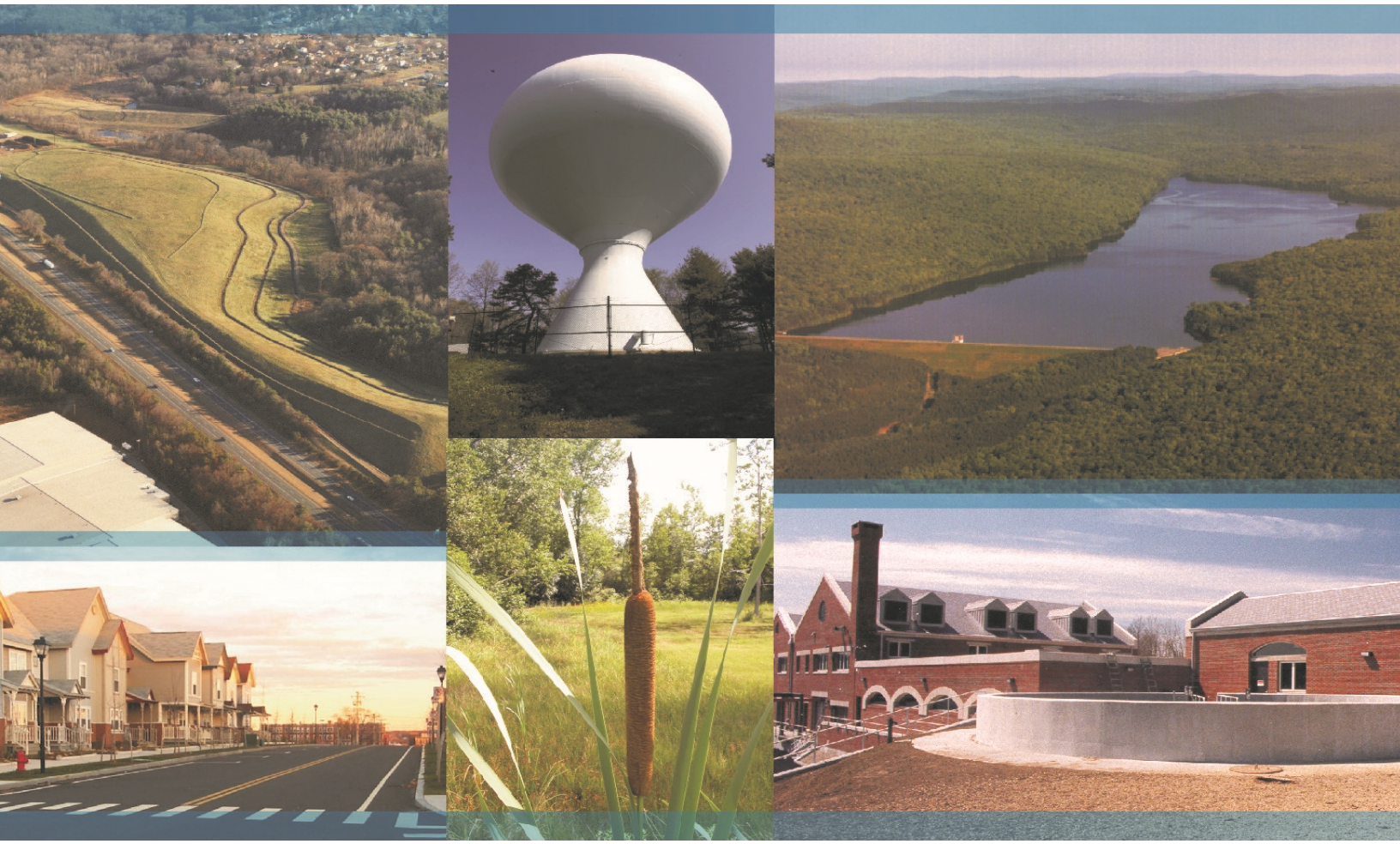

Shingle Mill Multi-Family Development
75 - 79 Pond Street
Rockland, Massachusetts 02370

STORMWATER MANAGEMENT REPORT

Jones Street Residential
100 High Street, Suite 2500
Boston, Massachusetts 02110

July 13, 2020

Last Revised: February 19 2021

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Tighe&Bond

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Project Description

The proposed project is located on a parcel at 0 Pond Street in Rockland, Massachusetts. The existing site is mostly wetlands that nearly surround an undeveloped, partially cleared upland area.The proposed project is to construct two new apartment buildings with their associated parking lot, walkways, landscaping, utilities, and stormwater management system. This project is being filed under the Chapter 40B Comprehensive Permit Projects and will follow all Massachusetts Stormwater Management Standards.

The proposed development consists of two apartment buildings, a community building, and recreational open space areas. In addition to these new structures, associated access drives, parking areas, walkways, utilities, and drainage systems will be installed throughout the site. These changes increase the overall impervious area found at the site. However, the proposed drainage system has been designed to capture the previously uncontrolled stormwater runoff and direct flows to storage and infiltration facilities, which results in a reduction of the peak rate of runoff. Furthermore, with the addition of the deep sump catch basins with oil/gas hoods, gravel wetland and an infiltration facility the runoff from the impervious areas will be treated appropriately prior to discharge.

Section 1
Compliance with Stormwater Management Standards

The proposed project is located on a parcel at 75 - 79 Pond Street in Rockland, Massachusetts. The existing site is mostly wetlands that nearly surround an undeveloped, partially cleared upland area. As part of this drainage analysis, an in-depth review of the subject site for conformance with the Massachusetts Department of Environmental Protection's Stormwater Management Standards has been performed. The project is not considered a redevelopment project (as defined in Standard 7) and is therefore required to meet all of the Massachusetts Stormwater Management Standards. The following is a summary of our findings relative to our review of each of the standards.

Standard 1: No New Untreated Discharges

No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

The stormwater shall be treated prior to release with deep sump catch basins with hoods, gravel wetland, and an infiltration facility with proprietary separators for pre-treatment. The deep sump will provide an area for sediment to settle out and the hood will provide oil and gas separation. Stormwater being directed to the infiltration system flows through a proprietary separator for pre-treatment prior to infiltrating. Outlets of the infiltration facilities have been designed to reduce erosion and eliminate scouring within the wetland areas. The gravel wetland is designed with a wetland soil mix and will be vegetated to clean stormwater prior to being discharged. A rip rap apron shall be installed at each discharge point. The rip rap apron slows down the velocity and therefore reduces scour.

Standard 2: Peak Rate Attenuation

Stormwater management systems shall be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

The existing and proposed site conditions were analyzed for the 2, 10, 25 and 100-year 24-hour storm events using the methodology discussed in Section 2. Due to the introduction of stormwater being captured, controlled, attenuated, and infiltrated there is no increase in peak discharge rates for all storm events analyzed (refer to Table 1.2), even though there is an increase in the overall impervious area on site.

To analyze the pre- and post-development conditions two (2) discharge points of analysis (PA-1 & PA-2) were determined. The pre- and post-development watersheds, the points of analysis, and longest flow paths are depicted on the plans entitled "Pre-Development Watershed Plan" (Sheet C-801) and "Post- Development Watershed Plan" (Sheet C-802). The following table summarizes and compares the pre- and post-development peak runoff rates for the 2-year, 10-year, 25-year and 100-year storm events at the point of analysis.

Table 1.2 – Comparison of Peak Flow Rates & Total Volume						
Point of Analysis – 1 (PA-1)						
	Existing Conditions		Proposed Conditions		Net Change	
Storm Frequency	Peak Runoff (CFS)	Total Volume (CF)	Peak Runoff (CFS)	Total Volume (CF)	Peak Runoff (CFS)	Total Volume (CF)
2-Year	*8.58*	*30,174*	3.95	29,294	-4.63	-880
10-Year	*16.65*	*57,392*	9.55	56,565	-7.10	-827
25-Year	*23.18*	*80,091*	13.42	79,075	-9.76	-1016
100-Year	*36.53*	*127,821*	29.29	126,219	-7.24	-1602
Point of Analysis – 2 (PA-2)						
	Existing Conditions	Proposed Conditions	Proposed Conditions		Net Change	
Storm Frequency	Peak Runoff (CFS)	Total Volume (CF)	Peak Runoff (CFS)	Total Volume (CF)	Peak Runoff (CFS)	Total Volume (CF)
2-Year	*6.88*	*26,390*	6.27	26,234	-0.61	-156
10-Year	*13.28*	*50,195*	13.26	49,900	-0.02	-295
25-Year	*18.49*	*70,048*	18.41	69,585	-0.08	-463
100-Year	*29.15*	*111,792*	28.91	110,946	-0.24	-846

As depicted in above table, the post-development peak runoff rates are less than the pre-development rates. The overall time span used for the calculations is 0 - 72 hours to demonstrate that the overall runoff volumes are not increased and that the Gravel Wetlands are fully drained within 48 hours.

The closed drainage system was sized using the 25-year storm event and as designed can handle the design flow as calculated, as well as maintaining a design velocity of between 2.0 feet per second (fps) and 10.0 fps. Two feet per second is considered "self-cleansing velocity" and will prevent the pipes from accumulating sediment. Ten feet per second is considered a safe maximum velocity, to reduce scouring of the pipes.

