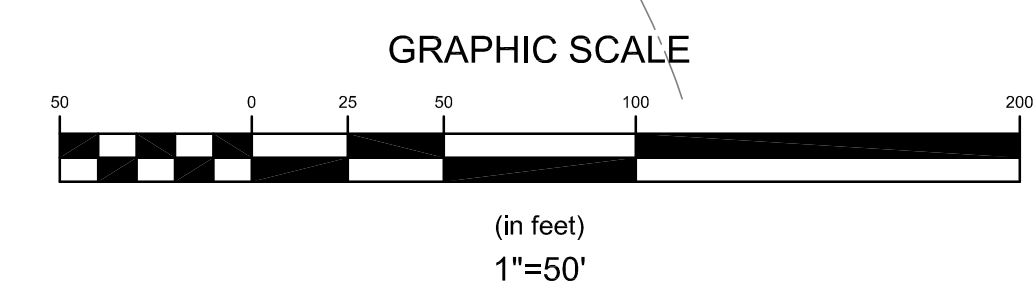
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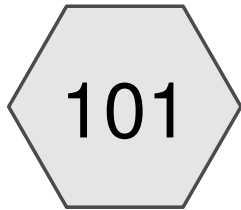
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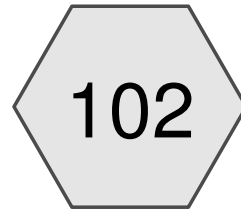




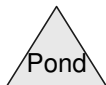
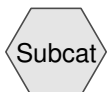
APPENDIX C EXISTING CONDITIONS HYDROCAD



To Valley



To Abutter



2022-08-08 lot b18225

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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.951	83	1/4 acre lots, 38% imp, HSG C (102)
5.818	74	>75% Grass cover, Good, HSG C (101, 102)
0.096	65	Brush, Good, HSG C (102)
0.027	98	Valley Road Sidewalk (101)

Summary for Subcatchment 101: To Valley

Runoff = 0.09 cfs @ 12.07 hrs, Volume= 0.006 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
1,178	98	Valley Road Sidewalk
550	74	>75% Grass cover, Good, HSG C
1,728	90	Weighted Average
550	74	31.83% Pervious Area
1,178	98	68.17% Impervious Area

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

Summary for Subcatchment 102: To Abutter

Runoff = 7.31 cfs @ 12.31 hrs, Volume= 0.807 af, Depth> 0.98"

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
172,085	83	1/4 acre lots, 38% imp, HSG C
252,883	74	>75% Grass cover, Good, HSG C
4,164	65	Brush, Good, HSG C
429,132	78	Weighted Average
363,740	74	84.76% Pervious Area
65,392	98	15.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		Sheet Flow, Lawns Grass: Short n= 0.150 P2= 3.30"
0.5	97	0.0400	3.22		Shallow Concentrated Flow, Lawns/Urban Unpaved Kv= 16.1 fps
1.8	500	0.0500	4.54		Shallow Concentrated Flow, Roads Paved Kv= 20.3 fps
2.7	586	0.0520	3.67		Shallow Concentrated Flow, Grasses Unpaved Kv= 16.1 fps
7.2	309	0.0020	0.72		Shallow Concentrated Flow, Grasses Unpaved Kv= 16.1 fps
20.4	1,592	Total			

Summary for Subcatchment 101: To Valley

Runoff = 0.18 cfs @ 12.07 hrs, Volume= 0.012 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
1,178	98	Valley Road Sidewalk
550	74	>75% Grass cover, Good, HSG C
1,728	90	Weighted Average
550	74	31.83% Pervious Area
1,178	98	68.17% Impervious Area

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

Summary for Subcatchment 102: To Abutter

Runoff = 20.25 cfs @ 12.28 hrs, Volume= 2.147 af, Depth> 2.62"

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
172,085	83	1/4 acre lots, 38% imp, HSG C
252,883	74	>75% Grass cover, Good, HSG C
4,164	65	Brush, Good, HSG C
429,132	78	Weighted Average
363,740	74	84.76% Pervious Area
65,392	98	15.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		Sheet Flow, Lawns Grass: Short n= 0.150 P2= 3.30"
0.5	97	0.0400	3.22		Shallow Concentrated Flow, Lawns/Urban Unpaved Kv= 16.1 fps
1.8	500	0.0500	4.54		Shallow Concentrated Flow, Roads Paved Kv= 20.3 fps
2.7	586	0.0520	3.67		Shallow Concentrated Flow, Grasses Unpaved Kv= 16.1 fps
7.2	309	0.0020	0.72		Shallow Concentrated Flow, Grasses Unpaved Kv= 16.1 fps
20.4	1,592	Total			

Summary for Subcatchment 101: To Valley

Runoff = 0.33 cfs @ 12.07 hrs, Volume= 0.024 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
1,178	98	Valley Road Sidewalk
550	74	>75% Grass cover, Good, HSG C
1,728	90	Weighted Average
550	74	31.83% Pervious Area
1,178	98	68.17% Impervious Area

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

Summary for Subcatchment 102: To Abutter

Runoff = 45.51 cfs @ 12.27 hrs, Volume= 4.865 af, Depth> 5.93"

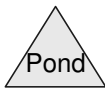
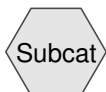
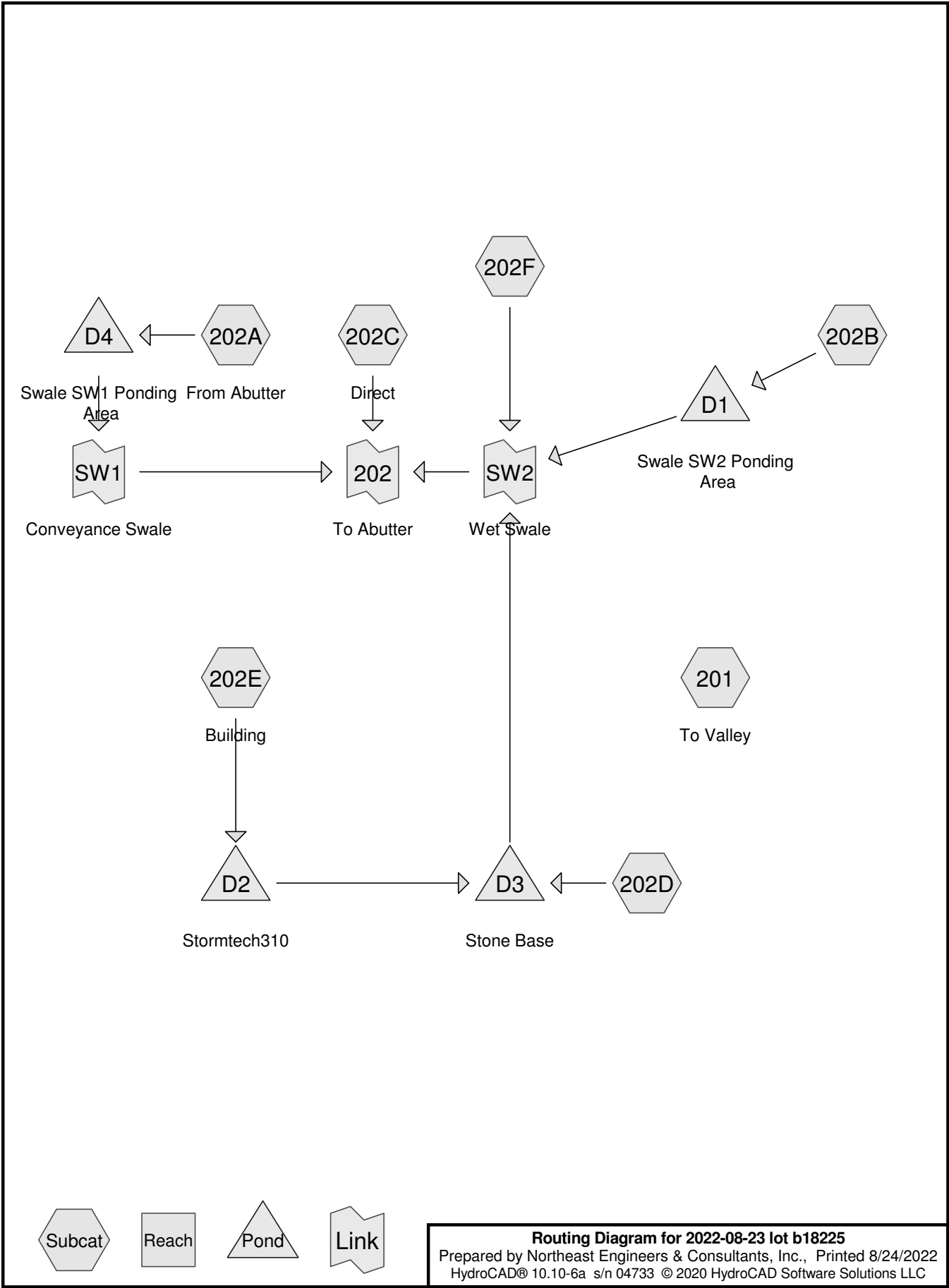
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.60"

Area (sf)	CN	Description
172,085	83	1/4 acre lots, 38% imp, HSG C
252,883	74	>75% Grass cover, Good, HSG C
4,164	65	Brush, Good, HSG C
429,132	78	Weighted Average
363,740	74	84.76% Pervious Area
65,392	98	15.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		Sheet Flow, Lawns Grass: Short n= 0.150 P2= 3.30"
0.5	97	0.0400	3.22		Shallow Concentrated Flow, Lawns/Urban Unpaved Kv= 16.1 fps
1.8	500	0.0500	4.54		Shallow Concentrated Flow, Roads Paved Kv= 20.3 fps
2.7	586	0.0520	3.67		Shallow Concentrated Flow, Grasses Unpaved Kv= 16.1 fps
7.2	309	0.0020	0.72		Shallow Concentrated Flow, Grasses Unpaved Kv= 16.1 fps
20.4	1,592	Total			



APPENDIX D PROPOSED CONDITIONS HYDROCAD



Routing Diagram for 2022-08-23 lot b18225
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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.943	83	1/4 acre lots, 38% imp, HSG C (202A, 202B, 202C, 202F)
4.500	74	>75% Grass cover, Good, HSG C (201, 202A, 202B, 202C, 202D, 202F)
0.012	98	Basin (98% capture) (202B)
0.076	65	Brush, Good, HSG C (202C)
0.344	98	Building (202E)
0.020	98	Pavement (202C)
0.897	98	Pervious Pavement (98% capture) (202D)
0.068	98	Sidewalk and Concrete (202D)
0.033	98	Valley Road Sidewalk and paved entrance (201)

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Valley Crossing I Proposed Conditions
Type III 24-hr 1-YEAR Rainfall=2.80"

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Summary for Subcatchment 201: To Valley

Runoff = 0.10 cfs @ 12.07 hrs, Volume= 0.007 af, Depth> 1.88"

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
1,439	98	Valley Road Sidewalk and paved entrance
550	74	>75% Grass cover, Good, HSG C
1,989	91	Weighted Average
550	74	27.65% Pervious Area
1,439	98	72.35% Impervious Area

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

Summary for Subcatchment 202A: From Abutter

Runoff = 5.44 cfs @ 12.22 hrs, Volume= 0.541 af, Depth> 0.98"
Routed to Pond D4 : Swale SW1 Ponding Area

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
134,093	83	1/4 acre lots, 38% imp, HSG C
152,874	74	>75% Grass cover, Good, HSG C
286,967	78	Weighted Average
236,012	74	82.24% Pervious Area
50,955	98	17.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		Sheet Flow, Lawms Grass: Short n= 0.150 P2= 3.30"
0.5	97	0.0400	3.22		Shallow Concentrated Flow, Lawns/Urban Unpaved Kv= 16.1 fps
1.8	500	0.0500	4.54		Shallow Concentrated Flow, Roads Paved Kv= 20.3 fps
2.7	586	0.0520	3.67		Shallow Concentrated Flow, Grasses Unpaved Kv= 16.1 fps
2.4	162	0.0050	1.14		Shallow Concentrated Flow, Grasses Unpaved Kv= 16.1 fps
15.6	1,445	Total			

Summary for Subcatchment 202B:

Runoff = 0.67 cfs @ 12.15 hrs, Volume= 0.056 af, Depth> 1.04"
Routed to Pond D1 : Swale SW2 Ponding Area

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"

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Area (sf)	CN	Description
15,604	83	1/4 acre lots, 38% imp, HSG C
* 514	98	Basin (98% capture)
12,163	74	>75% Grass cover, Good, HSG C
28,281	79	Weighted Average
21,837	74	77.22% Pervious Area
6,444	98	22.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.0700	0.29		Sheet Flow, Grasses Grass: Short n= 0.150 P2= 3.30"
0.5	89	0.0200	2.87		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
3.8	283	0.0060	1.25		Shallow Concentrated Flow, Primarily Grasses Unpaved Kv= 16.1 fps
10.1	472	Total			

Summary for Subcatchment 202C: Direct

Runoff = 0.66 cfs @ 12.13 hrs, Volume= 0.054 af, Depth> 0.88"
 Routed to Link 202 : To Abutter

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
9,657	83	1/4 acre lots, 38% imp, HSG C
3,305	65	Brush, Good, HSG C
17,975	74	>75% Grass cover, Good, HSG C
* 851	98	Pavement
31,788	76	Weighted Average
27,267	73	85.78% Pervious Area
4,521	98	14.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.0500	0.25		Sheet Flow, Lawns Grass: Short n= 0.150 P2= 3.30"
1.6	145	0.0086	1.49		Shallow Concentrated Flow, Grasses and Brush Unpaved Kv= 16.1 fps
8.3	245	Total			

Summary for Subcatchment 202D:

Runoff = 2.86 cfs @ 12.07 hrs, Volume= 0.203 af, Depth> 2.16"
 Routed to Pond D3 : Stone Base

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
* 39,061	98	Pervious Pavement (98% capture)
* 2,955	98	Sidewalk and Concrete
7,191	74	>75% Grass cover, Good, HSG C
49,207	94	Weighted Average
7,191	74	14.61% Pervious Area
42,016	98	85.39% Impervious Area

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

Summary for Subcatchment 202E: Building

Runoff = 0.97 cfs @ 12.07 hrs, Volume= 0.074 af, Depth> 2.57"
 Routed to Pond D2 : Stormtech310

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
* 15,000	98	Building
15,000	98	100.00% Impervious Area

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

Summary for Subcatchment 202F:

Runoff = 0.50 cfs @ 12.11 hrs, Volume= 0.037 af, Depth> 1.10"
 Routed to Link SW2 : Wet Swale

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
12,413	83	1/4 acre lots, 38% imp, HSG C
5,279	74	>75% Grass cover, Good, HSG C
17,692	80	Weighted Average
12,975	74	73.34% Pervious Area
4,717	98	26.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	87	0.0370	0.21		Sheet Flow, Lawns
					Grass: Short n= 0.150 P2= 3.30"
0.3	73	0.0822	4.62		Shallow Concentrated Flow, Grass/swale
					Unpaved Kv= 16.1 fps
7.0	160	Total			

Summary for Pond D1: Swale SW2 Ponding Area

Inflow Area = 0.649 ac, 22.78% Impervious, Inflow Depth > 1.04" for 1-YEAR event
 Inflow = 0.67 cfs @ 12.15 hrs, Volume= 0.056 af
 Outflow = 0.65 cfs @ 12.18 hrs, Volume= 0.056 af, Atten= 3%, Lag= 1.6 min
 Primary = 0.65 cfs @ 12.18 hrs, Volume= 0.056 af
 Routed to Link SW2 : Wet Swale

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 74.91' @ 12.18 hrs Surf.Area= 284 sf Storage= 62 cf
 Flood Elev= 76.00' Surf.Area= 566 sf Storage= 547 cf

Plug-Flow detention time= 1.9 min calculated for 0.056 af (100% of inflow)
 Center-of-Mass det. time= 1.5 min (857.2 - 855.7)

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Volume	Invert	Avail.Storage	Storage Description
#1	74.50'	1,236 cf	Depression (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
74.50	23	0	0
75.00	344	92	92
76.00	566	455	547
77.00	813	690	1,236

Device	Routing	Invert	Outlet Devices
#1	Primary	74.50'	12.0" Round 12" ADS L= 46.0' Ke= 0.500 Inlet / Outlet Invert= 74.50' / 73.00' S= 0.0326 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.65 cfs @ 12.18 hrs HW=74.91' TW=0.00' (Dynamic Tailwater)
 ↑1=12" ADS (Inlet Controls 0.65 cfs @ 2.17 fps)

Summary for Pond D2: Stormtech310

Inflow Area = 0.344 ac, 100.00% Impervious, Inflow Depth > 2.57" for 1-YEAR event
 Inflow = 0.97 cfs @ 12.07 hrs, Volume= 0.074 af
 Outflow = 0.99 cfs @ 12.06 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.0 min
 Discarded = 0.01 cfs @ 11.59 hrs, Volume= 0.009 af
 Primary = 0.98 cfs @ 12.06 hrs, Volume= 0.041 af
 Routed to Pond D3 : Stone Base

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 72.57' @ 12.06 hrs Surf.Area= 842 sf Storage= 1,000 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 56.8 min (814.8 - 757.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	68.38'	644 cf	4.83'W x 174.08'L x 2.33'H Field A 1,963 cf Overall - 354 cf Embedded = 1,609 cf x 40.0% Voids
#2A	68.88'	354 cf	ADS_StormTech SC-310 +Cap x 24 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
#3	69.71'	5 cf	0.50'D x 6.00'H Downspouts x 4
		1,002 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#0	Primary	75.71'	Automatic Storage Overflow (Discharged without head)
#1	Discarded	68.38'	0.270 in/hr Exfiltration over Surface area
#2	Primary	71.50'	4.0" Horiz. Roof overflow pipes (front) X 2.00 C= 0.600 Limited to weir flow at low heads
#3	Primary	72.50'	4.0" Horiz. Roof overflow pipes (rear) X 2.00 C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.01 cfs @ 11.59 hrs HW=69.72' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.98 cfs @ 12.06 hrs HW=72.57' TW=67.88' (Dynamic Tailwater)
 ↑2=Roof overflow pipes (front) (Orifice Controls 0.87 cfs @ 4.97 fps)
 ↓3=Roof overflow pipes (rear) (Weir Controls 0.12 cfs @ 0.84 fps)

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Summary for Pond D3: Stone Base

Inflow Area = 1.474 ac, 88.80% Impervious, Inflow Depth > 1.99" for 1-YEAR event
 Inflow = 3.83 cfs @ 12.08 hrs, Volume= 0.244 af
 Outflow = 0.56 cfs @ 12.55 hrs, Volume= 0.244 af, Atten= 85%, Lag= 28.5 min
 Discarded = 0.24 cfs @ 11.82 hrs, Volume= 0.198 af
 Primary = 0.32 cfs @ 12.55 hrs, Volume= 0.046 af
 Routed to Link SW2 : Wet Swale

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 68.04' @ 12.55 hrs Surf.Area= 39,061 sf Storage= 3,793 cf
 Flood Elev= 70.00' Surf.Area= 39,061 sf Storage= 29,003 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 77.3 min (872.2 - 794.9)

Volume	Invert	Avail.Storage	Storage Description
#1	67.75'	29,003 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 87,887 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
67.75	39,061	0	0
70.00	39,061	87,887	87,887

Device	Routing	Invert	Outlet Devices
#1	Primary	65.50'	12.0" Round 12" ADS L= 25.0' Ke= 0.500 Inlet / Outlet Invert= 65.50' / 65.25' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	67.85'	4.0" Vert. Underdrains X 4.00 C= 0.600 Limited to weir flow at low heads
#3	Discarded	67.75'	0.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.24 cfs @ 11.82 hrs HW=67.77' (Free Discharge)
 ↑ **3=Exfiltration** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=0.32 cfs @ 12.55 hrs HW=68.04' TW=0.00' (Dynamic Tailwater)
 ↑ **1=12" ADS** (Passes 0.32 cfs of 5.41 cfs potential flow)
 ↑ **2=Underdrains** (Orifice Controls 0.32 cfs @ 1.50 fps)

Summary for Pond D4: Swale SW1 Ponding Area

Inflow Area = 6.588 ac, 17.76% Impervious, Inflow Depth > 0.98" for 1-YEAR event
 Inflow = 5.44 cfs @ 12.22 hrs, Volume= 0.541 af
 Outflow = 5.23 cfs @ 12.27 hrs, Volume= 0.539 af, Atten= 4%, Lag= 3.0 min
 Discarded = 0.01 cfs @ 12.27 hrs, Volume= 0.008 af
 Primary = 5.21 cfs @ 12.27 hrs, Volume= 0.531 af
 Routed to Link SW1 : Conveyance Swale

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 65.17' @ 12.27 hrs Surf.Area= 2,091 sf Storage= 986 cf
 Flood Elev= 67.00' Surf.Area= 5,286 sf Storage= 7,684 cf

Plug-Flow detention time= 5.5 min calculated for 0.539 af (100% of inflow)
 Center-of-Mass det. time= 3.6 min (867.0 - 863.4)

Volume	Invert	Avail.Storage	Storage Description
#1	64.50'	7,684 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
64.50	825	0	0
65.00	1,812	659	659
66.00	3,476	2,644	3,303
67.00	5,286	4,381	7,684

Device	Routing	Invert	Outlet Devices
#1	Primary	64.50'	30.0" W x 18.0" H Box (2) 12"x30" X 2.00 L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 64.50' / 64.50' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 3.75 sf
#2	Discarded	64.50'	0.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.01 cfs @ 12.27 hrs HW=65.17' (Free Discharge)
 ↑ **2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=5.21 cfs @ 12.27 hrs HW=65.17' TW=0.00' (Dynamic Tailwater)
 ↑ **1=(2) 12"x30"** (Barrel Controls 5.21 cfs @ 2.08 fps)

Summary for Link 202: To Abutter

Inflow Area = 9.847 ac, 28.83% Impervious, Inflow Depth > 0.88" for 1-YEAR event
 Inflow = 6.59 cfs @ 12.30 hrs, Volume= 0.724 af
 Primary = 6.59 cfs @ 12.30 hrs, Volume= 0.724 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Link SW1: Conveyance Swale

Inflow Area = 6.588 ac, 17.76% Impervious, Inflow Depth > 0.97" for 1-YEAR event
 Inflow = 5.21 cfs @ 12.27 hrs, Volume= 0.531 af
 Primary = 5.21 cfs @ 12.31 hrs, Volume= 0.531 af, Atten= 0%, Lag= 2.4 min
 Routed to Link 202 : To Abutter

Primary outflow = Inflow delayed by 2.4 min, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Link SW2: Wet Swale

Inflow Area = 2.529 ac, 61.88% Impervious, Inflow Depth > 0.66" for 1-YEAR event
 Inflow = 1.18 cfs @ 12.16 hrs, Volume= 0.140 af
 Primary = 1.18 cfs @ 12.18 hrs, Volume= 0.140 af, Atten= 0%, Lag= 1.5 min
 Routed to Link 202 : To Abutter

Primary outflow = Inflow delayed by 1.5 min, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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Valley Crossing I Proposed Conditions
Type III 24-hr 2-YEAR Rainfall=3.30"

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Summary for Subcatchment 201: To Valley

Runoff = 0.13 cfs @ 12.07 hrs, Volume= 0.009 af, Depth> 2.35"

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
1,439	98	Valley Road Sidewalk and paved entrance
550	74	>75% Grass cover, Good, HSG C
1,989	91	Weighted Average
550	74	27.65% Pervious Area
1,439	98	72.35% Impervious Area

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

Summary for Subcatchment 202A: From Abutter

Runoff = 7.59 cfs @ 12.22 hrs, Volume= 0.737 af, Depth> 1.34"
Routed to Pond D4 : Swale SW1 Ponding Area

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
134,093	83	1/4 acre lots, 38% imp, HSG C
152,874	74	>75% Grass cover, Good, HSG C
286,967	78	Weighted Average
236,012	74	82.24% Pervious Area
50,955	98	17.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		Sheet Flow, Lawms Grass: Short n= 0.150 P2= 3.30"
0.5	97	0.0400	3.22		Shallow Concentrated Flow, Lawns/Urban Unpaved Kv= 16.1 fps
1.8	500	0.0500	4.54		Shallow Concentrated Flow, Roads Paved Kv= 20.3 fps
2.7	586	0.0520	3.67		Shallow Concentrated Flow, Grasses Unpaved Kv= 16.1 fps
2.4	162	0.0050	1.14		Shallow Concentrated Flow, Grasses Unpaved Kv= 16.1 fps
15.6	1,445	Total			

Summary for Subcatchment 202B:

Runoff = 0.92 cfs @ 12.15 hrs, Volume= 0.076 af, Depth> 1.41"
Routed to Pond D1 : Swale SW2 Ponding Area

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"

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Area (sf)	CN	Description
15,604	83	1/4 acre lots, 38% imp, HSG C
* 514	98	Basin (98% capture)
12,163	74	>75% Grass cover, Good, HSG C
28,281	79	Weighted Average
21,837	74	77.22% Pervious Area
6,444	98	22.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.0700	0.29		Sheet Flow, Grasses Grass: Short n= 0.150 P2= 3.30"
0.5	89	0.0200	2.87		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
3.8	283	0.0060	1.25		Shallow Concentrated Flow, Primarily Grasses Unpaved Kv= 16.1 fps
10.1	472	Total			

Summary for Subcatchment 202C: Direct

Runoff = 0.93 cfs @ 12.13 hrs, Volume= 0.074 af, Depth> 1.22"
 Routed to Link 202 : To Abutter

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
9,657	83	1/4 acre lots, 38% imp, HSG C
3,305	65	Brush, Good, HSG C
17,975	74	>75% Grass cover, Good, HSG C
* 851	98	Pavement
31,788	76	Weighted Average
27,267	73	85.78% Pervious Area
4,521	98	14.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.0500	0.25		Sheet Flow, Lawns Grass: Short n= 0.150 P2= 3.30"
1.6	145	0.0086	1.49		Shallow Concentrated Flow, Grasses and Brush Unpaved Kv= 16.1 fps
8.3	245	Total			

Summary for Subcatchment 202D:

Runoff = 3.46 cfs @ 12.07 hrs, Volume= 0.248 af, Depth> 2.64"
 Routed to Pond D3 : Stone Base

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
* 39,061	98	Pervious Pavement (98% capture)
* 2,955	98	Sidewalk and Concrete
7,191	74	>75% Grass cover, Good, HSG C
49,207	94	Weighted Average
7,191	74	14.61% Pervious Area
42,016	98	85.39% Impervious Area

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

Summary for Subcatchment 202E: Building

Runoff = 1.14 cfs @ 12.07 hrs, Volume= 0.088 af, Depth> 3.07"
 Routed to Pond D2 : Stormtech310

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
* 15,000	98	Building
15,000	98	100.00% Impervious Area

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

Summary for Subcatchment 202F:

Runoff = 0.67 cfs @ 12.10 hrs, Volume= 0.050 af, Depth> 1.48"
 Routed to Link SW2 : Wet Swale

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
12,413	83	1/4 acre lots, 38% imp, HSG C
5,279	74	>75% Grass cover, Good, HSG C
17,692	80	Weighted Average
12,975	74	73.34% Pervious Area
4,717	98	26.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	87	0.0370	0.21		Sheet Flow, Lawns
					Grass: Short n= 0.150 P2= 3.30"
0.3	73	0.0822	4.62		Shallow Concentrated Flow, Grass/swale
					Unpaved Kv= 16.1 fps
7.0	160	Total			

Summary for Pond D1: Swale SW2 Ponding Area

Inflow Area = 0.649 ac, 22.78% Impervious, Inflow Depth > 1.41" for 2-YEAR event
 Inflow = 0.92 cfs @ 12.15 hrs, Volume= 0.076 af
 Outflow = 0.89 cfs @ 12.17 hrs, Volume= 0.076 af, Atten= 3%, Lag= 1.6 min
 Primary = 0.89 cfs @ 12.17 hrs, Volume= 0.076 af
 Routed to Link SW2 : Wet Swale

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 74.98' @ 12.17 hrs Surf.Area= 334 sf Storage= 86 cf
 Flood Elev= 76.00' Surf.Area= 566 sf Storage= 547 cf

Plug-Flow detention time= 1.9 min calculated for 0.076 af (100% of inflow)
 Center-of-Mass det. time= 1.5 min (848.2 - 846.8)

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Volume	Invert	Avail.Storage	Storage Description
#1	74.50'	1,236 cf	Depression (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
74.50	23	0	0
75.00	344	92	92
76.00	566	455	547
77.00	813	690	1,236

Device	Routing	Invert	Outlet Devices
#1	Primary	74.50'	12.0" Round 12" ADS L= 46.0' Ke= 0.500 Inlet / Outlet Invert= 74.50' / 73.00' S= 0.0326 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.89 cfs @ 12.17 hrs HW=74.98' TW=0.00' (Dynamic Tailwater)
 ↑1=12" ADS (Inlet Controls 0.89 cfs @ 2.37 fps)

Summary for Pond D2: Stormtech310

Inflow Area = 0.344 ac, 100.00% Impervious, Inflow Depth > 3.07" for 2-YEAR event
 Inflow = 1.14 cfs @ 12.07 hrs, Volume= 0.088 af
 Outflow = 1.14 cfs @ 12.08 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.6 min
 Discarded = 0.01 cfs @ 11.13 hrs, Volume= 0.009 af
 Primary = 1.14 cfs @ 12.08 hrs, Volume= 0.056 af
 Routed to Pond D3 : Stone Base

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 72.61' @ 12.08 hrs Surf.Area= 842 sf Storage= 1,000 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 53.8 min (808.2 - 754.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	68.38'	644 cf	4.83'W x 174.08'L x 2.33'H Field A 1,963 cf Overall - 354 cf Embedded = 1,609 cf x 40.0% Voids
#2A	68.88'	354 cf	ADS_StormTech SC-310 +Cap x 24 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
#3	69.71'	5 cf	0.50'D x 6.00'H Downspouts x 4
		1,002 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#0	Primary	75.71'	Automatic Storage Overflow (Discharged without head)
#1	Discarded	68.38'	0.270 in/hr Exfiltration over Surface area
#2	Primary	71.50'	4.0" Horiz. Roof overflow pipes (front) X 2.00 C= 0.600 Limited to weir flow at low heads
#3	Primary	72.50'	4.0" Horiz. Roof overflow pipes (rear) X 2.00 C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.01 cfs @ 11.13 hrs HW=69.71' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=1.14 cfs @ 12.08 hrs HW=72.61' TW=67.96' (Dynamic Tailwater)
 ↑2=Roof overflow pipes (front) (Orifice Controls 0.89 cfs @ 5.07 fps)
 ↑3=Roof overflow pipes (rear) (Weir Controls 0.25 cfs @ 1.09 fps)

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Summary for Pond D3: Stone Base

Inflow Area = 1.474 ac, 88.80% Impervious, Inflow Depth > 2.47" for 2-YEAR event
 Inflow = 4.59 cfs @ 12.07 hrs, Volume= 0.304 af
 Outflow = 0.78 cfs @ 12.52 hrs, Volume= 0.304 af, Atten= 83%, Lag= 27.0 min
 Discarded = 0.24 cfs @ 11.74 hrs, Volume= 0.222 af
 Primary = 0.54 cfs @ 12.52 hrs, Volume= 0.082 af
 Routed to Link SW2 : Wet Swale

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 68.12' @ 12.52 hrs Surf.Area= 39,061 sf Storage= 4,791 cf
 Flood Elev= 70.00' Surf.Area= 39,061 sf Storage= 29,003 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 78.8 min (868.6 - 789.7)

Volume	Invert	Avail.Storage	Storage Description
#1	67.75'	29,003 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 87,887 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
67.75	39,061	0	0
70.00	39,061	87,887	87,887

Device	Routing	Invert	Outlet Devices
#1	Primary	65.50'	12.0" Round 12" ADS L= 25.0' Ke= 0.500 Inlet / Outlet Invert= 65.50' / 65.25' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	67.85'	4.0" Vert. Underdrains X 4.00 C= 0.600 Limited to weir flow at low heads
#3	Discarded	67.75'	0.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.24 cfs @ 11.74 hrs HW=67.77' (Free Discharge)
 ↑ **3=Exfiltration** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=0.54 cfs @ 12.52 hrs HW=68.12' TW=0.00' (Dynamic Tailwater)
 ↑ **1=12" ADS** (Passes 0.54 cfs of 5.51 cfs potential flow)
 ↑ **2=Underdrains** (Orifice Controls 0.54 cfs @ 1.77 fps)

Summary for Pond D4: Swale SW1 Ponding Area

Inflow Area = 6.588 ac, 17.76% Impervious, Inflow Depth > 1.34" for 2-YEAR event
 Inflow = 7.59 cfs @ 12.22 hrs, Volume= 0.737 af
 Outflow = 7.29 cfs @ 12.27 hrs, Volume= 0.735 af, Atten= 4%, Lag= 2.8 min
 Discarded = 0.01 cfs @ 12.27 hrs, Volume= 0.009 af
 Primary = 7.27 cfs @ 12.27 hrs, Volume= 0.726 af
 Routed to Link SW1 : Conveyance Swale

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 65.31' @ 12.27 hrs Surf.Area= 2,335 sf Storage= 1,311 cf
 Flood Elev= 67.00' Surf.Area= 5,286 sf Storage= 7,684 cf

Plug-Flow detention time= 5.0 min calculated for 0.735 af (100% of inflow)
 Center-of-Mass det. time= 3.4 min (857.6 - 854.2)

Volume	Invert	Avail.Storage	Storage Description
#1	64.50'	7,684 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
64.50	825	0	0
65.00	1,812	659	659
66.00	3,476	2,644	3,303
67.00	5,286	4,381	7,684

Device	Routing	Invert	Outlet Devices
#1	Primary	64.50'	30.0" W x 18.0" H Box (2) 12"x30" X 2.00 L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 64.50' / 64.50' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 3.75 sf
#2	Discarded	64.50'	0.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.01 cfs @ 12.27 hrs HW=65.31' (Free Discharge)
 ↑ **2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=7.27 cfs @ 12.27 hrs HW=65.31' TW=0.00' (Dynamic Tailwater)
 ↑ **1=(2) 12"x30"** (Barrel Controls 7.27 cfs @ 2.38 fps)