Standard 3: Recharge

Loss of annual recharge to groundwater shall be eliminated or minimized through the use of environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

Standard 3 requires that a certain volume of water be recharged to the site depending on existing soil types and square feet of total impervious area over each soil type. The on-site infiltration system must be designed with a minimum infiltration capacity of 2,450 cubic feet. The proposed design directs 49% of the proposed impervious on site to recharge facilities. The resulting adjustment factor and increases the required recharge volume to 5,015 cf. Soils in the proposed area of the infiltration facility are adequate for

infiltration, which was confirmed with onsite soil evaluation. Additionally, the bottom of the infiltration facility was placed 4 feet above seasonal high groundwater as determined by the soil evaluation. Please refer to Appendix A for the test pit soil logs.

The infiltration facility proposed for the site will provide a total recharge volume of 5,560 cubic feet, which exceeds the required recharge volume. It should be noted that the proposed Infiltration BMPs do not adversely impact nearby wetland resource areas.

Table 1.3 - Recharge Volume

STORMWATER MANAGEMENT STANDARD 3 - RECHARGE VOLUME					
	Hydrologic Soil Group				Total
	A	B	C	D	
Impervious Area	0 SF	0 SF	0 SF	294,008 SF	294,008 SF
Inches of Runoff to be Recharged	0.6	0.35	0.25	0.1	
Required Recharge Volume	0 CF	0 CF	0 CF	2,450 CF	2,450 CF

CAPTURE AREA ADJUSTMENT - ADJUSTED MINIMUM REQUIRED RECHARGE VOLUME			
Total Impervious Area	294,008 SF		
65% Impervious Area, Required to be Infiltrated	191,105 SF		
Impervious Area Draining to BMP	143,648 SF	49%	Percent Directed to Recharge BMP
Ratio of Total Impervious Area to Impervious Area Draining to Recharge BMP	2.05		
Adjusted Required Recharge Volume	5,015 CF		
Proposed Recharge Volume	5,560 CF		

Standard 4: Water Quality

Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).

The proposed stormwater management system will achieve the 80% TSS removal requirement for all surface water entering the system. Table 1.4 includes a TSS removal summary for each treatment practice. The Long-term Operations and Maintenance Plan has been developed as part of the analysis and can be found in Section 3.

Treatment of Suspended Solids

Catch basins will be equipped with hoods and four-foot sumps to limit sediment, oils, and grease from being discharged to the drainage system. The proprietary separators will further reduce total suspended solids (TSS) entering the infiltration facility, achieving 44% TSS removal pretreatment required to achieve the 80% removal rate within the infiltration facility. All other proposed impervious areas will be collected in the closed drainage system which is routed through a sedimentation forebay and gravel wetland.

Table 1.4 – Total Suspended Solids Removal				
Subsurface Infiltration Chambers				
BMP	TSS Removal Rate	Starting TSS Load	TSS Removed	Remaining TSS Load
Deep Sump Catchbasin w/Hood	0.25	1.00	0.25	0.75
Proprietary Separator	0.52	0.75	0.39	0.36
Subsurface Chambers	0.80	0.36	0.29	0.07
	Total Suspended Solids Removed:			**93%**
Gravel Wetland				
Deep Sump Catchbasin w/Hood	0.25	1.00	0.25	0.75
Gravel Wetland	0.80	0.75	0.60	0.15
	Total Suspended Solids Removed:			**85%**

Water Quality Volume

See Section 2.5.3 for required water quality volume calculations based on impervious area. The equation is as follows:

Water Quality Volume = Total impervious area of post-development project x 1 inch as required by the Stormwater Standards.

Water Quality Volume = 294,008 SF impervious area x 1.0 inches/12 inches per foot = 24,507 cubic feet.

The three onsite drainage components provide **25,229** CF of treatment volume, which is in excess of the required 24,500 CF.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.

The proposed project does not qualify as a land use with higher potential pollutant loads, thus is not required to meet the requirements of standard 5. However, as stated above the proposed Operations and Maintenance Plan & Long-Term Pollution Prevention Plan includes measures to help increase the water quality of stormwater runoff.

Standard 6: Critical Areas

Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures.

The project site discharges into an Outstanding Resource Water protection area. Due to these site conditions the proposed discharge is subject to greater stormwater discharge standards. The site is not within or discharge near or to any other critical areas. See Figure 5, Critical Areas.

Due to the project site discharging into an Outstanding Resource Water protection area the use of BMPs are limited to those approved by MassDEP for that protection area. In addition, the Stormwater Standards requires at least 44% TSS pretreatment prior to discharging into an infiltration facility. The primary source of pollution for the site will be the roadway, which is a necessary and integral part of the overall project. The stormwater treatment trains have been designed to meet all DEP stormwater standards.

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

The project involves new development of an undeveloped site, and therefore is required to fully meet all the Stormwater Management Standards.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

A Stormwater Pollution Prevention Plan (SWPPP) will be prepared before the disturbance of any earth commences on the project site. The SWPPP will be prepared by others per EPA NPDES NOI guidelines and submitted under a separate cover.

Standard 9: Operation and Maintenance Plan

A Long -Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that stormwater management systems function as designed.

Please refer to Section 3 for the Operation and Maintenance Plan for the proposed Stormwater Management System.

Standard 10: Prohibition of Illicit Discharges

All illicit discharges to the stormwater management system are prohibited.

There are no known or suspected illicit discharges to the stormwater management system at the redevelopment project site.

Illicit Discharge Compliance Statement: Based on visual observations prior to construction no illicit discharges to the stormwater management system exist within the project area.

Section 2
Drainage Analysis

2.1 Calculation Methods

The design storms analyzed in this study are the 2-year, 10-year, 25-year and 100-year, 24-hour duration storm events. The stormwater modeling system, HydroCAD 10.0, was utilized to predict the peak runoff rates and total volume from these storm events. The peak discharge rates were determined by analyzing Type III, 24-hour storm events. The rainfall data for these storm events was obtained from the data published by the Northeast Regional Climate Center at Cornell University.

The time of concentration was computed using the TR-55 Method, which provides a means of determining the time for an entire watershed to contribute runoff to a specific location via sheet flows, shallow concentrated flow and channel flow. Runoff curve numbers were calculated by determining the coverage areas and then summing the curve number for the coverage area as a percent of the entire watershed.

References:

1. HydroCAD Stormwater Modeling System, by HydroCAD Software Solutions LLC, Chocorua, New Hampshire.
2. "Extreme Precipitation in New York & New England." Extreme Precipitation in New York & New England by Northeast Regional Climate Center (NRCC).

2.2 Pre-Development Conditions

The site is located on the southwest side of Pond Street in Rockland, Massachusetts. The property is mostly wetlands that nearly surround an undeveloped upland area. The upland area is mostly wooded but also has some cleared and brush areas brush. There are access paths that connect the two major upland areas separating the wetland areas. There are existing culverts providing a hydraulic connection between the wetlands beneath the upland access paths. Topography generally slopes from the upland area to the surrounding wetlands. The wetlands generally slope from the northeast discharging flows along southwestern edge of the property. Grades range from approximately 0.5 to 8 percent.

In order to analyze the pre-development condition, three (3) watershed area was modeled at three (3) points of analysis, PA-1, PA-2, and VP-1. These points of analysis and watershed area is depicted on the plan entitled "Pre-Development Drainage Plan", Sheet C-801.

2.2.1 Pre-Development Calculations

2.2.2 Pre-Development Watershed Plans

Tighe&Bond

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DRAFT
PROGRESS DRAWINGS

SCALE IN FEET
0 30' 60'
GRAPHIC SCALE

Shingle Mill Multi-Family Development

Shinglemill, LLC

75 - 79 Pond Street
Rockland,
Massachusetts

MARK	DATE	DESCRIPTION
B	12/8/2020	Supplemental Comprehensive Permit - 2
A	7/13/2020	Submitted for Comprehensive Permit