Summary for Link 202: To Abutter

Inflow Area = 9.847 ac, 28.83% Impervious, Inflow Depth > 1.23" for 2-YEAR event
 Inflow = 9.30 cfs @ 12.30 hrs, Volume= 1.008 af
 Primary = 9.30 cfs @ 12.30 hrs, Volume= 1.008 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Link SW1: Conveyance Swale

Inflow Area = 6.588 ac, 17.76% Impervious, Inflow Depth > 1.32" for 2-YEAR event
 Inflow = 7.27 cfs @ 12.27 hrs, Volume= 0.726 af
 Primary = 7.27 cfs @ 12.31 hrs, Volume= 0.726 af, Atten= 0%, Lag= 2.4 min
 Routed to Link 202 : To Abutter

Primary outflow = Inflow delayed by 2.4 min, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Link SW2: Wet Swale

Inflow Area = 2.529 ac, 61.88% Impervious, Inflow Depth > 0.99" for 2-YEAR event
 Inflow = 1.74 cfs @ 12.16 hrs, Volume= 0.208 af
 Primary = 1.74 cfs @ 12.18 hrs, Volume= 0.208 af, Atten= 0%, Lag= 1.5 min
 Routed to Link 202 : To Abutter

Primary outflow = Inflow delayed by 1.5 min, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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Summary for Subcatchment 201: To Valley

Runoff = 0.21 cfs @ 12.07 hrs, Volume= 0.015 af, Depth> 3.88"

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
1,439	98	Valley Road Sidewalk and paved entrance
550	74	>75% Grass cover, Good, HSG C
1,989	91	Weighted Average
550	74	27.65% Pervious Area
1,439	98	72.35% Impervious Area

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

Summary for Subcatchment 202A: From Abutter

Runoff = 15.13 cfs @ 12.22 hrs, Volume= 1.438 af, Depth> 2.62"
 Routed to Pond D4 : Swale SW1 Ponding Area

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
134,093	83	1/4 acre lots, 38% imp, HSG C
152,874	74	>75% Grass cover, Good, HSG C
286,967	78	Weighted Average
236,012	74	82.24% Pervious Area
50,955	98	17.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		Sheet Flow, Lawms Grass: Short n= 0.150 P2= 3.30"
0.5	97	0.0400	3.22		Shallow Concentrated Flow, Lawns/Urban Unpaved Kv= 16.1 fps
1.8	500	0.0500	4.54		Shallow Concentrated Flow, Roads Paved Kv= 20.3 fps
2.7	586	0.0520	3.67		Shallow Concentrated Flow, Grasses Unpaved Kv= 16.1 fps
2.4	162	0.0050	1.14		Shallow Concentrated Flow, Grasses Unpaved Kv= 16.1 fps
15.6	1,445	Total			

Summary for Subcatchment 202B:

Runoff = 1.80 cfs @ 12.14 hrs, Volume= 0.147 af, Depth> 2.71"
 Routed to Pond D1 : Swale SW2 Ponding Area

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"

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Area (sf)	CN	Description
15,604	83	1/4 acre lots, 38% imp, HSG C
* 514	98	Basin (98% capture)
12,163	74	>75% Grass cover, Good, HSG C
28,281	79	Weighted Average
21,837	74	77.22% Pervious Area
6,444	98	22.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.0700	0.29		Sheet Flow, Grasses Grass: Short n= 0.150 P2= 3.30"
0.5	89	0.0200	2.87		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
3.8	283	0.0060	1.25		Shallow Concentrated Flow, Primarily Grasses Unpaved Kv= 16.1 fps
10.1	472	Total			

Summary for Subcatchment 202C: Direct

Runoff = 1.93 cfs @ 12.12 hrs, Volume= 0.149 af, Depth> 2.45"
 Routed to Link 202 : To Abutter

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
9,657	83	1/4 acre lots, 38% imp, HSG C
3,305	65	Brush, Good, HSG C
17,975	74	>75% Grass cover, Good, HSG C
* 851	98	Pavement
31,788	76	Weighted Average
27,267	73	85.78% Pervious Area
4,521	98	14.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.0500	0.25		Sheet Flow, Lawns Grass: Short n= 0.150 P2= 3.30"
1.6	145	0.0086	1.49		Shallow Concentrated Flow, Grasses and Brush Unpaved Kv= 16.1 fps
8.3	245	Total			

Summary for Subcatchment 202D:

Runoff = 5.38 cfs @ 12.07 hrs, Volume= 0.396 af, Depth> 4.21"
 Routed to Pond D3 : Stone Base

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
* 39,061	98	Pervious Pavement (98% capture)
* 2,955	98	Sidewalk and Concrete
7,191	74	>75% Grass cover, Good, HSG C
49,207	94	Weighted Average
7,191	74	14.61% Pervious Area
42,016	98	85.39% Impervious Area

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

Summary for Subcatchment 202E: Building

Runoff = 1.71 cfs @ 12.07 hrs, Volume= 0.134 af, Depth> 4.66"
 Routed to Pond D2 : Stormtech310

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
* 15,000	98	Building
15,000	98	100.00% Impervious Area

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

Summary for Subcatchment 202F:

Runoff = 1.29 cfs @ 12.10 hrs, Volume= 0.095 af, Depth> 2.80"
 Routed to Link SW2 : Wet Swale

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
12,413	83	1/4 acre lots, 38% imp, HSG C
5,279	74	>75% Grass cover, Good, HSG C
17,692	80	Weighted Average
12,975	74	73.34% Pervious Area
4,717	98	26.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	87	0.0370	0.21		Sheet Flow, Lawns
					Grass: Short n= 0.150 P2= 3.30"
0.3	73	0.0822	4.62		Shallow Concentrated Flow, Grass/swale
					Unpaved Kv= 16.1 fps
7.0	160	Total			

Summary for Pond D1: Swale SW2 Ponding Area

Inflow Area = 0.649 ac, 22.78% Impervious, Inflow Depth > 2.71" for 10-YEAR event
 Inflow = 1.80 cfs @ 12.14 hrs, Volume= 0.147 af
 Outflow = 1.74 cfs @ 12.17 hrs, Volume= 0.147 af, Atten= 3%, Lag= 1.7 min
 Primary = 1.74 cfs @ 12.17 hrs, Volume= 0.147 af
 Routed to Link SW2 : Wet Swale

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 75.22' @ 12.17 hrs Surf.Area= 392 sf Storage= 172 cf
 Flood Elev= 76.00' Surf.Area= 566 sf Storage= 547 cf

Plug-Flow detention time= 1.8 min calculated for 0.146 af (100% of inflow)
 Center-of-Mass det. time= 1.4 min (829.4 - 827.9)

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Volume	Invert	Avail.Storage	Storage Description
#1	74.50'	1,236 cf	Depression (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
74.50	23	0	0
75.00	344	92	92
76.00	566	455	547
77.00	813	690	1,236

Device	Routing	Invert	Outlet Devices
#1	Primary	74.50'	12.0" Round 12" ADS L= 46.0' Ke= 0.500 Inlet / Outlet Invert= 74.50' / 73.00' S= 0.0326 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=1.74 cfs @ 12.17 hrs HW=75.22' TW=0.00' (Dynamic Tailwater)
 ↑1=12" ADS (Inlet Controls 1.74 cfs @ 2.89 fps)

Summary for Pond D2: Stormtech310

Inflow Area = 0.344 ac, 100.00% Impervious, Inflow Depth > 4.66" for 10-YEAR event
 Inflow = 1.71 cfs @ 12.07 hrs, Volume= 0.134 af
 Outflow = 1.71 cfs @ 12.07 hrs, Volume= 0.111 af, Atten= 0%, Lag= 0.0 min
 Discarded = 0.01 cfs @ 9.65 hrs, Volume= 0.010 af
 Primary = 1.70 cfs @ 12.07 hrs, Volume= 0.101 af
 Routed to Pond D3 : Stone Base

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 73.09' @ 12.07 hrs Surf.Area= 842 sf Storage= 1,000 cf

Plug-Flow detention time= 119.3 min calculated for 0.111 af (83% of inflow)
 Center-of-Mass det. time= 49.1 min (796.1 - 747.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	68.38'	644 cf	4.83'W x 174.08'L x 2.33'H Field A 1,963 cf Overall - 354 cf Embedded = 1,609 cf x 40.0% Voids
#2A	68.88'	354 cf	ADS_StormTech SC-310 +Cap x 24 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
#3	69.71'	5 cf	0.50'D x 6.00'H Downspouts x 4
		1,002 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#0	Primary	75.71'	Automatic Storage Overflow (Discharged without head)
#1	Discarded	68.38'	0.270 in/hr Exfiltration over Surface area
#2	Primary	71.50'	4.0" Horiz. Roof overflow pipes (front) X 2.00 C= 0.600 Limited to weir flow at low heads
#3	Primary	72.50'	4.0" Horiz. Roof overflow pipes (rear) X 2.00 C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.01 cfs @ 9.65 hrs HW=69.71' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=1.70 cfs @ 12.07 hrs HW=73.09' TW=68.15' (Dynamic Tailwater)
 ↑2=Roof overflow pipes (front) (Orifice Controls 1.06 cfs @ 6.07 fps)
 ↑3=Roof overflow pipes (rear) (Orifice Controls 0.64 cfs @ 3.69 fps)

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Summary for Pond D3: Stone Base

Inflow Area = 1.474 ac, 88.80% Impervious, Inflow Depth > 4.05" for 10-YEAR event
 Inflow = 7.08 cfs @ 12.07 hrs, Volume= 0.497 af
 Outflow = 1.27 cfs @ 12.51 hrs, Volume= 0.497 af, Atten= 82%, Lag= 26.3 min
 Discarded = 0.24 cfs @ 11.14 hrs, Volume= 0.282 af
 Primary = 1.03 cfs @ 12.51 hrs, Volume= 0.214 af
 Routed to Link SW2 : Wet Swale

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 68.39' @ 12.51 hrs Surf.Area= 39,061 sf Storage= 8,282 cf
 Flood Elev= 70.00' Surf.Area= 39,061 sf Storage= 29,003 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 84.5 min (862.6 - 778.2)

Volume	Invert	Avail.Storage	Storage Description
#1	67.75'	29,003 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 87,887 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
67.75	39,061	0	0
70.00	39,061	87,887	87,887

Device	Routing	Invert	Outlet Devices
#1	Primary	65.50'	12.0" Round 12" ADS L= 25.0' Ke= 0.500 Inlet / Outlet Invert= 65.50' / 65.25' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	67.85'	4.0" Vert. Underdrains X 4.00 C= 0.600 Limited to weir flow at low heads
#3	Discarded	67.75'	0.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.24 cfs @ 11.14 hrs HW=67.77' (Free Discharge)
 ↑ **3=Exfiltration** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=1.03 cfs @ 12.51 hrs HW=68.39' TW=0.00' (Dynamic Tailwater)
 ↑ **1=12" ADS** (Passes 1.03 cfs of 5.85 cfs potential flow)
 ↑ **2=Underdrains** (Orifice Controls 1.03 cfs @ 2.95 fps)

Summary for Pond D4: Swale SW1 Ponding Area

Inflow Area = 6.588 ac, 17.76% Impervious, Inflow Depth > 2.62" for 10-YEAR event
 Inflow = 15.13 cfs @ 12.22 hrs, Volume= 1.438 af
 Outflow = 14.51 cfs @ 12.26 hrs, Volume= 1.435 af, Atten= 4%, Lag= 2.6 min
 Discarded = 0.02 cfs @ 12.26 hrs, Volume= 0.010 af
 Primary = 14.49 cfs @ 12.26 hrs, Volume= 1.424 af
 Routed to Link SW1 : Conveyance Swale

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 65.74' @ 12.26 hrs Surf.Area= 3,048 sf Storage= 2,465 cf
 Flood Elev= 67.00' Surf.Area= 5,286 sf Storage= 7,684 cf

Plug-Flow detention time= 4.2 min calculated for 1.434 af (100% of inflow)
 Center-of-Mass det. time= 3.0 min (838.0 - 834.9)

Volume	Invert	Avail.Storage	Storage Description
#1	64.50'	7,684 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
64.50	825	0	0
65.00	1,812	659	659
66.00	3,476	2,644	3,303
67.00	5,286	4,381	7,684

Device	Routing	Invert	Outlet Devices
#1	Primary	64.50'	30.0" W x 18.0" H Box (2) 12"x30" X 2.00 L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 64.50' / 64.50' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 3.75 sf
#2	Discarded	64.50'	0.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.02 cfs @ 12.26 hrs HW=65.74' (Free Discharge)
 ↑ **2=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=14.49 cfs @ 12.26 hrs HW=65.74' TW=0.00' (Dynamic Tailwater)
 ↑ **1=(2) 12"x30"** (Barrel Controls 14.49 cfs @ 3.11 fps)

Summary for Link 202: To Abutter

Inflow Area = 9.847 ac, 28.83% Impervious, Inflow Depth > 2.47" for 10-YEAR event
 Inflow = 18.55 cfs @ 12.28 hrs, Volume= 2.028 af
 Primary = 18.55 cfs @ 12.28 hrs, Volume= 2.028 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Link SW1: Conveyance Swale

Inflow Area = 6.588 ac, 17.76% Impervious, Inflow Depth > 2.59" for 10-YEAR event
 Inflow = 14.49 cfs @ 12.26 hrs, Volume= 1.424 af
 Primary = 14.49 cfs @ 12.30 hrs, Volume= 1.424 af, Atten= 0%, Lag= 2.4 min
 Routed to Link 202 : To Abutter

Primary outflow = Inflow delayed by 2.4 min, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Link SW2: Wet Swale

Inflow Area = 2.529 ac, 61.88% Impervious, Inflow Depth > 2.16" for 10-YEAR event
 Inflow = 3.68 cfs @ 12.14 hrs, Volume= 0.456 af
 Primary = 3.68 cfs @ 12.17 hrs, Volume= 0.456 af, Atten= 0%, Lag= 1.5 min
 Routed to Link 202 : To Abutter

Primary outflow = Inflow delayed by 1.5 min, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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Summary for Subcatchment 201: To Valley

Runoff = 0.26 cfs @ 12.07 hrs, Volume= 0.019 af, Depth> 5.05"

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
1,439	98	Valley Road Sidewalk and paved entrance
550	74	>75% Grass cover, Good, HSG C
1,989	91	Weighted Average
550	74	27.65% Pervious Area
1,439	98	72.35% Impervious Area

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

Summary for Subcatchment 202A: From Abutter

Runoff = 21.12 cfs @ 12.22 hrs, Volume= 2.007 af, Depth> 3.66"
 Routed to Pond D4 : Swale SW1 Ponding Area

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
134,093	83	1/4 acre lots, 38% imp, HSG C
152,874	74	>75% Grass cover, Good, HSG C
286,967	78	Weighted Average
236,012	74	82.24% Pervious Area
50,955	98	17.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		Sheet Flow, Lawms Grass: Short n= 0.150 P2= 3.30"
0.5	97	0.0400	3.22		Shallow Concentrated Flow, Lawns/Urban Unpaved Kv= 16.1 fps
1.8	500	0.0500	4.54		Shallow Concentrated Flow, Roads Paved Kv= 20.3 fps
2.7	586	0.0520	3.67		Shallow Concentrated Flow, Grasses Unpaved Kv= 16.1 fps
2.4	162	0.0050	1.14		Shallow Concentrated Flow, Grasses Unpaved Kv= 16.1 fps
15.6	1,445	Total			

Summary for Subcatchment 202B:

Runoff = 2.49 cfs @ 12.14 hrs, Volume= 0.204 af, Depth> 3.76"
 Routed to Pond D1 : Swale SW2 Ponding Area

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"

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Area (sf)	CN	Description
15,604	83	1/4 acre lots, 38% imp, HSG C
* 514	98	Basin (98% capture)
12,163	74	>75% Grass cover, Good, HSG C
28,281	79	Weighted Average
21,837	74	77.22% Pervious Area
6,444	98	22.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.0700	0.29		Sheet Flow, Grasses Grass: Short n= 0.150 P2= 3.30"
0.5	89	0.0200	2.87		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
3.8	283	0.0060	1.25		Shallow Concentrated Flow, Primarily Grasses Unpaved Kv= 16.1 fps
10.1	472	Total			

Summary for Subcatchment 202C: Direct

Runoff = 2.74 cfs @ 12.12 hrs, Volume= 0.210 af, Depth> 3.46"
 Routed to Link 202 : To Abutter

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
9,657	83	1/4 acre lots, 38% imp, HSG C
3,305	65	Brush, Good, HSG C
17,975	74	>75% Grass cover, Good, HSG C
* 851	98	Pavement
31,788	76	Weighted Average
27,267	73	85.78% Pervious Area
4,521	98	14.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.0500	0.25		Sheet Flow, Lawns Grass: Short n= 0.150 P2= 3.30"
1.6	145	0.0086	1.49		Shallow Concentrated Flow, Grasses and Brush Unpaved Kv= 16.1 fps
8.3	245	Total			

Summary for Subcatchment 202D:

Runoff = 6.80 cfs @ 12.07 hrs, Volume= 0.508 af, Depth> 5.39"
 Routed to Pond D3 : Stone Base

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
* 39,061	98	Pervious Pavement (98% capture)
* 2,955	98	Sidewalk and Concrete
7,191	74	>75% Grass cover, Good, HSG C
49,207	94	Weighted Average
7,191	74	14.61% Pervious Area
42,016	98	85.39% Impervious Area