PROJECT NO:	J5019-002
DATE:	7/13/2020
FILE:	J5019-002-C-DESIGN.DWG
DRAWN BY:	CML
CHECKED:	PMC
APPROVED:	BLM

PRE-DEVELOPMENT WATERSHED PLAN

SCALE: AS SHOWN

C-801

Last Save Date: January 22, 2021 8:10 AM By: CML
Plot Date: January 22, 2021 8:10 AM By: CM Langton
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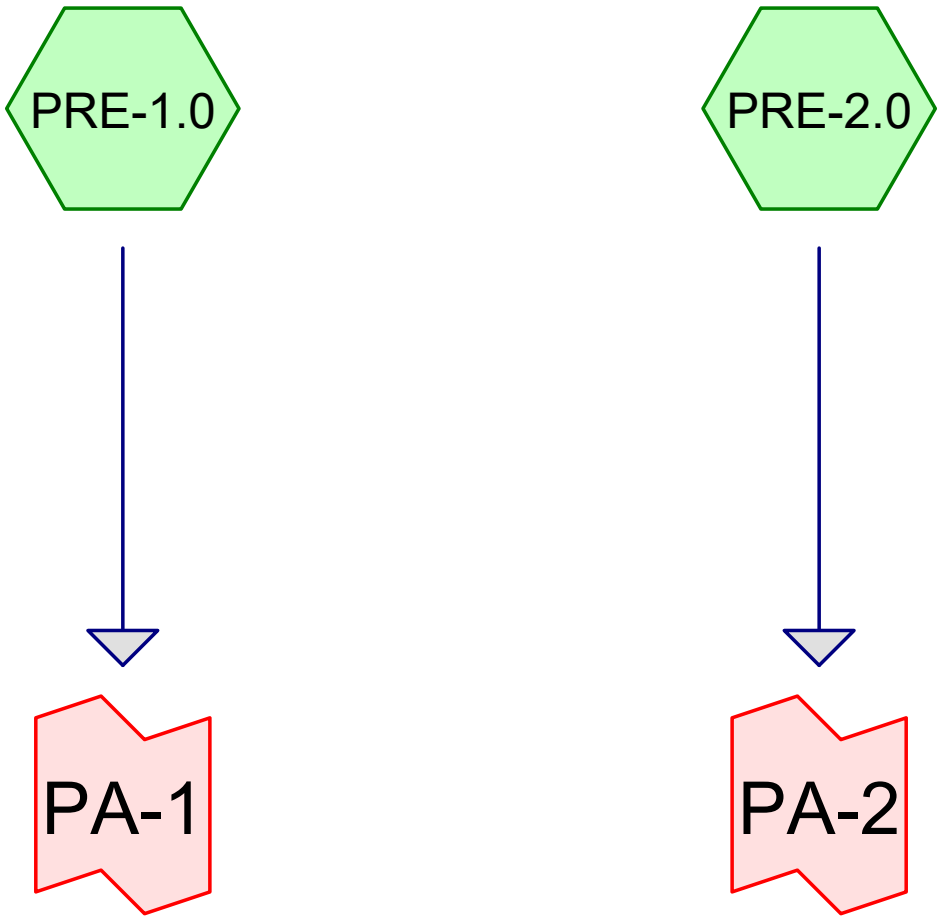


Subcat Reach Pond Link

Routing Diagram for J5019-002_PRE-Rev-2
Prepared by Tighe & Bond, Printed 1/22/2021

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
32,809	73	Brush, Good, HSG D (PRE-1.0, PRE-2.0)
75,135	89	Dirt roads, HSG D (PRE-1.0, PRE-2.0)
4,000	98	Paved roads w/curbs & sewers, HSG D (PRE-1.0, PRE-2.0)
356,050	77	Woods, Good, HSG D (PRE-1.0, PRE-2.0)
467,994	**79**	**TOTAL AREA**

Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PRE-1.0: Runoff Area=249,650 sf 1.28% Impervious Runoff Depth=1.45"
Flow Length=352' Slope=0.0085 '/' Tc=8.7 min CN=79 Runoff=8.58 cfs 30,174 cf

Subcatchment PRE-2.0: Runoff Area=218,344 sf 0.37% Impervious Runoff Depth=1.45"
Flow Length=181' Slope=0.0200 '/' Tc=11.9 min CN=79 Runoff=6.88 cfs 26,390 cf

Link PA-1: Inflow=8.58 cfs 30,174 cf
Primary=8.58 cfs 30,174 cf

Link PA-2: Inflow=6.88 cfs 26,390 cf
Primary=6.88 cfs 26,390 cf

Total Runoff Area = 467,994 sf Runoff Volume = 56,564 cf Average Runoff Depth = 1.45"
99.15% Pervious = 463,994 sf 0.85% Impervious = 4,000 sf

Summary for Subcatchment PRE-1.0:

Runoff = 8.58 cfs @ 12.13 hrs, Volume= 30,174 cf, Depth= 1.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.35"

	Area (sf)	CN	Description
	0	30	Brush, Good, HSG A
	0	48	Brush, Good, HSG B
	16,400	73	Brush, Good, HSG D
	37,500	89	Dirt roads, HSG D
	0	91	Gravel roads, HSG D
	0	98	Paved roads w/curbs & sewers, HSG A
	3,200	98	Paved roads w/curbs & sewers, HSG D
*	0	78	Wetlands, HSG A
*	0	78	Wetlands, HSG D
	0	30	Woods, Good, HSG A
	0	55	Woods, Good, HSG B
	192,550	77	Woods, Good, HSG D
	249,650	79	Weighted Average
	246,450		98.72% Pervious Area
	3,200		1.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	30	0.0085	0.10		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.35"
3.6	322	0.0085	1.48		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	352	Total			

Summary for Subcatchment PRE-2.0:

Runoff = 6.88 cfs @ 12.17 hrs, Volume= 26,390 cf, Depth= 1.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.35"

	Area (sf)	CN	Description
	0	30	Brush, Good, HSG A
	0	48	Brush, Good, HSG B
	16,409	73	Brush, Good, HSG D
	37,635	89	Dirt roads, HSG D
	0	91	Gravel roads, HSG D
	0	98	Paved roads w/curbs & sewers, HSG A
	800	98	Paved roads w/curbs & sewers, HSG D
*	0	78	Wetlands, HSG A
*	0	78	Wetlands, HSG D
	0	30	Woods, Good, HSG A
	0	55	Woods, Good, HSG B
	163,500	77	Woods, Good, HSG D
	218,344	79	Weighted Average
	217,544		99.63% Pervious Area
	800		0.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	15	0.0200	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.35"
3.9	166	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.9	181	Total			

Summary for Link PA-1:

Inflow Area = 249,650 sf, 1.28% Impervious, Inflow Depth = 1.45" for 2-year event
Inflow = 8.58 cfs @ 12.13 hrs, Volume= 30,174 cf
Primary = 8.58 cfs @ 12.13 hrs, Volume= 30,174 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Summary for Link PA-2:

Inflow Area = 218,344 sf, 0.37% Impervious, Inflow Depth = 1.45" for 2-year event
Inflow = 6.88 cfs @ 12.17 hrs, Volume= 26,390 cf
Primary = 6.88 cfs @ 12.17 hrs, Volume= 26,390 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PRE-1.0: Runoff Area=249,650 sf 1.28% Impervious Runoff Depth=2.76"
Flow Length=352' Slope=0.0085 '/' Tc=8.7 min CN=79 Runoff=16.65 cfs 57,392 cf

Subcatchment PRE-2.0: Runoff Area=218,344 sf 0.37% Impervious Runoff Depth=2.76"
Flow Length=181' Slope=0.0200 '/' Tc=11.9 min CN=79 Runoff=13.28 cfs 50,195 cf

Link PA-1: Inflow=16.65 cfs 57,392 cf
Primary=16.65 cfs 57,392 cf

Link PA-2: Inflow=13.28 cfs 50,195 cf
Primary=13.28 cfs 50,195 cf

Total Runoff Area = 467,994 sf Runoff Volume = 107,586 cf Average Runoff Depth = 2.76"
99.15% Pervious = 463,994 sf 0.85% Impervious = 4,000 sf

Summary for Subcatchment PRE-1.0:

Runoff = 16.65 cfs @ 12.12 hrs, Volume= 57,392 cf, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.95"

	Area (sf)	CN	Description
	0	30	Brush, Good, HSG A
	0	48	Brush, Good, HSG B
	16,400	73	Brush, Good, HSG D
	37,500	89	Dirt roads, HSG D
	0	91	Gravel roads, HSG D
	0	98	Paved roads w/curbs & sewers, HSG A
	3,200	98	Paved roads w/curbs & sewers, HSG D
*	0	78	Wetlands, HSG A
*	0	78	Wetlands, HSG D
	0	30	Woods, Good, HSG A
	0	55	Woods, Good, HSG B
	192,550	77	Woods, Good, HSG D
	249,650	79	Weighted Average
	246,450		98.72% Pervious Area
	3,200		1.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	30	0.0085	0.10		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.35"
3.6	322	0.0085	1.48		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	352	Total			

Summary for Subcatchment PRE-2.0:

Runoff = 13.28 cfs @ 12.17 hrs, Volume= 50,195 cf, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.95"

	Area (sf)	CN	Description
	0	30	Brush, Good, HSG A
	0	48	Brush, Good, HSG B
	16,409	73	Brush, Good, HSG D
	37,635	89	Dirt roads, HSG D
	0	91	Gravel roads, HSG D
	0	98	Paved roads w/curbs & sewers, HSG A
	800	98	Paved roads w/curbs & sewers, HSG D
*	0	78	Wetlands, HSG A
*	0	78	Wetlands, HSG D
	0	30	Woods, Good, HSG A
	0	55	Woods, Good, HSG B
	163,500	77	Woods, Good, HSG D
	218,344	79	Weighted Average
	217,544		99.63% Pervious Area
	800		0.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	15	0.0200	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.35"
3.9	166	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.9	181	Total			

Summary for Link PA-1:

Inflow Area = 249,650 sf, 1.28% Impervious, Inflow Depth = 2.76" for 10-year event
Inflow = 16.65 cfs @ 12.12 hrs, Volume= 57,392 cf
Primary = 16.65 cfs @ 12.12 hrs, Volume= 57,392 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Summary for Link PA-2:

Inflow Area = 218,344 sf, 0.37% Impervious, Inflow Depth = 2.76" for 10-year event
Inflow = 13.28 cfs @ 12.17 hrs, Volume= 50,195 cf
Primary = 13.28 cfs @ 12.17 hrs, Volume= 50,195 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PRE-1.0: Runoff Area=249,650 sf 1.28% Impervious Runoff Depth=3.85"
Flow Length=352' Slope=0.0085 '/' Tc=8.7 min CN=79 Runoff=23.18 cfs 80,091 cf