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

Summary for Subcatchment 202E: Building

Runoff = 2.13 cfs @ 12.07 hrs, Volume= 0.168 af, Depth> 5.86"
 Routed to Pond D2 : Stormtech310

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
* 15,000	98	Building
15,000	98	100.00% Impervious Area

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

Summary for Subcatchment 202F:

Runoff = 1.77 cfs @ 12.10 hrs, Volume= 0.131 af, Depth> 3.87"
 Routed to Link SW2 : Wet Swale

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
12,413	83	1/4 acre lots, 38% imp, HSG C
5,279	74	>75% Grass cover, Good, HSG C
17,692	80	Weighted Average
12,975	74	73.34% Pervious Area
4,717	98	26.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	87	0.0370	0.21		Sheet Flow, Lawns
					Grass: Short n= 0.150 P2= 3.30"
0.3	73	0.0822	4.62		Shallow Concentrated Flow, Grass/swale
					Unpaved Kv= 16.1 fps
7.0	160	Total			

Summary for Pond D1: Swale SW2 Ponding Area

Inflow Area = 0.649 ac, 22.78% Impervious, Inflow Depth > 3.76" for 25-YEAR event
 Inflow = 2.49 cfs @ 12.14 hrs, Volume= 0.204 af
 Outflow = 2.39 cfs @ 12.17 hrs, Volume= 0.203 af, Atten= 4%, Lag= 1.9 min
 Primary = 2.39 cfs @ 12.17 hrs, Volume= 0.203 af
 Routed to Link SW2 : Wet Swale

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 75.40' @ 12.17 hrs Surf.Area= 432 sf Storage= 246 cf
 Flood Elev= 76.00' Surf.Area= 566 sf Storage= 547 cf

Plug-Flow detention time= 1.7 min calculated for 0.203 af (100% of inflow)
 Center-of-Mass det. time= 1.5 min (820.1 - 818.6)

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Volume	Invert	Avail.Storage	Storage Description
#1	74.50'	1,236 cf	Depression (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
74.50	23	0	0
75.00	344	92	92
76.00	566	455	547
77.00	813	690	1,236

Device	Routing	Invert	Outlet Devices
#1	Primary	74.50'	12.0" Round 12" ADS L= 46.0' Ke= 0.500 Inlet / Outlet Invert= 74.50' / 73.00' S= 0.0326 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=2.39 cfs @ 12.17 hrs HW=75.40' TW=0.00' (Dynamic Tailwater)
 ↑1=12" ADS (Inlet Controls 2.39 cfs @ 3.22 fps)

Summary for Pond D2: Stormtech310

Inflow Area = 0.344 ac, 100.00% Impervious, Inflow Depth > 5.86" for 25-YEAR event
 Inflow = 2.13 cfs @ 12.07 hrs, Volume= 0.168 af
 Outflow = 2.13 cfs @ 12.07 hrs, Volume= 0.145 af, Atten= 0%, Lag= 0.0 min
 Discarded = 0.01 cfs @ 8.76 hrs, Volume= 0.010 af
 Primary = 2.13 cfs @ 12.07 hrs, Volume= 0.135 af
 Routed to Pond D3 : Stone Base

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 73.64' @ 12.07 hrs Surf.Area= 842 sf Storage= 1,001 cf

Plug-Flow detention time= 107.3 min calculated for 0.145 af (86% of inflow)
 Center-of-Mass det. time= 45.9 min (789.4 - 743.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	68.38'	644 cf	4.83'W x 174.08'L x 2.33'H Field A 1,963 cf Overall - 354 cf Embedded = 1,609 cf x 40.0% Voids
#2A	68.88'	354 cf	ADS_StormTech SC-310 +Cap x 24 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
#3	69.71'	5 cf	0.50'D x 6.00'H Downspouts x 4
		1,002 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#0	Primary	75.71'	Automatic Storage Overflow (Discharged without head)
#1	Discarded	68.38'	0.270 in/hr Exfiltration over Surface area
#2	Primary	71.50'	4.0" Horiz. Roof overflow pipes (front) X 2.00 C= 0.600 Limited to weir flow at low heads
#3	Primary	72.50'	4.0" Horiz. Roof overflow pipes (rear) X 2.00 C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.01 cfs @ 8.76 hrs HW=69.71' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=2.13 cfs @ 12.07 hrs HW=73.64' TW=68.30' (Dynamic Tailwater)
 ↑2=Roof overflow pipes (front) (Orifice Controls 1.23 cfs @ 7.04 fps)
 ↑3=Roof overflow pipes (rear) (Orifice Controls 0.90 cfs @ 5.14 fps)

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Summary for Pond D3: Stone Base

Inflow Area = 1.474 ac, 88.80% Impervious, Inflow Depth > 5.23" for 25-YEAR event
 Inflow = 8.92 cfs @ 12.07 hrs, Volume= 0.643 af
 Outflow = 1.54 cfs @ 12.52 hrs, Volume= 0.643 af, Atten= 83%, Lag= 26.7 min
 Discarded = 0.24 cfs @ 10.45 hrs, Volume= 0.318 af
 Primary = 1.30 cfs @ 12.52 hrs, Volume= 0.325 af
 Routed to Link SW2 : Wet Swale

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 68.61' @ 12.52 hrs Surf.Area= 39,061 sf Storage= 11,125 cf
 Flood Elev= 70.00' Surf.Area= 39,061 sf Storage= 29,003 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 91.7 min (863.8 - 772.1)

Volume	Invert	Avail.Storage	Storage Description
#1	67.75'	29,003 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 87,887 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
67.75	39,061	0	0
70.00	39,061	87,887	87,887

Device	Routing	Invert	Outlet Devices
#1	Primary	65.50'	12.0" Round 12" ADS L= 25.0' Ke= 0.500 Inlet / Outlet Invert= 65.50' / 65.25' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	67.85'	4.0" Vert. Underdrains X 4.00 C= 0.600 Limited to weir flow at low heads
#3	Discarded	67.75'	0.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.24 cfs @ 10.45 hrs HW=67.77' (Free Discharge)
 ↑ **3=Exfiltration** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=1.30 cfs @ 12.52 hrs HW=68.61' TW=0.00' (Dynamic Tailwater)
 ↑ **1=12" ADS** (Passes 1.30 cfs of 6.11 cfs potential flow)
 ↑ **2=Underdrains** (Orifice Controls 1.30 cfs @ 3.72 fps)

Summary for Pond D4: Swale SW1 Ponding Area

Inflow Area = 6.588 ac, 17.76% Impervious, Inflow Depth > 3.66" for 25-YEAR event
 Inflow = 21.12 cfs @ 12.22 hrs, Volume= 2.007 af
 Outflow = 20.22 cfs @ 12.26 hrs, Volume= 2.004 af, Atten= 4%, Lag= 2.6 min
 Discarded = 0.02 cfs @ 12.26 hrs, Volume= 0.012 af
 Primary = 20.20 cfs @ 12.26 hrs, Volume= 1.993 af
 Routed to Link SW1 : Conveyance Swale

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 66.03' @ 12.26 hrs Surf.Area= 3,532 sf Storage= 3,412 cf
 Flood Elev= 67.00' Surf.Area= 5,286 sf Storage= 7,684 cf

Plug-Flow detention time= 3.9 min calculated for 2.004 af (100% of inflow)
 Center-of-Mass det. time= 2.9 min (828.4 - 825.5)

Volume	Invert	Avail.Storage	Storage Description
#1	64.50'	7,684 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
64.50	825	0	0
65.00	1,812	659	659
66.00	3,476	2,644	3,303
67.00	5,286	4,381	7,684

Device	Routing	Invert	Outlet Devices
#1	Primary	64.50'	30.0" W x 18.0" H Box (2) 12"x30" X 2.00 L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 64.50' / 64.50' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 3.75 sf
#2	Discarded	64.50'	0.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.02 cfs @ 12.26 hrs HW=66.03' (Free Discharge)
 ↑ **2=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=20.20 cfs @ 12.26 hrs HW=66.03' TW=0.00' (Dynamic Tailwater)
 ↑ **1=(2) 12"x30"** (Barrel Controls 20.20 cfs @ 3.52 fps)

Summary for Link 202: To Abutter

Inflow Area = 9.847 ac, 28.83% Impervious, Inflow Depth > 3.49" for 25-YEAR event
 Inflow = 25.72 cfs @ 12.28 hrs, Volume= 2.861 af
 Primary = 25.72 cfs @ 12.28 hrs, Volume= 2.861 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Link SW1: Conveyance Swale

Inflow Area = 6.588 ac, 17.76% Impervious, Inflow Depth > 3.63" for 25-YEAR event
 Inflow = 20.20 cfs @ 12.26 hrs, Volume= 1.993 af
 Primary = 20.20 cfs @ 12.30 hrs, Volume= 1.992 af, Atten= 0%, Lag= 2.4 min
 Routed to Link 202 : To Abutter

Primary outflow = Inflow delayed by 2.4 min, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Link SW2: Wet Swale

Inflow Area = 2.529 ac, 61.88% Impervious, Inflow Depth > 3.13" for 25-YEAR event
 Inflow = 5.01 cfs @ 12.14 hrs, Volume= 0.659 af
 Primary = 5.00 cfs @ 12.16 hrs, Volume= 0.659 af, Atten= 0%, Lag= 1.5 min
 Routed to Link 202 : To Abutter

Primary outflow = Inflow delayed by 1.5 min, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

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Summary for Subcatchment 201: To Valley

Runoff = 0.39 cfs @ 12.07 hrs, Volume= 0.029 af, Depth> 7.51"

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
1,439	98	Valley Road Sidewalk and paved entrance
550	74	>75% Grass cover, Good, HSG C
1,989	91	Weighted Average
550	74	27.65% Pervious Area
1,439	98	72.35% Impervious Area

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

Summary for Subcatchment 202A: From Abutter

Runoff = 33.89 cfs @ 12.21 hrs, Volume= 3.256 af, Depth> 5.93"
 Routed to Pond D4 : Swale SW1 Ponding Area

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
134,093	83	1/4 acre lots, 38% imp, HSG C
152,874	74	>75% Grass cover, Good, HSG C
286,967	78	Weighted Average
236,012	74	82.24% Pervious Area
50,955	98	17.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		Sheet Flow, Lawms Grass: Short n= 0.150 P2= 3.30"
0.5	97	0.0400	3.22		Shallow Concentrated Flow, Lawns/Urban Unpaved Kv= 16.1 fps
1.8	500	0.0500	4.54		Shallow Concentrated Flow, Roads Paved Kv= 20.3 fps
2.7	586	0.0520	3.67		Shallow Concentrated Flow, Grasses Unpaved Kv= 16.1 fps
2.4	162	0.0050	1.14		Shallow Concentrated Flow, Grasses Unpaved Kv= 16.1 fps
15.6	1,445	Total			

Summary for Subcatchment 202B:

Runoff = 3.96 cfs @ 12.14 hrs, Volume= 0.328 af, Depth> 6.06"
 Routed to Pond D1 : Swale SW2 Ponding Area

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"

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Area (sf)	CN	Description
15,604	83	1/4 acre lots, 38% imp, HSG C
* 514	98	Basin (98% capture)
12,163	74	>75% Grass cover, Good, HSG C
28,281	79	Weighted Average
21,837	74	77.22% Pervious Area
6,444	98	22.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.0700	0.29		Sheet Flow, Grasses Grass: Short n= 0.150 P2= 3.30"
0.5	89	0.0200	2.87		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
3.8	283	0.0060	1.25		Shallow Concentrated Flow, Primarily Grasses Unpaved Kv= 16.1 fps
10.1	472	Total			

Summary for Subcatchment 202C: Direct

Runoff = 4.47 cfs @ 12.12 hrs, Volume= 0.347 af, Depth> 5.70"
 Routed to Link 202 : To Abutter

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
9,657	83	1/4 acre lots, 38% imp, HSG C
3,305	65	Brush, Good, HSG C
17,975	74	>75% Grass cover, Good, HSG C
* 851	98	Pavement
31,788	76	Weighted Average
27,267	73	85.78% Pervious Area
4,521	98	14.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.0500	0.25		Sheet Flow, Lawns Grass: Short n= 0.150 P2= 3.30"
1.6	145	0.0086	1.49		Shallow Concentrated Flow, Grasses and Brush Unpaved Kv= 16.1 fps
8.3	245	Total			

Summary for Subcatchment 202D:

Runoff = 9.73 cfs @ 12.07 hrs, Volume= 0.741 af, Depth> 7.87"
 Routed to Pond D3 : Stone Base

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
* 39,061	98	Pervious Pavement (98% capture)
* 2,955	98	Sidewalk and Concrete
7,191	74	>75% Grass cover, Good, HSG C
49,207	94	Weighted Average
7,191	74	14.61% Pervious Area
42,016	98	85.39% Impervious Area

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

Summary for Subcatchment 202E: Building

Runoff = 3.01 cfs @ 12.07 hrs, Volume= 0.240 af, Depth> 8.35"
 Routed to Pond D2 : Stormtech310

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
* 15,000	98	Building
15,000	98	100.00% Impervious Area

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

Summary for Subcatchment 202F:

Runoff = 2.79 cfs @ 12.10 hrs, Volume= 0.209 af, Depth> 6.18"
 Routed to Link SW2 : Wet Swale

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
12,413	83	1/4 acre lots, 38% imp, HSG C
5,279	74	>75% Grass cover, Good, HSG C
17,692	80	Weighted Average
12,975	74	73.34% Pervious Area
4,717	98	26.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	87	0.0370	0.21		Sheet Flow, Lawns
					Grass: Short n= 0.150 P2= 3.30"
0.3	73	0.0822	4.62		Shallow Concentrated Flow, Grass/swale
					Unpaved Kv= 16.1 fps
7.0	160	Total			

Summary for Pond D1: Swale SW2 Ponding Area

Inflow Area = 0.649 ac, 22.78% Impervious, Inflow Depth > 6.06" for 100-YEAR event
 Inflow = 3.96 cfs @ 12.14 hrs, Volume= 0.328 af
 Outflow = 3.60 cfs @ 12.19 hrs, Volume= 0.328 af, Atten= 9%, Lag= 3.0 min
 Primary = 3.60 cfs @ 12.19 hrs, Volume= 0.328 af
 Routed to Link SW2 : Wet Swale

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 75.90' @ 12.19 hrs Surf.Area= 545 sf Storage= 494 cf
 Flood Elev= 76.00' Surf.Area= 566 sf Storage= 547 cf

Plug-Flow detention time= 1.8 min calculated for 0.328 af (100% of inflow)
 Center-of-Mass det. time= 1.5 min (806.7 - 805.2)

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Volume	Invert	Avail.Storage	Storage Description
#1	74.50'	1,236 cf	Depression (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
74.50	23	0	0
75.00	344	92	92
76.00	566	455	547
77.00	813	690	1,236

Device	Routing	Invert	Outlet Devices
#1	Primary	74.50'	12.0" Round 12" ADS L= 46.0' Ke= 0.500 Inlet / Outlet Invert= 74.50' / 73.00' S= 0.0326 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=3.60 cfs @ 12.19 hrs HW=75.90' TW=0.00' (Dynamic Tailwater)
 ↑1=12" ADS (Inlet Controls 3.60 cfs @ 4.58 fps)

Summary for Pond D2: Stormtech310

Inflow Area = 0.344 ac, 100.00% Impervious, Inflow Depth > 8.35" for 100-YEAR event
 Inflow = 3.01 cfs @ 12.07 hrs, Volume= 0.240 af
 Outflow = 3.01 cfs @ 12.07 hrs, Volume= 0.217 af, Atten= 0%, Lag= 0.0 min
 Discarded = 0.01 cfs @ 7.19 hrs, Volume= 0.010 af
 Primary = 3.01 cfs @ 12.07 hrs, Volume= 0.207 af
 Routed to Pond D3 : Stone Base

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 75.22' @ 12.07 hrs Surf.Area= 842 sf Storage= 1,002 cf

Plug-Flow detention time= 88.3 min calculated for 0.217 af (90% of inflow)
 Center-of-Mass det. time= 39.6 min (778.6 - 739.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	68.38'	644 cf	4.83'W x 174.08'L x 2.33'H Field A 1,963 cf Overall - 354 cf Embedded = 1,609 cf x 40.0% Voids
#2A	68.88'	354 cf	ADS_StormTech SC-310 +Cap x 24 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
#3	69.71'	5 cf	0.50'D x 6.00'H Downspouts x 4
		1,002 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#0	Primary	75.71'	Automatic Storage Overflow (Discharged without head)
#1	Discarded	68.38'	0.270 in/hr Exfiltration over Surface area
#2	Primary	71.50'	4.0" Horiz. Roof overflow pipes (front) X 2.00 C= 0.600 Limited to weir flow at low heads
#3	Primary	72.50'	4.0" Horiz. Roof overflow pipes (rear) X 2.00 C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.01 cfs @ 7.19 hrs HW=69.71' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=3.01 cfs @ 12.07 hrs HW=75.22' TW=68.61' (Dynamic Tailwater)
 ↑2=Roof overflow pipes (front) (Orifice Controls 1.62 cfs @ 9.29 fps)
 ↑3=Roof overflow pipes (rear) (Orifice Controls 1.39 cfs @ 7.94 fps)

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Summary for Pond D3: Stone Base