Subcatchment PRE-2.0: Runoff Area=218,344 sf 0.37% Impervious Runoff Depth=3.85"
Flow Length=181' Slope=0.0200 '/' Tc=11.9 min CN=79 Runoff=18.49 cfs 70,048 cf

Link PA-1: Inflow=23.18 cfs 80,091 cf
Primary=23.18 cfs 80,091 cf

Link PA-2: Inflow=18.49 cfs 70,048 cf
Primary=18.49 cfs 70,048 cf

Total Runoff Area = 467,994 sf Runoff Volume = 150,139 cf Average Runoff Depth = 3.85"
99.15% Pervious = 463,994 sf 0.85% Impervious = 4,000 sf

Summary for Subcatchment PRE-1.0:

Runoff = 23.18 cfs @ 12.12 hrs, Volume= 80,091 cf, Depth= 3.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.19"

	Area (sf)	CN	Description
	0	30	Brush, Good, HSG A
	0	48	Brush, Good, HSG B
	16,400	73	Brush, Good, HSG D
	37,500	89	Dirt roads, HSG D
	0	91	Gravel roads, HSG D
	0	98	Paved roads w/curbs & sewers, HSG A
	3,200	98	Paved roads w/curbs & sewers, HSG D
*	0	78	Wetlands, HSG A
*	0	78	Wetlands, HSG D
	0	30	Woods, Good, HSG A
	0	55	Woods, Good, HSG B
	192,550	77	Woods, Good, HSG D
	249,650	79	Weighted Average
	246,450		98.72% Pervious Area
	3,200		1.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	30	0.0085	0.10		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.35"
3.6	322	0.0085	1.48		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	352	Total			

Summary for Subcatchment PRE-2.0:

Runoff = 18.49 cfs @ 12.16 hrs, Volume= 70,048 cf, Depth= 3.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.19"

	Area (sf)	CN	Description
	0	30	Brush, Good, HSG A
	0	48	Brush, Good, HSG B
	16,409	73	Brush, Good, HSG D
	37,635	89	Dirt roads, HSG D
	0	91	Gravel roads, HSG D
	0	98	Paved roads w/curbs & sewers, HSG A
	800	98	Paved roads w/curbs & sewers, HSG D
*	0	78	Wetlands, HSG A
*	0	78	Wetlands, HSG D
	0	30	Woods, Good, HSG A
	0	55	Woods, Good, HSG B
	163,500	77	Woods, Good, HSG D
	218,344	79	Weighted Average
	217,544		99.63% Pervious Area
	800		0.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	15	0.0200	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.35"
3.9	166	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.9	181	Total			

Summary for Link PA-1:

Inflow Area = 249,650 sf, 1.28% Impervious, Inflow Depth = 3.85" for 25-year event
Inflow = 23.18 cfs @ 12.12 hrs, Volume= 80,091 cf
Primary = 23.18 cfs @ 12.12 hrs, Volume= 80,091 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Summary for Link PA-2:

Inflow Area = 218,344 sf, 0.37% Impervious, Inflow Depth = 3.85" for 25-year event
Inflow = 18.49 cfs @ 12.16 hrs, Volume= 70,048 cf
Primary = 18.49 cfs @ 12.16 hrs, Volume= 70,048 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PRE-1.0: Runoff Area=249,650 sf 1.28% Impervious Runoff Depth=6.14"
Flow Length=352' Slope=0.0085 '/' Tc=8.7 min CN=79 Runoff=36.53 cfs 127,821 cf

Subcatchment PRE-2.0: Runoff Area=218,344 sf 0.37% Impervious Runoff Depth=6.14"
Flow Length=181' Slope=0.0200 '/' Tc=11.9 min CN=79 Runoff=29.15 cfs 111,792 cf

Link PA-1: Inflow=36.53 cfs 127,821 cf
Primary=36.53 cfs 127,821 cf

Link PA-2: Inflow=29.15 cfs 111,792 cf
Primary=29.15 cfs 111,792 cf

Total Runoff Area = 467,994 sf Runoff Volume = 239,613 cf Average Runoff Depth = 6.14"
99.15% Pervious = 463,994 sf 0.85% Impervious = 4,000 sf

Summary for Subcatchment PRE-1.0:

Runoff = 36.53 cfs @ 12.12 hrs, Volume= 127,821 cf, Depth= 6.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.68"

	Area (sf)	CN	Description
	0	30	Brush, Good, HSG A
	0	48	Brush, Good, HSG B
	16,400	73	Brush, Good, HSG D
	37,500	89	Dirt roads, HSG D
	0	91	Gravel roads, HSG D
	0	98	Paved roads w/curbs & sewers, HSG A
	3,200	98	Paved roads w/curbs & sewers, HSG D
*	0	78	Wetlands, HSG A
*	0	78	Wetlands, HSG D
	0	30	Woods, Good, HSG A
	0	55	Woods, Good, HSG B
	192,550	77	Woods, Good, HSG D
	249,650	79	Weighted Average
	246,450		98.72% Pervious Area
	3,200		1.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	30	0.0085	0.10		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.35"
3.6	322	0.0085	1.48		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	352	Total			

Summary for Subcatchment PRE-2.0:

Runoff = 29.15 cfs @ 12.16 hrs, Volume= 111,792 cf, Depth= 6.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.68"

	Area (sf)	CN	Description
	0	30	Brush, Good, HSG A
	0	48	Brush, Good, HSG B
	16,409	73	Brush, Good, HSG D
	37,635	89	Dirt roads, HSG D
	0	91	Gravel roads, HSG D
	0	98	Paved roads w/curbs & sewers, HSG A
	800	98	Paved roads w/curbs & sewers, HSG D
*	0	78	Wetlands, HSG A
*	0	78	Wetlands, HSG D
	0	30	Woods, Good, HSG A
	0	55	Woods, Good, HSG B
	163,500	77	Woods, Good, HSG D
	218,344	79	Weighted Average
	217,544		99.63% Pervious Area
	800		0.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	15	0.0200	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.35"
3.9	166	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.9	181	Total			

Summary for Link PA-1:

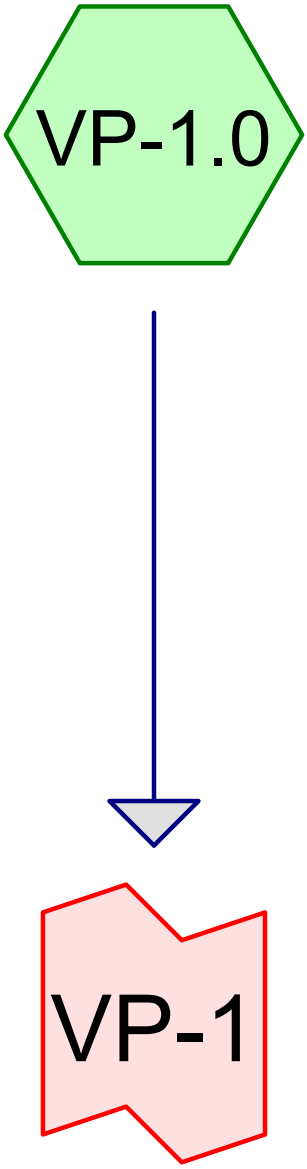
Inflow Area = 249,650 sf, 1.28% Impervious, Inflow Depth = 6.14" for 100-year event
Inflow = 36.53 cfs @ 12.12 hrs, Volume= 127,821 cf
Primary = 36.53 cfs @ 12.12 hrs, Volume= 127,821 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Summary for Link PA-2:

Inflow Area = 218,344 sf, 0.37% Impervious, Inflow Depth = 6.14" for 100-year event
Inflow = 29.15 cfs @ 12.16 hrs, Volume= 111,792 cf
Primary = 29.15 cfs @ 12.16 hrs, Volume= 111,792 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs



Subcat Reach Pond Link

Routing Diagram for J5019-002_PRE_BVW
Prepared by Tighe & Bond, Printed 2/19/2021

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
1,950	98	Paved roads w/curbs & sewers, HSG A (VP-1.0)
50,750	78	Wetlands, HSG D (VP-1.0)
78,300	77	Woods, Good, HSG D (VP-1.0)
131,000	**78**	**TOTAL AREA**

Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment VP-1.0: Runoff Area=131,000 sf 1.49% Impervious Runoff Depth=0.85"
Flow Length=55' Slope=0.0100 '/' Tc=9.1 min CN=78 Runoff=2.52 cfs 9,317 cf

Link VP-1: Inflow=2.52 cfs 9,317 cf
Primary=2.52 cfs 9,317 cf

Total Runoff Area = 131,000 sf Runoff Volume = 9,317 cf Average Runoff Depth = 0.85"
98.51% Pervious = 129,050 sf 1.49% Impervious = 1,950 sf

Summary for Subcatchment VP-1.0:

Runoff = 2.52 cfs @ 12.14 hrs, Volume= 9,317 cf, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2.6 Inch Rainfall=2.60"