Inflow Area = 1.474 ac, 88.80% Impervious, Inflow Depth > 7.72" for 100-YEAR event
 Inflow = 12.73 cfs @ 12.07 hrs, Volume= 0.948 af
 Outflow = 1.98 cfs @ 12.54 hrs, Volume= 0.940 af, Atten= 84%, Lag= 27.9 min
 Discarded = 0.24 cfs @ 9.17 hrs, Volume= 0.367 af
 Primary = 1.73 cfs @ 12.54 hrs, Volume= 0.573 af
 Routed to Link SW2 : Wet Swale

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 69.08' @ 12.54 hrs Surf.Area= 39,061 sf Storage= 17,122 cf
 Flood Elev= 70.00' Surf.Area= 39,061 sf Storage= 29,003 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 102.4 min (865.6 - 763.1)

Volume	Invert	Avail.Storage	Storage Description
#1	67.75'	29,003 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 87,887 cf Overall x 33.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
67.75	39,061	0	0
70.00	39,061	87,887	87,887

Device	Routing	Invert	Outlet Devices
#1	Primary	65.50'	12.0" Round 12" ADS L= 25.0' Ke= 0.500 Inlet / Outlet Invert= 65.50' / 65.25' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	67.85'	4.0" Vert. Underdrains X 4.00 C= 0.600 Limited to weir flow at low heads
#3	Discarded	67.75'	0.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.24 cfs @ 9.17 hrs HW=67.77' (Free Discharge)
 ↑ **3=Exfiltration** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=1.73 cfs @ 12.54 hrs HW=69.08' TW=0.00' (Dynamic Tailwater)
 ↑ **1=12" ADS** (Passes 1.73 cfs of 6.63 cfs potential flow)
 ↑ **2=Underdrains** (Orifice Controls 1.73 cfs @ 4.96 fps)

Summary for Pond D4: Swale SW1 Ponding Area

Inflow Area = 6.588 ac, 17.76% Impervious, Inflow Depth > 5.93" for 100-YEAR event
 Inflow = 33.89 cfs @ 12.21 hrs, Volume= 3.256 af
 Outflow = 31.83 cfs @ 12.27 hrs, Volume= 3.252 af, Atten= 6%, Lag= 3.2 min
 Discarded = 0.03 cfs @ 12.27 hrs, Volume= 0.014 af
 Primary = 31.80 cfs @ 12.27 hrs, Volume= 3.239 af
 Routed to Link SW1 : Conveyance Swale

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 66.61' @ 12.27 hrs Surf.Area= 4,577 sf Storage= 5,753 cf
 Flood Elev= 67.00' Surf.Area= 5,286 sf Storage= 7,684 cf

Plug-Flow detention time= 3.6 min calculated for 3.252 af (100% of inflow)
 Center-of-Mass det. time= 2.8 min (814.7 - 811.9)

Volume	Invert	Avail.Storage	Storage Description
#1	64.50'	7,684 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
64.50	825	0	0
65.00	1,812	659	659
66.00	3,476	2,644	3,303
67.00	5,286	4,381	7,684

Device	Routing	Invert	Outlet Devices
#1	Primary	64.50'	30.0" W x 18.0" H Box (2) 12"x30" X 2.00 L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 64.50' / 64.50' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 3.75 sf
#2	Discarded	64.50'	0.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.03 cfs @ 12.27 hrs HW=66.61' (Free Discharge)
 ↑ **2=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=31.78 cfs @ 12.27 hrs HW=66.61' TW=0.00' (Dynamic Tailwater)
 ↑ **1=(2) 12"x30"** (Barrel Controls 31.78 cfs @ 4.24 fps)

Summary for Link 202: To Abutter

Inflow Area = 9.847 ac, 28.83% Impervious, Inflow Depth > 5.72" for 100-YEAR event
 Inflow = 40.21 cfs @ 12.29 hrs, Volume= 4.693 af
 Primary = 40.21 cfs @ 12.29 hrs, Volume= 4.693 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Link SW1: Conveyance Swale

Inflow Area = 6.588 ac, 17.76% Impervious, Inflow Depth > 5.90" for 100-YEAR event
 Inflow = 31.80 cfs @ 12.27 hrs, Volume= 3.239 af
 Primary = 31.80 cfs @ 12.31 hrs, Volume= 3.237 af, Atten= 0%, Lag= 2.4 min
 Routed to Link 202 : To Abutter

Primary outflow = Inflow delayed by 2.4 min, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Link SW2: Wet Swale

Inflow Area = 2.529 ac, 61.88% Impervious, Inflow Depth > 5.27" for 100-YEAR event
 Inflow = 7.41 cfs @ 12.14 hrs, Volume= 1.110 af
 Primary = 7.41 cfs @ 12.16 hrs, Volume= 1.110 af, Atten= 0%, Lag= 1.5 min
 Routed to Link 202 : To Abutter

Primary outflow = Inflow delayed by 1.5 min, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs



APPENDIX E SUPPLEMENTARY CALCULATIONS



WS1: Wet Swale (HydroCAD ID SW2)

Project: 18225.5 Valley Crossing

Water Quality Volume Calculation (RIDEM Minimum Standard 3):

Pavement =	0	sf		
Driveways =	0	sf		
Buildings =	0	sf		
Offsite Impervious*:	10,646	sf	WQ_R:	887 cf
Total Disturbed Area:	n/a	sf		
Ponding Area:	<i>varies</i>	sf		
Depth of Ponding:	<i>varies</i>	ft		
Total Storage:	900	cf		

* Off-site impervious = area of abutting residential neighborhoods in subcatchments 202B and 202F multiplied by the % impervious (15,604 + 12,413 *.38)



D2: Infiltration system
Project: 18225.5 Valley Crossing

Impervious Area*: 15,000 sf

Water Recharge Volume Calculations:

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

Impervious Area: 15,000 sf **F =** 0.25

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

$$WRec_v = \mathbf{313} \text{ cf}$$

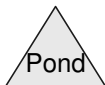
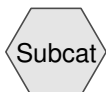
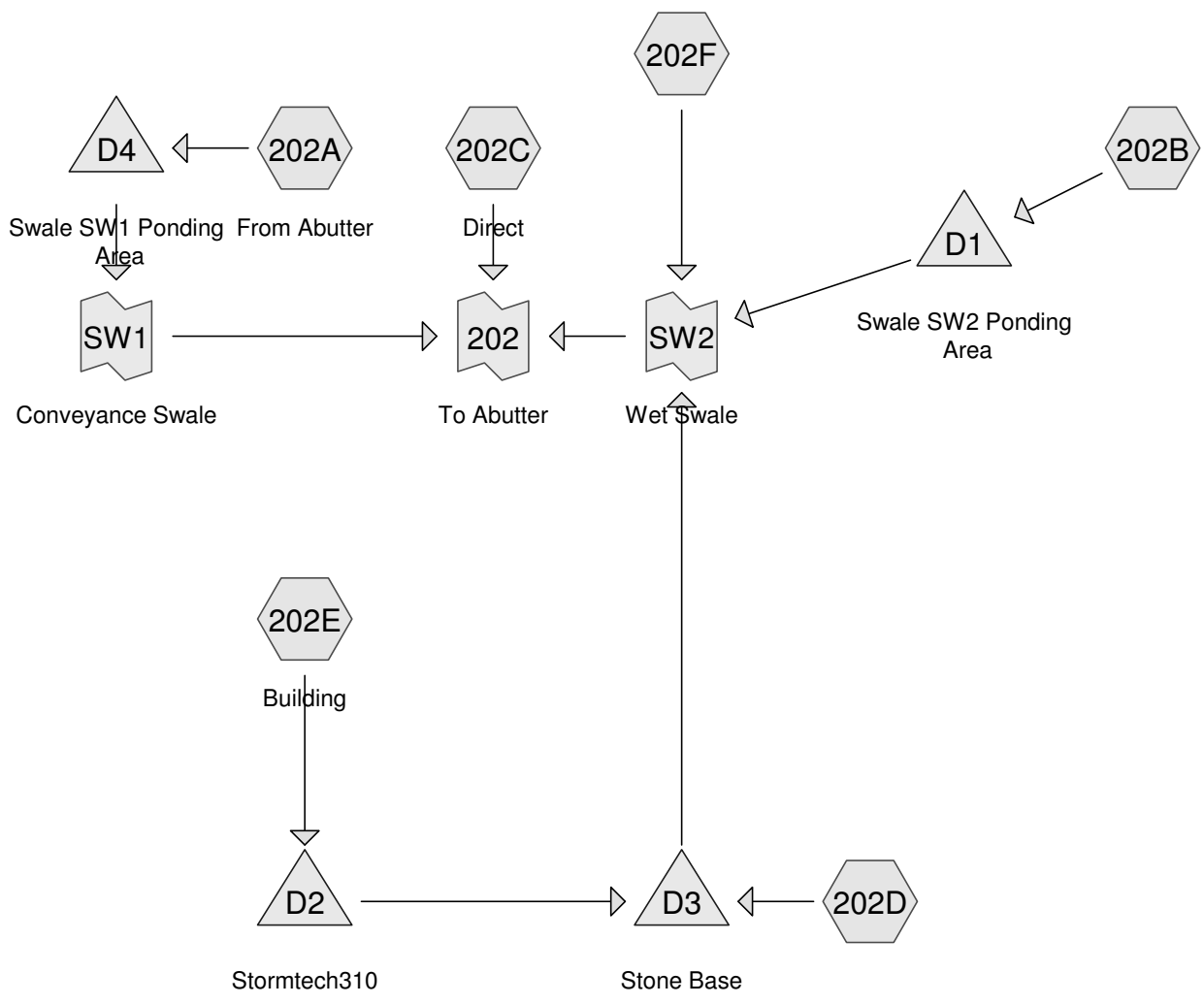
Volume of Infiltration for a WQ storm:** 348 cf

* Structure only

** Inf. system volume as shown in the HydroCAD analysis for the WQ storm (24-hr)



APPENDIX F WQ STORM ANALYSIS (SPLIT PERVIOUS METHOD)



Routing Diagram for 2022-08-23 lot b18225
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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.943	83	1/4 acre lots, 38% imp, HSG C (202A, 202B, 202C, 202F)
4.488	74	>75% Grass cover, Good, HSG C (202A, 202B, 202C, 202D, 202F)
0.012	98	Basin (98% capture) (202B)
0.076	65	Brush, Good, HSG C (202C)
0.344	98	Building (202E)
0.020	98	Pavement (202C)
0.897	98	Pervious Pavement (98% capture) (202D)
0.068	98	Sidewalk and Concrete (202D)

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Summary for Subcatchment 202A: From Abutter

Runoff = 0.96 cfs @ 12.21 hrs, Volume= 0.123 af, Depth> 0.22"
 Routed to Pond D4 : Swale SW1 Ponding Area

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr WQ Rainfall=1.20"

Area (sf)	CN	Description
134,093	83	1/4 acre lots, 38% imp, HSG C
152,874	74	>75% Grass cover, Good, HSG C
286,967	78	Weighted Average
236,012	74	82.24% Pervious Area
50,955	98	17.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		Sheet Flow, Lawms Grass: Short n= 0.150 P2= 3.30"
0.5	97	0.0400	3.22		Shallow Concentrated Flow, Lawns/Urban Unpaved Kv= 16.1 fps
1.8	500	0.0500	4.54		Shallow Concentrated Flow, Roads Paved Kv= 20.3 fps
2.7	586	0.0520	3.67		Shallow Concentrated Flow, Grasses Unpaved Kv= 16.1 fps
2.4	162	0.0050	1.14		Shallow Concentrated Flow, Grasses Unpaved Kv= 16.1 fps
15.6	1,445	Total			

Summary for Subcatchment 202B:

Runoff = 0.14 cfs @ 12.13 hrs, Volume= 0.015 af, Depth> 0.27"
 Routed to Pond D1 : Swale SW2 Ponding Area

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Type III 24-hr WQ Rainfall=1.20"

Area (sf)	CN	Description
15,604	83	1/4 acre lots, 38% imp, HSG C
* 514	98	Basin (98% capture)
12,163	74	>75% Grass cover, Good, HSG C
28,281	79	Weighted Average
21,837	74	77.22% Pervious Area
6,444	98	22.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.0700	0.29		Sheet Flow, Grasses Grass: Short n= 0.150 P2= 3.30"
0.5	89	0.0200	2.87		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
3.8	283	0.0060	1.25		Shallow Concentrated Flow, Primarily Grasses Unpaved Kv= 16.1 fps
10.1	472	Total			

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Summary for Subcatchment 202C: DirectRunoff = 0.11 cfs @ 12.11 hrs, Volume= 0.011 af, Depth> 0.18"
Routed to Link 202 : To AbutterRunoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr WQ Rainfall=1.20"

Area (sf)	CN	Description
9,657	83	1/4 acre lots, 38% imp, HSG C
3,305	65	Brush, Good, HSG C
17,975	74	>75% Grass cover, Good, HSG C
* 851	98	Pavement
31,788	76	Weighted Average
27,267	73	85.78% Pervious Area
4,521	98	14.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.0500	0.25		Sheet Flow, Lawns Grass: Short n= 0.150 P2= 3.30"
1.6	145	0.0086	1.49		Shallow Concentrated Flow, Grasses and Brush Unpaved Kv= 16.1 fps
8.3	245	Total			

Summary for Subcatchment 202D:Runoff = 1.09 cfs @ 12.07 hrs, Volume= 0.080 af, Depth> 0.85"
Routed to Pond D3 : Stone BaseRunoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr WQ Rainfall=1.20"

Area (sf)	CN	Description
* 39,061	98	Pervious Pavement (98% capture)
* 2,955	98	Sidewalk and Concrete
7,191	74	>75% Grass cover, Good, HSG C
49,207	94	Weighted Average
7,191	74	14.61% Pervious Area
42,016	98	85.39% Impervious Area

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

Summary for Subcatchment 202E: BuildingRunoff = 0.39 cfs @ 12.07 hrs, Volume= 0.028 af, Depth> 0.98"
Routed to Pond D2 : Stormtech310Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr WQ Rainfall=1.20"

Area (sf)	CN	Description
* 15,000	98	Building
15,000	98	100.00% Impervious Area

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

Summary for Subcatchment 202F:

Runoff = 0.11 cfs @ 12.10 hrs, Volume= 0.010 af, Depth> 0.31"
Routed to Link SW2 : Wet Swale

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr WQ Rainfall=1.20"

Area (sf)	CN	Description
12,413	83	1/4 acre lots, 38% imp, HSG C
5,279	74	>75% Grass cover, Good, HSG C
17,692	80	Weighted Average
12,975	74	73.34% Pervious Area
4,717	98	26.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	87	0.0370	0.21		Sheet Flow, Lawns Grass: Short n= 0.150 P2= 3.30"
0.3	73	0.0822	4.62		Shallow Concentrated Flow, Grass/swale Unpaved Kv= 16.1 fps
7.0	160	Total			

Summary for Pond D1: Swale SW2 Ponding Area

Inflow Area = 0.649 ac, 22.78% Impervious, Inflow Depth > 0.27" for WQ event
Inflow = 0.14 cfs @ 12.13 hrs, Volume= 0.015 af
Outflow = 0.14 cfs @ 12.16 hrs, Volume= 0.015 af, Atten= 3%, Lag= 1.6 min
Primary = 0.14 cfs @ 12.16 hrs, Volume= 0.015 af
Routed to Link SW2 : Wet Swale

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 74.68' @ 12.16 hrs Surf.Area= 138 sf Storage= 14 cf
Flood Elev= 76.00' Surf.Area= 566 sf Storage= 547 cf

Plug-Flow detention time= 2.8 min calculated for 0.015 af (100% of inflow)
Center-of-Mass det. time= 2.1 min (822.7 - 820.6)

Volume	Invert	Avail.Storage	Storage Description
#1	74.50'	1,236 cf	Depression (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
74.50	23	0	0
75.00	344	92	92
76.00	566	455	547
77.00	813	690	1,236

Device	Routing	Invert	Outlet Devices
#1	Primary	74.50'	12.0" Round 12" ADS L= 46.0' Ke= 0.500 Inlet / Outlet Invert= 74.50' / 73.00' S= 0.0326 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

Primary OutFlow Max=0.14 cfs @ 12.16 hrs HW=74.68' TW=0.00' (Dynamic Tailwater)

↑1=12" ADS (Inlet Controls 0.14 cfs @ 1.44 fps)

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Summary for Pond D2: Stormtech310

Inflow Area = 0.344 ac, 100.00% Impervious, Inflow Depth > 0.98" for WQ event
 Inflow = 0.39 cfs @ 12.07 hrs, Volume= 0.028 af
 Outflow = 0.01 cfs @ 12.39 hrs, Volume= 0.008 af, Atten= 99%, Lag= 19.1 min
 Discarded = 0.01 cfs @ 12.39 hrs, Volume= 0.008 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Pond D3 : Stone Base