	Area (sf)	CN	Description
	0	30	Brush, Good, HSG A
	0	48	Brush, Good, HSG B
	0	73	Brush, Good, HSG D
	0	89	Dirt roads, HSG D
	0	91	Gravel roads, HSG D
	1,950	98	Paved roads w/curbs & sewers, HSG A
	0	98	Paved roads w/curbs & sewers, HSG D
*	0	78	Wetlands, HSG A
*	50,750	78	Wetlands, HSG D
	0	30	Woods, Good, HSG A
	0	55	Woods, Good, HSG B
	78,300	77	Woods, Good, HSG D
	131,000	78	Weighted Average
	129,050		98.51% Pervious Area
	1,950		1.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	10	0.0100	0.02		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.35"
1.5	45	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.1	55	Total			

Summary for Link VP-1:

Inflow Area = 131,000 sf, 1.49% Impervious, Inflow Depth = 0.85" for 2.6 Inch event
Inflow = 2.52 cfs @ 12.14 hrs, Volume= 9,317 cf
Primary = 2.52 cfs @ 12.14 hrs, Volume= 9,317 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

2.3 Post Development Conditions

The post-development condition consists of the two apartment buildings, a community building, and recreational open space areas. In addition to these new structures, associated access drives, parking areas, walkways, utilities, and drainage systems will be installed throughout the site. These changes increase the overall impervious area found at the site. However, the proposed drainage system has been designed to capture the previously uncontrolled stormwater runoff and direct flows to storage and infiltration facilities, which results in a reduction of the peak rate and total volume of runoff. Furthermore, with the addition of the deep sump catch basins with oil/gas hoods, proprietary separators, proprietary filtration systems, level spreader gravel wetlands and an infiltration facility the runoff from the impervious areas will be cleaned appropriately prior to discharge.

The post-development condition was analyzed by dividing the site into nine (9) watershed areas. Stormwater runoff from these areas flow mostly by underground drainage to the gravel wetland or subsurface chamber system prior to being discharged into the onsite wetlands. Flows from these sub-catchment areas are modeled at the same points of analysis that was modeled in the pre-development analysis, PA-1, PA-2, and VP-1. These points of analysis and sub-catchment areas are depicted on the plan entitled "Post-Development Drainage Plan", Sheet C-802.

2.3.1 Post-Development Calculations

2.3.2 Post-Development Watershed Plans

Tighe&Bond

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DRAFT
PROGRESS DRAWINGS

SCALE IN FEET
0 30' 60'
GRAPHIC SCALE

Shingle Mill Multi-Family Development

Shinglemill, LLC

75 - 79 Pond Street
Rockland, Massachusetts

MARK	DATE	DESCRIPTION
C	2/19/2021	Rev Con Com Submission
B	12/8/2020	Supplemental Comprehensive Permit - 2
A	7/13/2020	Submitted for Comprehensive Permit

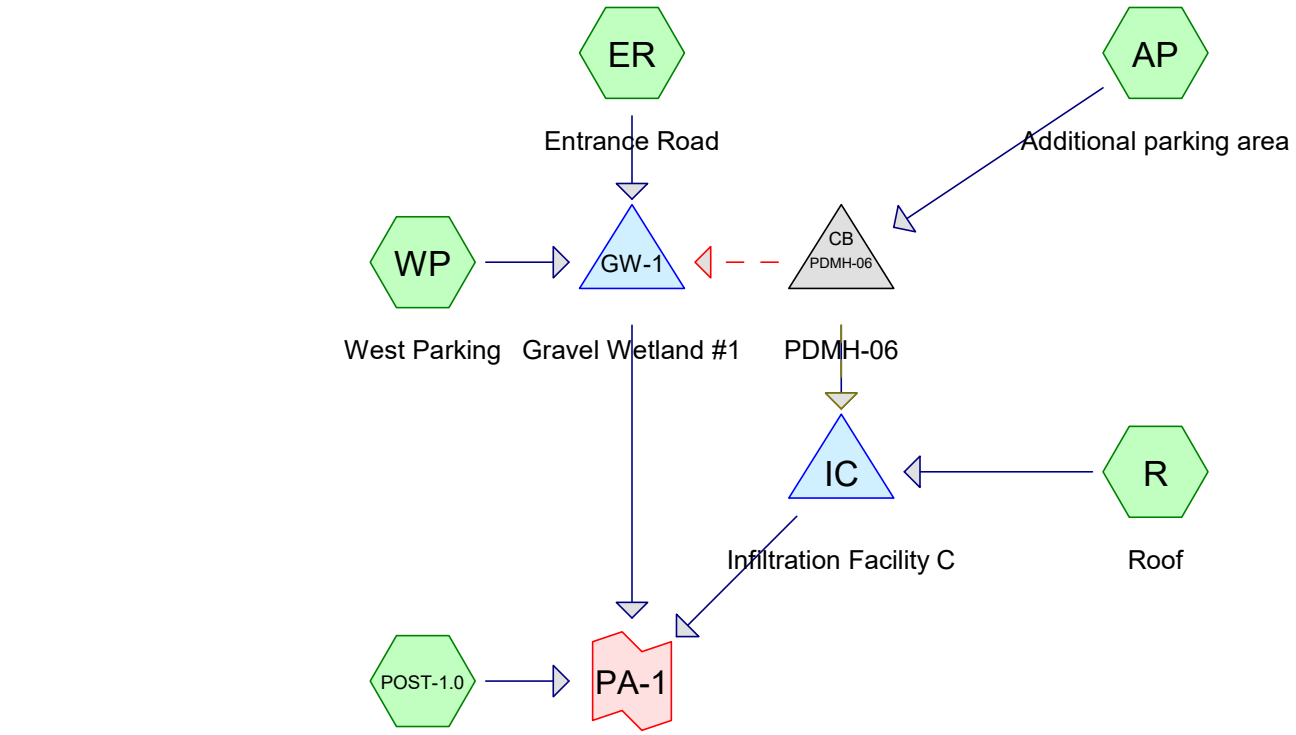
PROJECT NO:	J5019-002
DATE:	7/13/2020
FILE:	J5019-002-C-DESIGN.DWG
DRAWN BY:	CML
CHECKED:	PMC
APPROVED:	BLM

POST-DEVELOPMENT WATERSHED PLAN

SCALE: AS SHOWN

C-802

Last Save Date: February 19, 2021 2:53 PM By: CML
Plot Date: Friday, February 19, 2021 Plotted By: Craig M. Langton
T&B File Location: J:\J\J5019 Jones Street\002 Pond St, Rockland\Drawings_Figures\AutoCAD\Sheet\J5019-002-C-Design.dwg Layout Tab: Post



Subcat Reach Pond Link

Routing Diagram for J5019-002_Post_Rev-3
Prepared by Tighe & Bond, Printed 1/25/2021

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
29,262	80	>75% Grass cover, Good, HSG D (AP, ER, NP, WP)
16,409	73	Brush, Good, HSG D (POST-2.0)
113,164	98	Paved parking, HSG D (AP, NP)
97,442	98	Paved roads w/curbs & sewers, HSG D (ER, POST-1.0, POST-2.0, WP)
59,482	98	Roofs, HSG D (AP, R)
164,235	77	Woods, Good, HSG D (POST-2.0)
479,994	**89**	**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment AP: Additional parking Runoff Area=122,014 sf 96.13% Impervious Runoff Depth=3.01"
Tc=6.0 min CN=97 Runoff=8.78 cfs 30,559 cf

Subcatchment ER: Entrance Road Runoff Area=23,348 sf 98.74% Impervious Runoff Depth=3.12"
Tc=6.0 min CN=98 Runoff=1.70 cfs 6,065 cf

Subcatchment NP: New parking area Runoff Area=34,000 sf 85.29% Impervious Runoff Depth=2.79"
Tc=6.0 min CN=95 Runoff=2.35 cfs 7,910 cf

Subcatchment POST-1.0: Runoff Area=46,004 sf 100.00% Impervious Runoff Depth=3.12"
Tc=6.0 min CN=98 Runoff=3.36 cfs 11,949 cf

Subcatchment POST-2.0: Runoff Area=182,644 sf 1.10% Impervious Runoff Depth=1.32"
Flow Length=181' Slope=0.0200 '/' Tc=11.9 min CN=77 Runoff=5.18 cfs 20,092 cf

Subcatchment R: Roof Runoff Area=26,352 sf 100.00% Impervious Runoff Depth=3.12"
Tc=6.0 min CN=98 Runoff=1.92 cfs 6,845 cf

Subcatchment WP: West Parking Runoff Area=45,632 sf 57.82% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=90 Runoff=2.74 cfs 8,776 cf

Pond GW-1: Gravel Wetland #1 Peak Elev=136.28' Storage=12,388 cf Inflow=6.74 cfs 16,638 cf
Outflow=0.16 cfs 10,162 cf

Pond GW-2: Gravel Wetland #2 Peak Elev=135.19' Storage=3,613 cf Inflow=2.35 cfs 7,910 cf
Outflow=1.22 cfs 6,142 cf

Pond IC: Infiltration Facility C Peak Elev=140.09' Storage=9,177 cf Inflow=8.40 cfs 35,606 cf
Discarded=0.72 cfs 28,457 cf Primary=2.59 cfs 7,183 cf Outflow=3.31 cfs 35,640 cf