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 70.43' @ 20.13 hrs Surf.Area= 842 sf Storage= 904 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 118.9 min (899.5 - 780.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	68.38'	644 cf	4.83'W x 174.08'L x 2.33'H Field A 1,963 cf Overall - 354 cf Embedded = 1,609 cf x 40.0% Voids
#2A	68.88'	354 cf	ADS StormTech SC-310 +Cap x 24 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
#3	69.71'	5 cf	0.50'D x 6.00'H Downspouts x 4
		1,002 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#0	Primary	75.71'	Automatic Storage Overflow (Discharged without head)
#1	Discarded	68.38'	0.270 in/hr Exfiltration over Surface area
#2	Primary	71.50'	4.0" Horiz. Roof overflow pipes (front) X 2.00 C= 0.600 Limited to weir flow at low heads
#3	Primary	72.50'	4.0" Horiz. Roof overflow pipes (rear) X 2.00 C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.01 cfs @ 12.39 hrs HW=69.71' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=68.38' TW=67.75' (Dynamic Tailwater)

↑ **2=Roof overflow pipes (front)** (Controls 0.00 cfs)

↑ **3=Roof overflow pipes (rear)** (Controls 0.00 cfs)

Summary for Pond D3: Stone Base

Inflow Area = 1.474 ac, 88.80% Impervious, Inflow Depth > 0.65" for WQ event
 Inflow = 1.09 cfs @ 12.07 hrs, Volume= 0.080 af
 Outflow = 0.24 cfs @ 12.06 hrs, Volume= 0.080 af, Atten= 78%, Lag= 0.0 min
 Discarded = 0.24 cfs @ 12.06 hrs, Volume= 0.080 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Link SW2 : Wet Swale

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 67.81' @ 12.47 hrs Surf.Area= 39,061 sf Storage= 736 cf
 Flood Elev= 70.00' Surf.Area= 39,061 sf Storage= 29,003 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 14.6 min (797.4 - 782.8)

Volume	Invert	Avail.Storage	Storage Description
#1	67.75'	29,003 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 87,887 cf Overall x 33.0% Voids

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
67.75	39,061	0	0
70.00	39,061	87,887	87,887

Device	Routing	Invert	Outlet Devices
#1	Primary	65.50'	12.0" Round 12" ADS L= 25.0' Ke= 0.500 Inlet / Outlet Invert= 65.50' / 65.25' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	67.85'	4.0" Vert. Underdrains X 4.00 C= 0.600 Limited to weir flow at low heads
#3	Discarded	67.75'	0.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.24 cfs @ 12.06 hrs HW=67.77' (Free Discharge)↑**3=Exfiltration** (Exfiltration Controls 0.24 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=67.75' TW=0.00' (Dynamic Tailwater)↑**1=12" ADS** (Passes 0.00 cfs of 5.00 cfs potential flow)↑**2=Underdrains** (Controls 0.00 cfs)

Summary for Pond D4: Swale SW1 Ponding Area

Inflow Area = 6.588 ac, 17.76% Impervious, Inflow Depth > 0.22" for WQ event
 Inflow = 0.96 cfs @ 12.21 hrs, Volume= 0.123 af
 Outflow = 0.91 cfs @ 12.26 hrs, Volume= 0.123 af, Atten= 5%, Lag= 3.2 min
 Discarded = 0.01 cfs @ 12.26 hrs, Volume= 0.009 af
 Primary = 0.90 cfs @ 12.26 hrs, Volume= 0.113 af
 Routed to Link SW1 : Conveyance Swale

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 64.75' @ 12.26 hrs Surf.Area= 1,317 sf Storage= 267 cf

Flood Elev= 67.00' Surf.Area= 5,286 sf Storage= 7,684 cf

Plug-Flow detention time= 11.0 min calculated for 0.123 af (99% of inflow)

Center-of-Mass det. time= 7.3 min (842.3 - 835.0)

Volume	Invert	Avail.Storage	Storage Description
#1	64.50'	7,684 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
64.50	825	0	0
65.00	1,812	659	659
66.00	3,476	2,644	3,303
67.00	5,286	4,381	7,684

Device	Routing	Invert	Outlet Devices
#1	Primary	64.50'	30.0" W x 18.0" H Box (2) 12"x30" X 2.00 L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 64.50' / 64.50' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 3.75 sf
#2	Discarded	64.50'	0.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.01 cfs @ 12.26 hrs HW=64.75' (Free Discharge)↑**2=Exfiltration** (Exfiltration Controls 0.01 cfs)**Primary OutFlow** Max=0.90 cfs @ 12.26 hrs HW=64.75' TW=0.00' (Dynamic Tailwater)↑**1=(2) 12"x30"** (Barrel Controls 0.90 cfs @ 0.97 fps)

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Summary for Link 202: To Abutter

Inflow Area = 9.847 ac, 28.83% Impervious, Inflow Depth > 0.18" for WQ event
Inflow = 1.12 cfs @ 12.28 hrs, Volume= 0.149 af
Primary = 1.12 cfs @ 12.28 hrs, Volume= 0.149 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Link SW1: Conveyance Swale

Inflow Area = 6.588 ac, 17.76% Impervious, Inflow Depth > 0.21" for WQ event
Inflow = 0.90 cfs @ 12.26 hrs, Volume= 0.113 af
Primary = 0.90 cfs @ 12.30 hrs, Volume= 0.113 af, Atten= 0%, Lag= 2.4 min
Routed to Link 202 : To Abutter

Primary outflow = Inflow delayed by 2.4 min, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Link SW2: Wet Swale

Inflow Area = 2.529 ac, 61.88% Impervious, Inflow Depth > 0.12" for WQ event
Inflow = 0.24 cfs @ 12.13 hrs, Volume= 0.025 af
Primary = 0.24 cfs @ 12.15 hrs, Volume= 0.025 af, Atten= 0%, Lag= 1.5 min
Routed to Link 202 : To Abutter

Primary outflow = Inflow delayed by 1.5 min, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs



APPENDIX G SOIL EVALUATIONS

TH1

Depth	Horizon	Color	Redoximorphic Features	Texture	Structure/Grade	Parent Material
0 – 7	Ap	2.5Y 3/2	7.5YR 4/6	SL	1 M GR	Lodgement till
7 – 25	Bw	2.5Y 4/2	7.5YR 4/6	FSL	1 M SBK	Lodgement till
25 – 75	Cdg	5Y 4/1	7.5YR 4/6	CH SiL	2 M PL	Lodgement till
Test Hole	Total Depth	Depth to Ledge	Depth to Seep	SHWT		
TH1	75	75	55	3		

TH2

Depth	Horizon	Color	Redoximorphic Features	Texture	Structure/Grade	Parent Material
0 – 16	Ap	2.5Y 3/2	-	FSL	1 M GR	Lodgement till
16 – 35	Bw	2.5Y 4/2	-	VFSL	1 M SBK	Lodgement till
35 – 101	Cd	5Y 4/1	7.5YR 4/6	CH SiL	2 M PL	Lodgement till
Test Hole	Total Depth	Depth to Ledge	Depth to Seep	SHWT		
TH2	101	none	none	39		

TH3

Depth	Horizon	Color	Redoximorphic Features	Texture	Structure/Grade	Parent Material
0 – 15	Ap	2.5Y 3/2	-	FSL	1 M GR	Lodgement till
15 – 41	Bw	2.5Y 5/1	7.5YR 4/6	VFSL	1 M SBK	Lodgement till
41 – 71	Cd	2.5Y 5/1	7.5YR 4/6	CH SiL	2 M PL	Lodgement till
Test Hole	Total Depth	Depth to Ledge	Depth to Seep	SHWT		
TH3	71	none	60	32		

TH4

Depth	Horizon	Color	Redoximorphic Features	Texture	Structure/Grade	Parent Material
0 – 7	Ap	2.5Y 3/3	-	FSL	1 C GR	Lodgement till
7 – 54	Bw	2.5Y 5/3	@24 F, 3, D @32 C, 4, D @32 F, 4, D concentrations line 48"-54"	CH SiL	1 M SBK	Lodgement till
54 – 96	Cd	5Y 4/2	-	CH SiL	2 M PL	Lodgement till
Test Hole	Total Depth	Depth to Ledge	Depth to Seep	SHWT		
TH4	96	none	dry	24		

TH5

Depth	Horizon	Color	Redoximorphic Features	Texture	Structure/Grade	Parent Material
0 – 8	Ap	2.5Y 3/3	-	FSL	1 C GR	Lodgement till
8 – 42	Bw1	2.5Y 5/3	@19 F, 2, D @21 F, 4, D depletions @27 C, 4, D	CH SiL	1 M SBK	Lodgement till
42 – 62	Bw2	2.5Y 6/4	-	SiL	2 M SBK	Lodgement till
62 - 96	Cd	5Y 4/2	Depletions and C, 4, D	CH SiL	1 M PL	Lodgement till
Test Hole	Total Depth		Depth to Ledge	Depth to Seep	SHWT	
TH5	96		none	dry	18	

TH6

Depth	Horizon	Color	Redoximorphic Features	Texture	Structure/Grade	Parent Material
0 – 9	Ap	2.5Y 3/3	-	FSL	1 C GR	Lodgement till
9 – 18	Bw1	2.5Y 4/4	-	CH SiL	1 M SBK	Lodgement till
18 – 53	Bw2	2.5Y 4/3	@27 C, 4, D and C, 5, D depletions	SiL	1 M SBK	Lodgement till
53 - 96	Cd	5Y 4/2	C, 3, D and C, 4, D depletions throughout	CH SiL	1 M PL	Lodgement till
Test Hole		Total Depth	Depth to Ledge	Depth to Seep		SHWT
TH6		96	none	dry		27

TH7

Depth	Horizon	Color	Redoximorphic Features	Texture	Structure/Grade	Parent Material
0 – 9	Ap	2.5Y 3/3	-	GR FSL	1 C GR	Lodgement till
9 – 28	Bw	2.5Y 5/3	-	GR SiL	1 M SBK	Lodgement till
28 – 72	Cd	5Y 4/2	@39 C, 3, D depletions	VCOB LS	0 SG	Lodgement till
72	R	-	-	-	-	-
Test Hole		Total Depth	Depth to Ledge	Depth to Seep		SHWT
TH7		72	72	dry		39

SUMMARY TABLE

<i>Test Hole</i>	Total Depth	Depth to Ledge	Depth to Seep	SHWT
<i>TH1</i>	75	75	55	3
<i>TH2</i>	101	none	none	39
<i>TH3</i>	71	none	60	32
<i>TH4</i>	96	none	dry	24
<i>TH5</i>	96	none	dry	18
<i>TH6</i>	96	none	dry	27
<i>TH7</i>	72	72	dry	39

CLOSING

Thank you for giving AES the opportunity to assist you with preliminary planning of this project. AES has completed the onsite soil evaluations for this property. Please review the preceding data tables that describe the explored soils. In addition, the attached map depicts the test hole locations. AES staff has used a Spectra SP20 submetric GPS unit to locate the soil evaluations which are numbered consistent with the numbering of the data tables. This does not constitute a survey but is useful in preliminary planning and is generally sufficient for soil evaluation purposes. Please do not hesitate to let me know if you have any questions and best of luck moving forward.



APPENDIX H RISDISM STORMWATER CHECKLIST (APPENDIX A)

APPENDIX A: STORMWATER MANAGEMENT PLAN CHECKLIST AND LID PLANNING REPORT – STORMWATER DESIGN SUMMARY

PROJECT NAME: Valley Crossing I	(RIDEM USE ONLY)
TOWN: Middletown RI	STW/WQC File #:
BRIEF PROJECT DESCRIPTION: Construction of a 15k sf medical office building on a vacant property with associated parking, utilities and stormwater control	Date Received:

Stormwater Management Plan (SMP) Elements – Minimum Standards

When submitting a SMP,¹ submit **four separately bound** documents: Appendix A Checklist; Stormwater Site Planning, Analysis and Design Report with Plan Set/Drawings; Soil Erosion and Sediment Control (SESC) Plan, and Post Construction Operations and Maintenance (O&M) Plan. Please refer to [Suggestions to Promote Brevity](#).

Note: All stormwater construction projects **must create** a Stormwater Management Plan (SMP). However, not every element listed below is required per the [RIDEM Stormwater Rules](#) and the [RIPDES Construction General Permit \(CGP\)](#). This checklist will help identify the required elements to be submitted with an Application for Stormwater Construction Permit & Water Quality Certification.

PART 1. PROJECT AND SITE INFORMATION

PROJECT TYPE (Check all that apply)

<input type="checkbox"/> Residential	<input checked="" type="checkbox"/> Commercial	<input type="checkbox"/> Federal	<input type="checkbox"/> Retrofit	<input type="checkbox"/> Restoration
<input type="checkbox"/> Road	<input type="checkbox"/> Utility	<input type="checkbox"/> Fill	<input type="checkbox"/> Dredge	<input type="checkbox"/> Mine
<input type="checkbox"/> Other (specify):				

SITE INFORMATION

Vicinity Map

INITIAL DISCHARGE LOCATION(S): The WQv discharges to: (You may choose more than one answer if several discharge points are associated with the project.)

<input checked="" type="checkbox"/> Groundwater	<input type="checkbox"/> Surface Water	<input type="checkbox"/> MS4
<input type="checkbox"/> GAA	<input type="checkbox"/> Isolated Wetland	<input type="checkbox"/> RIDOT
<input checked="" type="checkbox"/> GA	<input type="checkbox"/> Named Waterbody	<input type="checkbox"/> RIDOT Alteration Permit is Approved
<input type="checkbox"/> GB	<input type="checkbox"/> Unnamed Waterbody Connected to Named Waterbody	<input type="checkbox"/> Town
<input type="checkbox"/> Other (specify):		

ULTIMATE RECEIVING WATERBODY LOCATION(S): Include pertinent information that applies to both WQv and flow from larger storm events including overflows. Choose all that apply, and repeat table for each waterbody.

<input checked="" type="checkbox"/> Groundwater or Disconnected Wetland	<input type="checkbox"/> SRWP
<input checked="" type="checkbox"/> Waterbody Name: Bailey Brook	<input type="checkbox"/> Coldwater <input type="checkbox"/> Warmwater <input type="checkbox"/> Unassessed
<input checked="" type="checkbox"/> Waterbody ID: RI0007035R-01	<input type="checkbox"/> 4 th order stream of pond 50 acres or more
<input checked="" type="checkbox"/> TMDL for: Enterococcus	<input type="checkbox"/> Watershed of flood prone river (e.g., Pocasset River)
<input checked="" type="checkbox"/> Contributes to a priority outfall listed in the TMDL	<input type="checkbox"/> Contributes stormwater to a public beach
<input checked="" type="checkbox"/> 303(d) list – Impairment(s) for: enterococcus, phosphorus, Lead	<input type="checkbox"/> Contributes to shellfishing grounds

¹ Applications for a Construction General Permit that do not require any other permits from RIDEM and will disturb less than 5 acres over the entire course of the project do not need to submit a SMP. The Appendix A checklist must still be submitted.

PROJECT HISTORY		
<input type="checkbox"/> RIDEM Pre- Application Meeting	Meeting Date:	<input type="checkbox"/> Minutes Attached
<input type="checkbox"/> Municipal Master Plan Approval	Approval Date:	<input type="checkbox"/> Minutes Attached
<input type="checkbox"/> Subdivision Suitability Required	Approval #:	
<input type="checkbox"/> Previous Enforcement Action has been taken on the property	Enforcement #:	
FLOODPLAIN & FLOODWAY See Guidance Pertaining to Floodplain and Floodways		
<input checked="" type="checkbox"/> Riverine 100-year floodplain: FEMA FLOODPLAIN FIRMETTE has been reviewed and the 100-year floodplain is on site		
<input checked="" type="checkbox"/> Delineated from FEMA Maps		
NOTE: Per Rule 250-RICR-150-10-8-1.1(B)(5)(d)(3), provide volumetric floodplain compensation calculations for cut and fill/displacement calculated by qualified professional		
<input type="checkbox"/> Calculated by Professional Engineer		
<input type="checkbox"/> Calculations are provided for cut vs. fill/displacement volumes proposed within the 100-year floodplain	Amount of Fill (CY):	
	Amount of Cut (CY):	
<input type="checkbox"/> Restrictions or modifications are proposed to the flow path or velocities in a floodway		
<input type="checkbox"/> Floodplain storage capacity is impacted		
<input checked="" type="checkbox"/> Project area is not within 100-year floodplain as defined by RIDEM		

CRMC JURISDICTION
<input type="checkbox"/> CRMC Assent required
<input type="checkbox"/> Property subject to a Special Area Management Plan (SAMP). If so, specify which SAMP:
<input type="checkbox"/> Sea level rise mitigation has been designed into this project