Pond PDMH-06: PDMH-06 Peak Elev=141.22' Inflow=8.78 cfs 30,559 cf
Primary=4.18 cfs 26,993 cf Secondary=2.30 cfs 1,798 cf Tertiary=2.30 cfs 1,768 cf Outflow=8.78 cfs 30,559 cf

Link PA-1: Inflow=3.95 cfs 29,294 cf
Primary=3.95 cfs 29,294 cf

Link PA-2: Inflow=6.27 cfs 26,234 cf
Primary=6.27 cfs 26,234 cf

Total Runoff Area = 479,994 sf Runoff Volume = 92,196 cf Average Runoff Depth = 2.30"
43.73% Pervious = 209,906 sf 56.27% Impervious = 270,088 sf

Summary for Subcatchment AP: Additional parking area

Runoff = 8.78 cfs @ 12.09 hrs, Volume= 30,559 cf, Depth= 3.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.35"

Area (sf)	CN	Description
4,720	80	>75% Grass cover, Good, HSG D
84,164	98	Paved parking, HSG D
33,130	98	Roofs, HSG D
122,014	97	Weighted Average
4,720		3.87% Pervious Area
117,294		96.13% Impervious Area

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

Summary for Subcatchment ER: Entrance Road

Runoff = 1.70 cfs @ 12.09 hrs, Volume= 6,065 cf, Depth= 3.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.35"

Area (sf)	CN	Description
295	80	>75% Grass cover, Good, HSG D
23,053	98	Paved roads w/curbs & sewers, HSG D
23,348	98	Weighted Average
295		1.26% Pervious Area
23,053		98.74% Impervious Area

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

Summary for Subcatchment NP: New parking area

Runoff = 2.35 cfs @ 12.09 hrs, Volume= 7,910 cf, Depth= 2.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.35"

Area (sf)	CN	Description
5,000	80	>75% Grass cover, Good, HSG D
29,000	98	Paved parking, HSG D
34,000	95	Weighted Average
5,000		14.71% Pervious Area
29,000		85.29% Impervious Area

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

Summary for Subcatchment POST-1.0:

Runoff = 3.36 cfs @ 12.09 hrs, Volume= 11,949 cf, Depth= 3.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.35"

Area (sf)	CN	Description
0	80	>75% Grass cover, Good, HSG D
46,004	98	Paved roads w/curbs & sewers, HSG D
46,004	98	Weighted Average
46,004		100.00% Impervious Area

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

Summary for Subcatchment POST-2.0:

Runoff = 5.18 cfs @ 12.17 hrs, Volume= 20,092 cf, Depth= 1.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.35"

	Area (sf)	CN	Description
	0	30	Brush, Good, HSG A
	0	48	Brush, Good, HSG B
	16,409	73	Brush, Good, HSG D
	0	89	Dirt roads, HSG D
	0	91	Gravel roads, HSG D
	0	98	Paved roads w/curbs & sewers, HSG A
	2,000	98	Paved roads w/curbs & sewers, HSG D
*	0	78	Wetlands, HSG A
*	0	78	Wetlands, HSG D
	0	30	Woods, Good, HSG A
	0	55	Woods, Good, HSG B
	164,235	77	Woods, Good, HSG D
	182,644	77	Weighted Average
	180,644		98.90% Pervious Area
	2,000		1.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	15	0.0200	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.35"
3.9	166	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.9	181	Total			

Summary for Subcatchment R: Roof

Runoff = 1.92 cfs @ 12.09 hrs, Volume= 6,845 cf, Depth= 3.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.35"

Area (sf)	CN	Description
26,352	98	Roofs, HSG D
26,352		100.00% Impervious Area

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

Summary for Subcatchment WP: West Parking

Runoff = 2.74 cfs @ 12.09 hrs, Volume= 8,776 cf, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.35"

Area (sf)	CN	Description
19,247	80	>75% Grass cover, Good, HSG D
26,385	98	Paved roads w/curbs & sewers, HSG D
45,632	90	Weighted Average
19,247		42.18% Pervious Area
26,385		57.82% Impervious Area

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

Summary for Pond GW-1: Gravel Wetland #1

Inflow Area = 68,980 sf, 71.67% Impervious, Inflow Depth = 2.89" for 2-year event
Inflow = 6.74 cfs @ 12.09 hrs, Volume= 16,638 cf
Outflow = 0.16 cfs @ 15.56 hrs, Volume= 10,162 cf, Atten= 98%, Lag= 208.2 min
Primary = 0.16 cfs @ 15.56 hrs, Volume= 10,162 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Peak Elev= 136.28' @ 15.56 hrs Surf.Area= 6,276 sf Storage= 12,388 cf
Flood Elev= 139.50' Surf.Area= 13,912 sf Storage= 42,211 cf

Plug-Flow detention time= 674.3 min calculated for 10,162 cf (61% of inflow)
Center-of-Mass det. time= 579.7 min (1,358.2 - 778.5)

Volume	Invert	Avail.Storage	Storage Description
#1	132.50'	42,211 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
132.50	4,937	0.0	0	0
134.85	4,937	40.0	4,641	4,641
135.50	5,159	100.0	3,281	7,922
136.00	5,907	100.0	2,767	10,688
137.00	7,230	100.0	6,569	17,257
138.00	9,405	100.0	8,318	25,574
139.00	11,275	100.0	10,340	35,914
139.50	13,912	100.0	6,297	42,211

Device	Routing	Invert	Outlet Devices
#1	Primary	135.20'	**24.0" Round Culvert** L= 19.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 135.20' / 135.15' S= 0.0026 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	135.20'	**2.5" Vert. Orifice/Grate** C= 0.600
#3	Device 1	137.25'	**4.0' long x 0.60' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	138.50'	**4.0" x 4.0" Horiz. Orifice/Grate X 106.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.16 cfs @ 15.56 hrs HW=136.28' TW=0.00' (Dynamic Tailwater)
↑**1=Culvert** (Passes 0.16 cfs of 4.04 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 0.16 cfs @ 4.75 fps)
3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
4=Orifice/Grate (Controls 0.00 cfs)

Summary for Pond GW-2: Gravel Wetland #2

Inflow Area = 34,000 sf, 85.29% Impervious, Inflow Depth = 2.79" for 2-year event
Inflow = 2.35 cfs @ 12.09 hrs, Volume= 7,910 cf
Outflow = 1.22 cfs @ 12.23 hrs, Volume= 6,142 cf, Atten= 48%, Lag= 8.8 min
Primary = 1.22 cfs @ 12.23 hrs, Volume= 6,142 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 135.19' @ 12.23 hrs Surf.Area= 3,021 sf Storage= 3,613 cf
Flood Elev= 137.00' Surf.Area= 5,615 sf Storage= 11,376 cf

Plug-Flow detention time= 212.4 min calculated for 6,138 cf (78% of inflow)
Center-of-Mass det. time= 133.1 min (912.7 - 779.6)

Volume	Invert	Avail.Storage	Storage Description
#1	131.50'	11,376 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
131.50	1,810	0.0	0	0
133.85	1,810	40.0	1,701	1,701
134.50	2,175	10.0	130	1,831
135.00	2,765	100.0	1,235	3,066
136.00	4,120	100.0	3,443	6,508
137.00	5,615	100.0	4,868	11,376

Device	Routing	Invert	Outlet Devices
#1	Primary	134.20'	**24.0" Round Culvert** L= 19.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 134.20' / 134.15' S= 0.0026 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	134.20'	**2.5" Vert. Orifice/Grate** C= 0.600
#3	Device 1	135.00'	**4.0' long x 0.60' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	136.00'	**4.0" x 4.0" Horiz. Orifice/Grate X 106.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.21 cfs @ 12.23 hrs HW=135.19' TW=0.00' (Dynamic Tailwater)
↑**1=Culvert** (Passes 1.21 cfs of 3.44 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 0.15 cfs @ 4.53 fps)
3=Sharp-Crested Rectangular Weir (Weir Controls 1.06 cfs @ 1.42 fps)
4=Orifice/Grate (Controls 0.00 cfs)

Summary for Pond IC: Infiltration Facility C

Inflow Area = 148,366 sf, 96.82% Impervious, Inflow Depth = 2.88" for 2-year event
Inflow = 8.40 cfs @ 12.09 hrs, Volume= 35,606 cf
Outflow = 3.31 cfs @ 12.38 hrs, Volume= 35,640 cf, Atten= 61%, Lag= 17.7 min
Discarded = 0.72 cfs @ 11.30 hrs, Volume= 28,457 cf
Primary = 2.59 cfs @ 12.38 hrs, Volume= 7,183 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 140.09' @ 12.38 hrs Surf.Area= 13,840 sf Storage= 9,177 cf
Flood Elev= 141.33' Surf.Area= 13,840 sf Storage= 17,852 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 51.3 min (816.3 - 765.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	9,615 cf	**54.83'W x 252.40'L x 2.33'H Field A** 32,293 cf Overall - 8,255 cf Embedded = 24,038 cf x 40.0% Voids
#2A	139.50'	8,255 cf	**ADS_StormTech SC-310 +Cap** x 560 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 16 Rows of 35 Chambers

17,871 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 3	139.00'	**24.0" Round Culvert** L= 130.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.00' / 136.00' S= 0.0231 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Discarded	139.00'	**2.250 in/hr Exfiltration over Surface area**
#3	Primary	139.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.72 cfs @ 11.30 hrs HW=139.03' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.72 cfs)

Primary OutFlow Max=2.58 cfs @ 12.38 hrs HW=140.09' TW=0.00' (Dynamic Tailwater)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 2.58 cfs @ 1.91 fps)
└**1=Culvert** (Passes 2.58 cfs of 3.07 cfs potential flow)

Summary for Pond PDMH-06: PDMH-06

Inflow Area = 122,014 sf, 96.13% Impervious, Inflow Depth = 3.01" for 2-year event
Inflow = 8.78 cfs @ 12.09 hrs, Volume= 30,559 cf
Outflow = 8.78 cfs @ 12.09 hrs, Volume= 30,559 cf, Atten= 0%, Lag= 0.0 min
Primary = 4.18 cfs @ 12.09 hrs, Volume= 26,993 cf
Secondary = 2.30 cfs @ 12.09 hrs, Volume= 1,798 cf
Tertiary = 2.30 cfs @ 12.09 hrs, Volume= 1,768 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 141.22' @ 12.09 hrs
Flood Elev= 142.85'

Device	Routing	Invert	Outlet Devices
#1	Primary	139.50'	**12.0" Round Culvert** L= 10.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.50' / 137.50' S= 0.2000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Secondary	140.35'	**12.0" Round Culvert** L= 25.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 140.35' / 137.50' S= 0.1140 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Tertiary	140.35'	**12.0" Round Culvert** L= 65.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 140.35' / 139.50' S= 0.0131 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=4.13 cfs @ 12.09 hrs HW=141.19' TW=139.82' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 4.13 cfs @ 5.26 fps)

Secondary OutFlow Max=2.21 cfs @ 12.09 hrs HW=141.19' TW=135.27' (Dynamic Tailwater)
└**2=Culvert** (Inlet Controls 2.21 cfs @ 3.13 fps)

Tertiary OutFlow Max=2.21 cfs @ 12.09 hrs HW=141.19' TW=139.82' (Dynamic Tailwater)
└**3=Culvert** (Inlet Controls 2.21 cfs @ 3.13 fps)

Summary for Link PA-1:

Inflow Area = 263,350 sf, 90.79% Impervious, Inflow Depth > 1.33" for 2-year event
Inflow = 3.95 cfs @ 12.29 hrs, Volume= 29,294 cf
Primary = 3.95 cfs @ 12.29 hrs, Volume= 29,294 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link PA-2:

Inflow Area = 216,644 sf, 14.31% Impervious, Inflow Depth = 1.45" for 2-year event
Inflow = 6.27 cfs @ 12.19 hrs, Volume= 26,234 cf
Primary = 6.27 cfs @ 12.19 hrs, Volume= 26,234 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment AP: Additional parking Runoff Area=122,014 sf 96.13% Impervious Runoff Depth=4.60"
Tc=6.0 min CN=97 Runoff=13.15 cfs 46,744 cf

Subcatchment ER: Entrance Road Runoff Area=23,348 sf 98.74% Impervious Runoff Depth=4.71"
Tc=6.0 min CN=98 Runoff=2.53 cfs 9,170 cf

Subcatchment NP: New parking area Runoff Area=34,000 sf 85.29% Impervious Runoff Depth=4.37"
Tc=6.0 min CN=95 Runoff=3.59 cfs 12,382 cf

Subcatchment POST-1.0: Runoff Area=46,004 sf 100.00% Impervious Runoff Depth=4.71"
Tc=6.0 min CN=98 Runoff=4.99 cfs 18,069 cf

Subcatchment POST-2.0: Runoff Area=182,644 sf 1.10% Impervious Runoff Depth=2.58"
Flow Length=181' Slope=0.0200 '/' Tc=11.9 min CN=77 Runoff=10.38 cfs 39,287 cf

Subcatchment R: Roof Runoff Area=26,352 sf 100.00% Impervious Runoff Depth=4.71"
Tc=6.0 min CN=98 Runoff=2.86 cfs 10,350 cf

Subcatchment WP: West Parking Runoff Area=45,632 sf 57.82% Impervious Runoff Depth=3.83"
Tc=6.0 min CN=90 Runoff=4.44 cfs 14,557 cf

Pond GW-1: Gravel Wetland #1 Peak Elev=137.34' Storage=19,837 cf Inflow=10.95 cfs 28,108 cf
Outflow=0.58 cfs 21,605 cf

Pond GW-2: Gravel Wetland #2 Peak Elev=135.36' Storage=4,137 cf Inflow=3.59 cfs 12,382 cf
Outflow=2.90 cfs 10,613 cf

Pond IC: Infiltration Facility C Peak Elev=140.37' Storage=11,845 cf Inflow=12.04 cfs 52,714 cf
Discarded=0.72 cfs 35,861 cf Primary=5.90 cfs 16,892 cf Outflow=6.62 cfs 52,753 cf

Pond PDMH-06: PDMH-06 Peak Elev=141.95' Inflow=13.15 cfs 46,744 cf
Primary=5.20 cfs 38,188 cf Secondary=3.98 cfs 4,381 cf Tertiary=3.98 cfs 4,176 cf Outflow=13.15 cfs 46,744 cf

Link PA-1: Inflow=9.55 cfs 56,565 cf
Primary=9.55 cfs 56,565 cf

Link PA-2: Inflow=13.26 cfs 49,900 cf
Primary=13.26 cfs 49,900 cf

Total Runoff Area = 479,994 sf Runoff Volume = 150,560 cf Average Runoff Depth = 3.76"
43.73% Pervious = 209,906 sf 56.27% Impervious = 270,088 sf

Summary for Subcatchment AP: Additional parking area

Runoff = 13.15 cfs @ 12.09 hrs, Volume= 46,744 cf, Depth= 4.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.95"

Area (sf)	CN	Description
4,720	80	>75% Grass cover, Good, HSG D
84,164	98	Paved parking, HSG D
33,130	98	Roofs, HSG D
122,014	97	Weighted Average
4,720		3.87% Pervious Area
117,294		96.13% Impervious Area

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

Summary for Subcatchment ER: Entrance Road

Runoff = 2.53 cfs @ 12.09 hrs, Volume= 9,170 cf, Depth= 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.95"

Area (sf)	CN	Description
295	80	>75% Grass cover, Good, HSG D
23,053	98	Paved roads w/curbs & sewers, HSG D
23,348	98	Weighted Average
295		1.26% Pervious Area
23,053		98.74% Impervious Area

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

Summary for Subcatchment NP: New parking area

Runoff = 3.59 cfs @ 12.09 hrs, Volume= 12,382 cf, Depth= 4.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.95"

Area (sf)	CN	Description
5,000	80	>75% Grass cover, Good, HSG D
29,000	98	Paved parking, HSG D
34,000	95	Weighted Average
5,000		14.71% Pervious Area
29,000		85.29% Impervious Area

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

Summary for Subcatchment POST-1.0:

Runoff = 4.99 cfs @ 12.09 hrs, Volume= 18,069 cf, Depth= 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.95"

Area (sf)	CN	Description
0	80	>75% Grass cover, Good, HSG D
46,004	98	Paved roads w/curbs & sewers, HSG D
46,004	98	Weighted Average
46,004		100.00% Impervious Area

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

Summary for Subcatchment POST-2.0:

Runoff = 10.38 cfs @ 12.17 hrs, Volume= 39,287 cf, Depth= 2.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.95"

	Area (sf)	CN	Description
	0	30	Brush, Good, HSG A
	0	48	Brush, Good, HSG B
	16,409	73	Brush, Good, HSG D
	0	89	Dirt roads, HSG D
	0	91	Gravel roads, HSG D
	0	98	Paved roads w/curbs & sewers, HSG A
	2,000	98	Paved roads w/curbs & sewers, HSG D
*	0	78	Wetlands, HSG A
*	0	78	Wetlands, HSG D
	0	30	Woods, Good, HSG A
	0	55	Woods, Good, HSG B
	164,235	77	Woods, Good, HSG D
	182,644	77	Weighted Average
	180,644		98.90% Pervious Area
	2,000		1.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	15	0.0200	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.35"
3.9	166	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.9	181	Total			

Summary for Subcatchment R: Roof

Runoff = 2.86 cfs @ 12.09 hrs, Volume= 10,350 cf, Depth= 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.95"

Area (sf)	CN	Description
26,352	98	Roofs, HSG D
26,352		100.00% Impervious Area

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

Summary for Subcatchment WP: West Parking

Runoff = 4.44 cfs @ 12.09 hrs, Volume= 14,557 cf, Depth= 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.95"

Area (sf)	CN	Description
19,247	80	>75% Grass cover, Good, HSG D
26,385	98	Paved roads w/curbs & sewers, HSG D
45,632	90	Weighted Average
19,247		42.18% Pervious Area
26,385		57.82% Impervious Area

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

Summary for Pond GW-1: Gravel Wetland #1

Inflow Area = 68,980 sf, 71.67% Impervious, Inflow Depth = 4.89" for 10-year event
Inflow = 10.95 cfs @ 12.09 hrs, Volume= 28,108 cf
Outflow = 0.58 cfs @ 13.06 hrs, Volume= 21,605 cf, Atten= 95%, Lag= 58.3 min
Primary = 0.58 cfs @ 13.06 hrs, Volume= 21,605 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Peak Elev= 137.34' @ 13.06 hrs Surf.Area= 7,968 sf Storage= 19,837 cf
Flood Elev= 139.50' Surf.Area= 13,912 sf Storage= 42,211 cf