LUHPPL IDENTIFICATION - MINIMUM STANDARD 8:		
1. OFFICE OF Land Revitalization and Sustainable Materials Management (OLRSMM)		
<input type="checkbox"/> Known or suspected releases of HAZARDOUS MATERIAL are present at the site (Hazardous Material is defined in Rule 1.4(A)(33) of 250-140-30-1 of the RIDEM Rules and Regulations for Investigation and Remediation of Hazardous Materials (the Remediation Regulations))		RIDEM CONTACT:
<input type="checkbox"/> Known or suspected releases of PETROLEUM PRODUCT are present at the site (Petroleum Product as defined in Rule 1.5(A)(84) of 250-140-25-1 of the RIDEM Rules and Regulations for Underground Storage Facilities Used for Regulated Substances and Hazardous Materials)		
<input type="checkbox"/> This site is identified on the RIDEM Environmental Resources Map as one of the following regulated facilities		SITE ID#:
<input type="checkbox"/> CERCLIS/Superfund (NPL)		
<input type="checkbox"/> State Hazardous Waste Site (SHWS)		
<input type="checkbox"/> Environmental Land Usage Restriction (ELUR)		
<input type="checkbox"/> Leaking Underground Storage Tank (LUST)		
<input type="checkbox"/> Closed Landfill		
Note: If any boxes in 1 above are checked, the applicant must contact the RIDEM OLRSM Project Manager associated with the Site to determine if subsurface infiltration of stormwater is allowable for the project. Indicate if the infiltration corresponds to "Red," "Yellow" or "Green" as described in Section 3.2.8 of the RISDISM Guidance (Subsurface Contamination Guidance). Also, note and reference approval in PART 3, Minimum Standard 2: Groundwater Recharge/Infiltration.		
2. PER MINIMUM STANDARD 8 of RICR 8.14.C.1-6 "LUHPPLS," THE SITE IS/HAS:		
<input type="checkbox"/> Industrial Site with RIPDES MSGP, except where No Exposure Certification exists. http://www.dem.ri.gov/programs/water/permits/ripdes/stormwater/status.php		
<input type="checkbox"/> Auto Fueling Facility (e.g., gas station)		
<input type="checkbox"/> Exterior Vehicles Service, Maintenance, or Equipment Cleaning Area		

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

<input type="checkbox"/>	Road Salt Storage and Loading Areas (exposed to rainwater)	
<input type="checkbox"/>	Outdoor Storage and Loading/Unloading of Hazardous Substances	
3. STORMWATER INDUSTRIAL PERMITTING		
<input type="checkbox"/>	The site is associated with existing or proposed activities that are considered Land Uses with Higher Potential Pollutant Loads (LUHPPLS) (see RICR 8.14.C)	Activities: Sector:
<input type="checkbox"/>	Construction is proposed on a site that is subject to THE MULTI-SECTOR GENERAL PERMIT (MSGP) UNDER RULE 31(B)15 OF THE RIPDES REGULATIONS.	MSGP permit #
<input type="checkbox"/>	Additional stormwater treatment is required by the MSGP Explain:	

REDEVELOPMENT STANDARD – MINIMUM STANDARD 6		
<input checked="" type="checkbox"/> Pre Construction Impervious Area		
<input checked="" type="checkbox"/>	Total Pre-Construction Impervious Area (TIA): 0 acres	
<input checked="" type="checkbox"/>	Total Site Area (TSA) 2.25 acres	
<input checked="" type="checkbox"/>	Jurisdictional Wetlands (JW) 0.14 acres	
<input checked="" type="checkbox"/>	Conservation Land (CL) 0.00 acres	
<input checked="" type="checkbox"/> Calculate the Site Size (defined as contiguous properties under same ownership)		
<input checked="" type="checkbox"/>	Site Size (SS) = (TSA) – (JW) – (CL) = 2.11 acres	
<input checked="" type="checkbox"/>	(TIA) / (SS) = 0.0	<input type="checkbox"/> (TIA) / (SS) >0.4?
<input type="checkbox"/> YES, Redevelopment		

PART 2. LOW IMPACT DEVELOPMENT ASSESSMENT – MINIMUM STANDARD 1

Note: A written description must be provided specifying why each method is not being used or is not applicable at the Site. Appropriate answers may include:

- Town requires ... (state the specific local requirement)
- Meets Town’s dimensional requirement of ...
- Not practical for site because ...
- Applying for waiver/variance to achieve this (pending/approved/denied)
- Applying for wavier/variance to seek relief from this (pending/approved/denied)

A) PRESERVATION OF UNDISTURBED AREAS, BUFFERS, AND FLOODPLAINS	
<input checked="" type="checkbox"/> Sensitive resource areas and site constraints are identified (required)	
<input checked="" type="checkbox"/> Local development regulations have been reviewed (required)	
<input checked="" type="checkbox"/> All vegetated buffers and coastal and freshwater wetlands will be protected during and after construction	
<input type="checkbox"/> Conservation Development or another site design technique has been incorporated to protect open space and pre-development hydrology. Note: If Conservation Development has been used, check box and skip to Subpart C	
<input checked="" type="checkbox"/> As much natural vegetation and pre-development hydrology as possible has been maintained	

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<p>B) LOCATE DEVELOPMENT IN LESS SENSITIVE AREAS AND WORK WITH THE NATURAL LANDSCAPE CONDITIONS, HYDROLOGY, AND SOILS</p> <ul style="list-style-type: none"> <input type="checkbox"/> Development sites and building envelopes have been appropriately distanced from wetlands and waterbodies <input type="checkbox"/> Development and stormwater systems have been located in areas with greatest infiltration capacity (e.g., soil groups A and B) <input type="checkbox"/> Plans show measures to prevent soil compaction in areas designated as Qualified Pervious Areas (QPA's) <input type="checkbox"/> Development sites and building envelopes have been positioned outside of floodplains <input checked="" type="checkbox"/> Site design positions buildings, roadways and parking areas in a manner that avoids impacts to surface water features <input checked="" type="checkbox"/> Development sites and building envelopes have been located to minimize impacts to steep slopes ($\geq 15\%$) <input type="checkbox"/> Other (describe): 	<p>No type A or B soils located on site.</p> <p>No steep slopes are present on site.</p>
<p>C) MINIMIZE CLEARING AND GRADING</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Site clearing has been restricted to <u>minimum area needed</u> for building footprints, development activities, construction access, and safety. <input type="checkbox"/> Site has been designed to position buildings, roadways, and parking areas in a manner that minimizes grading (cut and fill quantities) <input type="checkbox"/> Protection for stands of trees and individual trees and their root zones to be preserved has been specified, and such protection extends at least to the tree canopy drip line(s) <input type="checkbox"/> Plan notes specify that public trees removed or damaged during construction shall be replaced with equivalent 	<p>There are minimal trees located in the area of development along Valley Road. These trees are to be removed.</p>
<p>D) REDUCE IMPERVIOUS COVER</p> <ul style="list-style-type: none"> <input type="checkbox"/> Reduced roadway widths (≤ 22 feet for ADT ≤ 400; ≤ 26 feet for ADT 400 - 2,000) <input type="checkbox"/> Reduced driveway areas (length minimized via reduced ROW width (≤ 45 ft.) and/or reduced (or absolute minimum) front yard setback; width minimized to ≤ 9 ft. wide one lane; ≤ 18 ft. wide two lanes; shared driveways; pervious surface) <input type="checkbox"/> Reduced building footprint: Explain approach: <input type="checkbox"/> Reduced sidewalk area (≤ 4 ft. wide; one side of the street; unpaved path; pervious surface) <input type="checkbox"/> Reduced cul-de-sacs (radius < 45 ft; vegetated island; alternative turn-around) <input type="checkbox"/> Reduced parking lot area: Explain approach <input checked="" type="checkbox"/> Use of pervious surfaces for driveways, sidewalks, parking areas/overflow parking areas, etc. <input checked="" type="checkbox"/> Minimized impervious surfaces (project meets or is less than maximum specified by Zoning Ordinance) <input type="checkbox"/> Other (describe): 	<p>Entire parking lot is proposed as pervious pavement.</p>
<p>E) DISCONNECT IMPERVIOUS AREA</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Impervious surfaces have been disconnected, and runoff has been diverted to QPAs to the maximum extent possible <input type="checkbox"/> Residential street edges allow side-of-the-road drainage into vegetated open swales <input checked="" type="checkbox"/> Parking lot landscaping breaks up impervious expanse AND accepts runoff <input type="checkbox"/> Other (describe): 	
<p>F) MITIGATE RUNOFF AT THE POINT OF GENERATION</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Small-scale BMPs have been designated to treat runoff as close as possible to the source 	

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<p>G) PROVIDE LOW-MAINTENANCE NATIVE VEGETATION</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Low-maintenance landscaping has been proposed using native species and cultivars <input type="checkbox"/> Plantings of native trees and shrubs in areas previously cleared of native vegetation are shown on site plan <input checked="" type="checkbox"/> Lawn areas have been limited/minimized, and yards have been kept undisturbed to the maximum extent practicable on residential lots 	
<p>H) RESTORE STREAMS/WETLANDS</p> <ul style="list-style-type: none"> <input type="checkbox"/> Historic drainage patterns have been restored by removing closed drainage systems, daylighting buried streams, and/or restoring degraded stream channels and/or wetlands <input type="checkbox"/> Removal of invasive species <input type="checkbox"/> Other 	N/A

PART 3. SUMMARY OF REMAINING STANDARDS

GROUNDWATER RECHARGE – MINIMUM STANDARD 2		
YES	NO	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	The project has been designed to meet the groundwater recharge standard.
<input type="checkbox"/>	<input type="checkbox"/>	If “No,” the justification for groundwater recharge criterion waiver has been explained in the Narrative (e.g., threat of groundwater contamination or physical limitation), if applicable (see RICR 8.8.D);
<input type="checkbox"/>	<input type="checkbox"/>	Your waiver request has been explained in the Narrative, if applicable.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Is this site identified as a Regulated Facility in Part 1, Minimum Standard 8: LUHPPL Identification?
<input type="checkbox"/>	<input type="checkbox"/>	If “Yes,” has approval for infiltration by the OLRSM Site Project Manager, per Part 1, Minimum Standard 8, been requested?

TABLE 2-1: Summary of Recharge (see RISDISM Section 3.3.2)

Design Point	Impervious Area Treated (sq ft)	Total Re _v Required (cu ft)	LID Stormwater Credits (see RISDISM Section 4.6.1)	Recharge Required by Remaining BMPs (cu ft)	Recharge Provided by BMPs (cu ft)
			Portion of Re _v directed to a QPA (cu ft)		
DP-1: Northern Abutter	0.34	313	0	313	348
DP-2:					
DP-3:					
DP-4:					
TOTALS:					

Notes:

1. Only BMPs listed in RISDISM Table 3-5 “List of BMPs Acceptable for Recharge” may be used to meet the recharge requirement.
2. Recharge requirement must be satisfied for each waterbody ID.

Indicate where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.):

Stormwater Report: Appendix E “Supplementary Calculations”

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

WATER QUALITY – MINIMUM STANDARD 3		
YES	NO	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Does this project meet or exceed the required water quality volume WQv (see RICR 8.9.E-I)?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Is the proposed final impervious cover greater than 20% of the disturbed area (see RICR 8.9.E-I)?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	If “Yes,” either the Modified Curve Number Method or the Split Pervious/Impervious method in Hydro-CAD was used to calculate WQv; or,
<input checked="" type="checkbox"/>	<input type="checkbox"/>	If “Yes,” either TR-55 or TR-20 was used to calculate WQv; and,
<input checked="" type="checkbox"/>	<input type="checkbox"/>	If “No,” the project meets the minimum WQv of 0.2 watershed inches over the entire disturbed area.
<input type="checkbox"/>	<input type="checkbox"/>	Not Applicable
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Does this project meet or exceed the ability to treat required water quality flow WQf (see RICR 8.9.I.1-3)?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Does this project propose an increase of impervious cover to a receiving water body with impairments? If “Yes,” please indicate below the method that was used to address the water quality requirements of no further degradation to a low-quality water. BMPs have been designed in accordance with the manual. WQ provided exceeds that which is required. Downstream water body is impaired for bacteria per TMDL.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	RICR 8.36. A Pollutant Loading Analysis is needed and has been completed.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	The Water Quality Guidance Document (Water Quality Goals and Pollutant Loading Analysis Guidance for Discharges to Impaired Waters) has been followed as applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	BMPs are proposed that are on the approved technology list . If “Yes,” please provide all required worksheets from the manufacturer.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Additional pollutant-specific requirements and/or pollutant removal efficiencies are applicable to the site as the result of a TMDL, SAMP, or other watershed-specific requirements. If “Yes,” please describe: Treatment provided for off-site impervious surfaces to compensate for pollutants generated by the development.

TABLE 3-1: Summary of Water Quality (see RICR 8.9)					
Design Point	Impervious area treated (ac. Ft.)	Total WQv Required (cu ft)	LID Stormwater Credits (see RICR 8.18)	Water Quality Treatment Remaining (cu ft)	Water Quality Provided by BMPs (cu ft)
			WQv directed to a QPA (cu ft)		
Abutton (SC310)	0.344	1,250	0	1,250	1,250
Abutton (P. Pavement)	0.897	3,255	0	3,255	3,255
Abutton (wet swale)	0.244	892	0	892	900
TOTALS:				5,397	5,405
Notes:					
1. Only BMPs listed in RICR 8.20 and 8.25 or the Approved Technologies List of BMPs is Acceptable for Water Quality treatment.					
2. For each Design Point, the Water Quality Volume Standard must be met for each Waterbody ID.					
<input checked="" type="checkbox"/> YES	This project has met the setback requirements for each BMP.				
<input type="checkbox"/> NO	If “No,” please explain:				
<input checked="" type="checkbox"/>	Indicate where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.): Stormwater Report: Appendix E “Supplementary Calculations”				

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

CONVEYANCE AND NATURAL CHANNEL PROTECTION (RICR 8.10) – MINIMUM STANDARD 4		
YES	NO	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Is this standard waived? If “Yes,” please indicate one or more of the reasons below:
		<input type="checkbox"/> The project directs discharge to a large river (i.e., 4th-order stream or larger. See RISDISM Appendix I for State-wide list and map of stream orders), bodies of water >50.0 acres in surface area (i.e., lakes, ponds, reservoirs), or tidal waters. <input checked="" type="checkbox"/> The project is a small facility with impervious cover of less than or equal to 1 acre. (Pavement is Pervious) <input type="checkbox"/> The project has a post-development peak discharge rate from the facility that is less than 2 cfs for the 1-year, 24-hour Type III design storm event (prior to any attenuation). (<u>Note</u> : LID design strategies can greatly reduce the peak discharge rate).
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Conveyance and natural channel protection for the site have been met. If “No,” explain why:

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

OVERBANK FLOOD PROTECTION (RICR 8.11) AND OTHER POTENTIAL HIGH FLOWS – MINIMUM STANDARD 5		
YES	NO	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Is this standard waived? If yes, please indicate one or more of the reasons below:
		<input type="checkbox"/> The project directs discharge to a large river (i.e., 4th-order stream or larger. See Appendix I for state-wide list and map of stream orders), bodies of water >50.0 acres in surface area (i.e., lakes, ponds, reservoirs), or tidal waters. <input type="checkbox"/> A Downstream Analysis (see RICR 8.11.D and E) indicates that peak discharge control would not be beneficial or would exacerbate peak flows in a downstream tributary of a particular site (e.g., through coincident peaks).
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Does the project flow to an MS4 system or subject to other stormwater requirements? If "Yes," indicate as follows:
		<input checked="" type="checkbox"/> RIDOT <input type="checkbox"/> Other (specify):
<p>Note: The project could be approved by RIDEM but not meet RIDOT or Town standards. RIDOT's regulations indicate that post-volumes must be less than pre-volumes for the 10-yr storm at the design point entering the RIDOT system. If you have not already received approval for the discharge to an MS4, please explain below your strategy to comply with RIDEM and the MS4.</p>		
		Indicate below which model was used for your analysis. <input type="checkbox"/> TR-55 <input type="checkbox"/> TR-20 <input checked="" type="checkbox"/> HydroCAD <input type="checkbox"/> Bentley/Haestad <input type="checkbox"/> Intellisolve <input type="checkbox"/> Other (Specify):
YES	NO	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Does the drainage design demonstrate that flows from the 100-year storm event through a BMP will safely manage and convey the 100-year storm? If "No," please explain briefly below and reference where in the application further documentation can be found (i.e., name of report/document, page numbers, appendices, etc.):
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Do off-site areas contribute to the sub-watersheds and design points? If "Yes,"
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Are the areas modeled as "present condition" for both pre- and post-development analysis?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Are the off-site areas shown on the subwatershed maps?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Does the drainage design confirm safe passage of the 100-year flow through the site for off-site runoff?
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Is a Downstream Analysis required (see RICR 8.11.E.1)?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Calculate the following:
		<input checked="" type="checkbox"/> Area of disturbance within the sub-watershed (areas) 2.0 acres
		<input checked="" type="checkbox"/> Impervious cover (%) 17%
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Is a dam breach analysis required (earthen embankments over six (6) feet in height, or a capacity of 15 acre-feet or more, and contributes to a significant or high hazard dam)?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Does this project meet the overbank flood protection standard?

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

Table 5-1 Hydraulic Analysis Summary

Subwatershed (Design Point)	1.2" Peak Flow (cfs) **		1-yr Peak Flow (cfs)		10-yr Peak Flow (cfs)		100-yr Peak Flow (cfs)	
	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)
DP-1: Valley Rd	0.03	0.04	0.09	0.10	0.18	0.21	0.33	0.39
DP-2: Abutter	1.12	1.12	7.31	6.59	20.25	18.55	45.51	40.21
DP-3:								
DP-4:								
TOTALS:								

** Utilize modified curve number method or split pervious /impervious method in HydroCAD.

Note: The hydraulic analysis must demonstrate no impact to each individual subwatershed DP unless each DP discharges to the same wetland or water resource.

Indicate as follows where the pertinent calculations and/or information for the items above are provided	Name of report/document, page numbers, appendices, etc.
Existing conditions analysis for each subwatershed, including curve numbers, times of concentration, runoff rates, volumes, and water surface elevations showing methodologies used and supporting calculations.	Stormwater Report Appendix C
Proposed conditions analysis for each subwatershed, including curve numbers, times of concentration, runoff rates, volumes, water surface elevations, and routing showing the methodologies used and supporting calculations.	Stormwater Report Appendix D
Final sizing calculations for structural stormwater BMPs, including contributing drainage area, storage, and outlet configuration.	Stormwater Report Appendix E
Stage-storage, inflow and outflow hydrographs for storage facilities (e.g., detention, retention, or infiltration facilities).	n/a

Table 5-2 Summary of Best Management Practices

BMP ID	DP #	BMP Type (e.g., bioretention, tree filter)	BMP Functions					Bypass Type	Horizontal Setback Criteria are met per RICR 8.21.B.10, 8.22.D.11, and 8.35.B.4		
			Pre-Treatment (Y/N/NA)	Re _v	WQ _v	CP _v (Y/N/NA)	Overbank Flood Reduction (Y/N/NA)		External (E) Internal (I) or NA	Yes/No	Technical Justification (Design Report page number)
D-2	202	Infiltration Chambers	N	348 cf	1,250 cf	N	N	E	Y		
SW2	202	Wet Swale	N	0	900	N	N	NA	Y		
D-3	202	Perv. Pave.	N	3,484	3,484	N	N	NA	Y		
		TOTALS:									

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

Table 5.3 Summary of Soils to Evaluate Each BMP									
DP #	BMP ID	BMP Type (e.g., bioretention, tree filter)	Soils Analysis for Each BMP						
			Test Pit ID# and Ground Elevation		SHWT Elevation (ft)	Bottom of Practice Elevation* (ft)	Separation Distance Provided (ft)	Hydrologic Soil Group (A, B, C, D)	Exfiltration Rate Applied (in/hr)
			Primary	Secondary					
202	D-2	UG chambers	TH#4		65.38	68.28	3	C	0.27
202	SW2	Wet swale	TH#5		75.5 / 73	74 / 72	-1.0	C	n/a
202	D-3	Perv. Pave,	TH#4		64	68.25	Varies	C	0.27
		TOTALS:							

* For underground infiltration systems (UICs) bottom equals bottom of stone, for surface infiltration basins bottom equals bottom of basin, for filters bottom equals interface of storage and top of filter layer

LAND USES WITH HIGHER POTENTIAL POLLUTANTS LOADS (LUHPPLs) – MINIMUM STANDARD 8			
YES	NO	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Describe any LUHPPLs identified in Part 1, Minimum Standard 8, Section 2. If not applicable, continue to Minimum Standard 9.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Are these activities already covered under an MSGP? If “No,” please explain if you have applied for an MSGP or intend to do so?
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	List the specific BMPs that are proposed for this project that receive stormwater from LUHPPL drainage areas. These BMP types must be listed in RISDISM Table 3-3, “Acceptable BMPs for Use at LUHPPLs.” Please list BMPs:
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Additional BMPs, or additional pretreatment BMP’s if any, that meet RIPDES MSGP requirements; Please list BMPs:
			Indicate below where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.).

ILLICIT DISCHARGES – MINIMUM STANDARD 9			
Illicit discharges are defined as unpermitted discharges to Waters of the State that do not consist entirely of stormwater or uncontaminated groundwater, except for certain discharges identified in the RIPDES Phase II Stormwater General Permit.			
YES	NO	N/A	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Have you checked for illicit discharges?
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Have any been found and/or corrected? If “Yes,” please identify.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Does your report explain preventative measures that keep non-stormwater discharges out of the Waters of the State (during and after construction)?

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SOIL EROSION AND SEDIMENT CONTROL (SESC) – MINIMUM STANDARD 10		
YES	NO	N/A
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<p>Have you included a Soil Erosion and Sediment Control Plan Set and/or Complete Construction Plan Set?</p> <p>Have you provided a separately-bound document based upon the SESC Template? If yes, proceed to Minimum Standard 11 (the following items can be assumed to be addressed).</p> <p>If “No,” include a document with your submittal that addresses the following elements of an SESC Plan:</p> <p><input type="checkbox"/> Soil Erosion and Sediment Control Plan Project Narrative, including a description of how the fifteen (15) Performance Criteria have been met:</p> <p><input type="checkbox"/> Provide Natural Buffers and Maintain Existing Vegetation</p> <p><input type="checkbox"/> Minimize Area of Disturbance</p> <p><input type="checkbox"/> Minimize the Disturbance of Steep Slopes</p> <p><input type="checkbox"/> Preserve Topsoil</p> <p><input type="checkbox"/> Stabilize Soils</p> <p><input type="checkbox"/> Protect Storm Drain Inlets</p> <p><input type="checkbox"/> Protect Storm Drain Outlets</p> <p><input type="checkbox"/> Establish Temporary Controls for the Protection of Post-Construction Stormwater Control Measures</p> <p><input type="checkbox"/> Establish Perimeter Controls and Sediment Barriers</p> <p><input type="checkbox"/> Divert or Manage Run-On from Up-Gradient Areas</p> <p><input type="checkbox"/> Properly Design Constructed Stormwater Conveyance Channels</p> <p><input type="checkbox"/> Retain Sediment On-Site</p> <p><input type="checkbox"/> Control Temporary Increases in Stormwater Velocity, Volume, and Peak Flows</p> <p><input type="checkbox"/> Apply Construction Activity Pollution Prevention Control Measures</p> <p><input type="checkbox"/> Install, Inspect, and Maintain Control Measures and Take Corrective Actions</p> <p><input type="checkbox"/> Qualified SESC Plan Preparer’s Information and Certification</p> <p><input type="checkbox"/> Operator’s Information and Certification; if not known at the time of application, the Operator must certify the SESC Plan upon selection and prior to initiating site activities</p> <p><input type="checkbox"/> Description of Control Measures, such as Temporary Sediment Trapping and Conveyance Practices, including design calculations and supporting documentation, as required</p>

STORMWATER MANAGEMENT SYSTEM OPERATION, MAINTENANCE, AND POLLUTION PREVENTION PLAN – MINIMUM STANDARDS 7 AND 9		
Operation and Maintenance Section		
YES	NO	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Have you minimized all sources of pollutant contact with stormwater runoff, to the maximum extent practicable?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Have you provided a separately-bound Operation and Maintenance Plan for the site and for all of the BMPs, and does it address each element of RICR 8.17 and RISDISM Appendix C and E?
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Lawn, Garden, and Landscape Management meet the requirements of RISDISM Section G.7? If “No,” why not?
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Is the property owner or homeowner’s association responsible for the stormwater maintenance of all BMP’s? If “No,” you must provide a legally binding and enforceable maintenance agreement (see RISDISM Appendix E, page 26) that identifies the entity that will be responsible for maintenance of the stormwater. Indicate where this agreement can be found in your report (i.e., name of report/document, page numbers, appendices, etc.).
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Do you anticipate that you will need legal agreements related to the stormwater structures? (e.g. off-site easements, deed restrictions, covenants, or ELUR per the Remediation Regulations). If “Yes,” have you obtained them? Or please explain your plan to obtain them:

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

<input type="checkbox"/>	<input checked="" type="checkbox"/>	Is stormwater being directed from public areas to private property? If "Yes," note the following: <u>Note:</u> This is not allowed unless a funding mechanism is in place to provide the finances for the long-term maintenance of the BMP and drainage, or a funding mechanism is demonstrated that can guarantee the long-term maintenance of a stormwater BMP by an individual homeowner.
Pollution Prevention Section		
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Designated snow stockpile locations?
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Trash racks to prevent floatables, trash, and debris from discharging to Waters of the State?
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Asphalt-only based sealants?
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Pet waste stations? (<u>Note:</u> If a receiving water has a bacterial impairment, and the project involves housing units, then this could be an important part of your pollution prevention plan).
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Regular sweeping? Please describe: (Vacuuming of pervious pavement required)
<input type="checkbox"/>	<input checked="" type="checkbox"/>	De-icing specifications, in accordance with RISDISM Appendix G. (NOTE: If the groundwater is GAA, or this area contributes to a drinking water supply, then this could be an important part of your pollution prevention plan).
<input type="checkbox"/>	<input checked="" type="checkbox"/>	A prohibition of phosphate-based fertilizers? (<u>Note:</u> If the site discharges to a phosphorus impaired waterbody, then this could be an important part of your pollution prevention plan).

PART 4. SUBWATERSHED MAPPING AND SITE-PLAN DETAILS

Existing and Proposed Subwatershed Mapping (REQUIRED)		
YES	NO	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Existing and proposed drainage area delineations
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Locations of all streams and drainage swales
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Drainage flow paths, mapped according to the DEM <i>Guidance for Preparation of Drainage Area Maps</i> (included in RISDISM Appendix K)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Complete drainage area boundaries; include off-site areas in both mapping and analyses, as applicable
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Logs of borings and/or test pit investigations along with supporting soils/geotechnical report
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Mapped seasonal high-water-table test pit locations
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Mapped locations of the site-specific borings and/or test pits and soils information from the test pits at the locations of the BMPs
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Mapped locations of the BMPs, with the BMPs consistently identified on the Site Construction Plans
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Mapped bedrock outcrops adjacent to any infiltration BMP
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Soils were logged by a:
	<input checked="" type="checkbox"/>	DEM-licensed Class IV soil evaluator Name: Ed Avizinis
	<input type="checkbox"/>	RI-registered P.E. Name:

Subwatershed and Impervious Area Summary				
Subwatershed (area to each design point)	First Receiving Water ID or MS4	Area Disturbed (units)	Existing Impervious (units)	Proposed Impervious (units)
DP-1: Valley Road	RI0007035R-01	0.04	0.03	0.03
DP-2: Abutter	RI0007035R-01	1.96	0.0	0.344
DP-3:				
TOTALS:		2.0	0.03	0.374

Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8)

Site Construction Plans (Indicate that the following applicable specifications are provided)		
YES	NO	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Existing and proposed plans (scale not greater than 1" = 40') with North arrow
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Existing and proposed site topography (with 1 or 2-foot contours); 10-foot contours accepted for off-site areas
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Boundaries of existing predominant vegetation and proposed limits of clearing
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Site Location clarification
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Location and field-verified boundaries of resource protection areas such as: <ul style="list-style-type: none"> ▶ freshwater and coastal wetlands, including lakes and ponds ▶ coastal shoreline features Perennial and intermittent streams, in addition to Areas Subject to Storm Flowage (ASSFs)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	All required setbacks (e.g., buffers, water-supply wells, septic systems)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Representative cross-section and profile drawings, and notes and details of structural stormwater management practices and conveyances (i.e., storm drains, open channels, swales, etc.), which include: <ul style="list-style-type: none"> ▶ Location and size of the stormwater treatment practices (type of practice, depth, area). Stormwater treatment practices (BMPs) must have labels that correspond to RISDISM Table 5-2; ▶ Design water surface elevations (applicable storms); ▶ Structural details of outlet structures, embankments, spillways, stilling basins, grade-control structures, conveyance channels, etc.; ▶ Existing and proposed structural elevations (e.g., inverts of pipes, manholes, etc.); ▶ Location of floodplain and, if applicable, floodway limits and relationship of site to upstream and downstream properties or drainage that could be affected by work in the floodplain; ▶ Planting plans for structural stormwater BMPs, including species, size, planting methods, and maintenance requirements of proposed planting
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Logs of borings and/or test pit investigations along with supporting soils/geotechnical report and corresponding water tables
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Mapping of any OLRSM-approv ed remedial actions/systems (including ELURs)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Location of existing and proposed roads, buildings, and other structures including limits of disturbance; <ul style="list-style-type: none"> ▶ Existing and proposed utilities (e.g., water, sewer, gas, electric) and easements; ▶ Location of existing and proposed conveyance systems, such as grass channels, swales, and storm drains, and location(s) of final discharge point(s) (wetland, waterbody, etc.); ▶ Cross sections of roadways, with edge details such as curbs and sidewalks; ▶ Location and dimensions of channel modifications, such as bridge or culvert crossings
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Locations, cross sections, and profiles of all stream or wetland crossings and their method of stabilization



APPENDIX I 72-HOUR DRAIN DOWN TABLE AND GW MOUNDING

2022-08-23 lot b18225

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

Type III 24-hr WQ Rainfall=1.20"

Printed 9/20/2022

Hydrograph for Pond D3: Stone Base

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.00	0	67.75	0.00	0.00	0.00
0.50	0.00	0	67.75	0.00	0.00	0.00
1.00	0.00	0	67.75	0.00	0.00	0.00
1.50	0.00	0	67.75	0.00	0.00	0.00
2.00	0.00	0	67.75	0.00	0.00	0.00
2.50	0.00	0	67.75	0.00	0.00	0.00
3.00	0.00	0	67.75	0.00	0.00	0.00
3.50	0.00	0	67.75	0.00	0.00	0.00
4.00	0.00	0	67.75	0.00	0.00	0.00
4.50	0.00	0	67.75	0.00	0.00	0.00
5.00	0.00	0	67.75	0.00	0.00	0.00
5.50	0.00	0	67.75	0.00	0.00	0.00
6.00	0.01	0	67.75	0.01	0.01	0.00
6.50	0.01	0	67.75	0.01	0.01	0.00
7.00	0.01	0	67.75	0.01	0.01	0.00
7.50	0.01	0	67.75	0.01	0.01	0.00
8.00	0.02	0	67.75	0.02	0.02	0.00
8.50	0.02	0	67.75	0.02	0.02	0.00
9.00	0.03	0	67.75	0.03	0.03	0.00
9.50	0.03	0	67.75	0.03	0.03	0.00
10.00	0.04	0	67.75	0.04	0.04	0.00
10.50	0.05	0	67.75	0.05	0.05	0.00
11.00	0.07	0	67.75	0.07	0.07	0.00
11.50	0.11	0	67.75	0.11	0.11	0.00
12.00	0.73	157	67.76	0.24	0.24	0.00
12.50	0.21	734	67.81	0.24	0.24	0.00
13.00	0.09	518	67.79	0.24	0.24	0.00
13.50	0.07	222	67.77	0.24	0.24	0.00
14.00	0.06	0	67.75	0.00	0.00	0.00
14.50	0.05	0	67.75	0.00	0.00	0.00
15.00	0.04	0	67.75	0.00	0.00	0.00
15.50	0.04	0	67.75	0.00	0.00	0.00
16.00	0.03	0	67.75	0.00	0.00	0.00
16.50	0.03	0	67.75	0.00	0.00	0.00
17.00	0.03	0	67.75	0.00	0.00	0.00
17.50	0.02	0	67.75	0.00	0.00	0.00
18.00	0.02	0	67.75	0.00	0.00	0.00
18.50	0.02	0	67.75	0.00	0.00	0.00
19.00	0.02	0	67.75	0.00	0.00	0.00
19.50	0.02	0	67.75	0.00	0.00	0.00
20.00	0.02	0	67.75	0.00	0.00	0.00
20.50	0.01	0	67.75	0.00	0.00	0.00
21.00	0.01	0	67.75	0.00	0.00	0.00
21.50	0.01	0	67.75	0.00	0.00	0.00
22.00	0.01	0	67.75	0.00	0.00	0.00
22.50	0.01	0	67.75	0.00	0.00	0.00
23.00	0.01	0	67.75	0.00	0.00	0.00
23.50	0.01	0	67.75	0.00	0.00	0.00
24.00	0.01	0	67.75	0.00	0.00	0.00

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.

Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. **The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed** otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

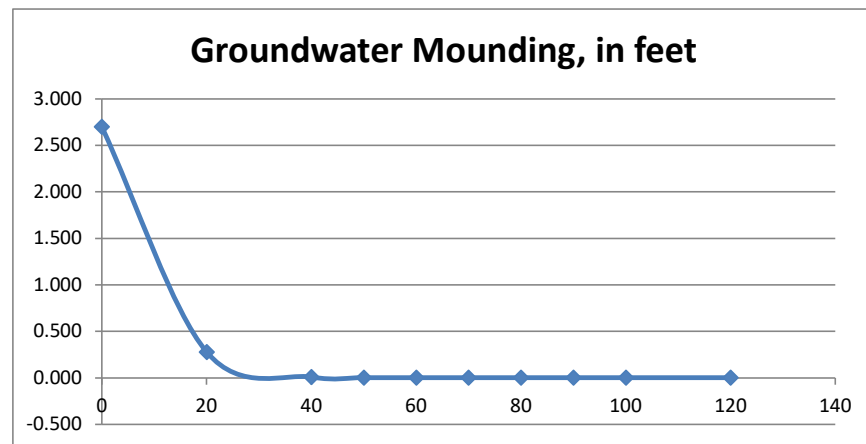
Input Values		use consistent units (e.g. feet & days or inches & hours)	Conversion Table	
			inch/hour	feet/day
0.5400	R	Recharge (infiltration) rate (feet/day)	0.67	1.33
0.080	Sy	Specific yield, Sy (dimensionless, between 0 and 1)		
0.26	K	Horizontal hydraulic conductivity, Kh (feet/day)*	2.00	4.00
2.000	x	1/2 length of basin (x direction, in feet)		
86.000	y	1/2 width of basin (y direction, in feet)	hours	days
2.000	t	duration of infiltration period (days)	36	1.50
15.000	hi(0)	initial thickness of saturated zone (feet)		
17.699	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)		
2.699	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)		

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
2.699	0
0.278	20
0.010	40
0.005	50
0.005	60
0.005	70
0.005	80
0.005	90
0.005	100
0.005	120



Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.