Plug-Flow detention time= 759.9 min calculated for 21,605 cf (77% of inflow)
Center-of-Mass det. time= 686.3 min (1,453.5 - 767.1)

Volume	Invert	Avail.Storage	Storage Description
#1	132.50'	42,211 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
132.50	4,937	0.0	0	0
134.85	4,937	40.0	4,641	4,641
135.50	5,159	100.0	3,281	7,922
136.00	5,907	100.0	2,767	10,688
137.00	7,230	100.0	6,569	17,257
138.00	9,405	100.0	8,318	25,574
139.00	11,275	100.0	10,340	35,914
139.50	13,912	100.0	6,297	42,211

Device	Routing	Invert	Outlet Devices
#1	Primary	135.20'	**24.0" Round Culvert** L= 19.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 135.20' / 135.15' S= 0.0026 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	135.20'	**2.5" Vert. Orifice/Grate** C= 0.600
#3	Device 1	137.25'	**4.0' long x 0.60' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	138.50'	**4.0" x 4.0" Horiz. Orifice/Grate X 106.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.58 cfs @ 13.06 hrs HW=137.34' TW=0.00' (Dynamic Tailwater)
↑**1=Culvert** (Passes 0.58 cfs of 12.78 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 0.23 cfs @ 6.87 fps)
3=Sharp-Crested Rectangular Weir (Weir Controls 0.35 cfs @ 0.98 fps)
4=Orifice/Grate (Controls 0.00 cfs)

Summary for Pond GW-2: Gravel Wetland #2

Inflow Area = 34,000 sf, 85.29% Impervious, Inflow Depth = 4.37" for 10-year event
Inflow = 3.59 cfs @ 12.09 hrs, Volume= 12,382 cf
Outflow = 2.90 cfs @ 12.15 hrs, Volume= 10,613 cf, Atten= 19%, Lag= 3.9 min
Primary = 2.90 cfs @ 12.15 hrs, Volume= 10,613 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 135.36' @ 12.15 hrs Surf.Area= 3,248 sf Storage= 4,137 cf
Flood Elev= 137.00' Surf.Area= 5,615 sf Storage= 11,376 cf

Plug-Flow detention time= 170.6 min calculated for 10,613 cf (86% of inflow)
Center-of-Mass det. time= 107.7 min (876.2 - 768.5)

Volume	Invert	Avail.Storage	Storage Description
#1	131.50'	11,376 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
131.50	1,810	0.0	0	0
133.85	1,810	40.0	1,701	1,701
134.50	2,175	10.0	130	1,831
135.00	2,765	100.0	1,235	3,066
136.00	4,120	100.0	3,443	6,508
137.00	5,615	100.0	4,868	11,376

Device	Routing	Invert	Outlet Devices
#1	Primary	134.20'	**24.0" Round Culvert** L= 19.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 134.20' / 134.15' S= 0.0026 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	134.20'	**2.5" Vert. Orifice/Grate** C= 0.600
#3	Device 1	135.00'	**4.0' long x 0.60' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	136.00'	**4.0" x 4.0" Horiz. Orifice/Grate X 106.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.89 cfs @ 12.15 hrs HW=135.36' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Passes 2.89 cfs of 4.58 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 0.17 cfs @ 4.94 fps)
  - **3=Sharp-Crested Rectangular Weir** (Weir Controls 2.73 cfs @ 1.95 fps)
  - **4=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond IC: Infiltration Facility C

Inflow Area = 148,366 sf, 96.82% Impervious, Inflow Depth = 4.26" for 10-year event
Inflow = 12.04 cfs @ 12.09 hrs, Volume= 52,714 cf
Outflow = 6.62 cfs @ 12.22 hrs, Volume= 52,753 cf, Atten= 45%, Lag= 8.2 min
Discarded = 0.72 cfs @ 10.35 hrs, Volume= 35,861 cf
Primary = 5.90 cfs @ 12.22 hrs, Volume= 16,892 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 140.37' @ 12.22 hrs Surf.Area= 13,840 sf Storage= 11,845 cf
Flood Elev= 141.33' Surf.Area= 13,840 sf Storage= 17,852 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 48.8 min (805.6 - 756.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	9,615 cf	**54.83'W x 252.40'L x 2.33'H Field A** 32,293 cf Overall - 8,255 cf Embedded = 24,038 cf x 40.0% Voids
#2A	139.50'	8,255 cf	**ADS_StormTech SC-310 +Cap** x 560 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 16 Rows of 35 Chambers

17,871 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 3	139.00'	**24.0" Round Culvert** L= 130.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.00' / 136.00' S= 0.0231 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Discarded	139.00'	**2.250 in/hr Exfiltration over Surface area**
#3	Primary	139.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.72 cfs @ 10.35 hrs HW=139.03' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.72 cfs)

Primary OutFlow Max=5.85 cfs @ 12.22 hrs HW=140.37' TW=0.00' (Dynamic Tailwater)
└**3=Sharp-Crested Rectangular Weir** (Passes 5.85 cfs of 6.18 cfs potential flow)
└**1=Culvert** (Outlet Controls 5.85 cfs @ 3.60 fps)

Summary for Pond PDMH-06: PDMH-06

Inflow Area = 122,014 sf, 96.13% Impervious, Inflow Depth = 4.60" for 10-year event
Inflow = 13.15 cfs @ 12.09 hrs, Volume= 46,744 cf
Outflow = 13.15 cfs @ 12.09 hrs, Volume= 46,744 cf, Atten= 0%, Lag= 0.0 min
Primary = 5.20 cfs @ 12.08 hrs, Volume= 38,188 cf
Secondary = 3.98 cfs @ 12.09 hrs, Volume= 4,381 cf
Tertiary = 3.98 cfs @ 12.09 hrs, Volume= 4,176 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 141.95' @ 12.09 hrs
Flood Elev= 142.85'

Device	Routing	Invert	Outlet Devices
#1	Primary	139.50'	**12.0" Round Culvert** L= 10.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.50' / 137.50' S= 0.2000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Secondary	140.35'	**12.0" Round Culvert** L= 25.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 140.35' / 137.50' S= 0.1140 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Tertiary	140.35'	**12.0" Round Culvert** L= 65.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 140.35' / 139.50' S= 0.0131 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=4.91 cfs @ 12.08 hrs HW=141.87' TW=140.18' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 4.91 cfs @ 6.25 fps)

Secondary OutFlow Max=3.87 cfs @ 12.09 hrs HW=141.90' TW=136.20' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 3.87 cfs @ 4.92 fps)

Tertiary OutFlow Max=3.87 cfs @ 12.09 hrs HW=141.90' TW=140.20' (Dynamic Tailwater)
↑—**3=Culvert** (Inlet Controls 3.87 cfs @ 4.92 fps)

Summary for Link PA-1:

Inflow Area = 263,350 sf, 90.79% Impervious, Inflow Depth > 2.58" for 10-year event
Inflow = 9.55 cfs @ 12.13 hrs, Volume= 56,565 cf
Primary = 9.55 cfs @ 12.13 hrs, Volume= 56,565 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link PA-2:

Inflow Area = 216,644 sf, 14.31% Impervious, Inflow Depth = 2.76" for 10-year event
Inflow = 13.26 cfs @ 12.16 hrs, Volume= 49,900 cf
Primary = 13.26 cfs @ 12.16 hrs, Volume= 49,900 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment AP: Additional parking Runoff Area=122,014 sf 96.13% Impervious Runoff Depth=5.83"
Tc=6.0 min CN=97 Runoff=16.52 cfs 59,316 cf

Subcatchment ER: Entrance Road Runoff Area=23,348 sf 98.74% Impervious Runoff Depth=5.95"
Tc=6.0 min CN=98 Runoff=3.18 cfs 11,580 cf

Subcatchment NP: New parking area Runoff Area=34,000 sf 85.29% Impervious Runoff Depth=5.60"
Tc=6.0 min CN=95 Runoff=4.54 cfs 15,868 cf

Subcatchment POST-1.0: Runoff Area=46,004 sf 100.00% Impervious Runoff Depth=5.95"
Tc=6.0 min CN=98 Runoff=6.26 cfs 22,817 cf

Subcatchment POST-2.0: Runoff Area=182,644 sf 1.10% Impervious Runoff Depth=3.65"
Flow Length=181' Slope=0.0200 '/' Tc=11.9 min CN=77 Runoff=14.67 cfs 55,486 cf

Subcatchment R: Roof Runoff Area=26,352 sf 100.00% Impervious Runoff Depth=5.95"
Tc=6.0 min CN=98 Runoff=3.58 cfs 13,070 cf

Subcatchment WP: West Parking Runoff Area=45,632 sf 57.82% Impervious Runoff Depth=5.03"
Tc=6.0 min CN=90 Runoff=5.74 cfs 19,131 cf

Pond GW-1: Gravel Wetland #1 Peak Elev=137.68' Storage=22,634 cf Inflow=14.26 cfs 37,318 cf
Outflow=3.80 cfs 30,811 cf

Pond GW-2: Gravel Wetland #2 Peak Elev=135.43' Storage=4,378 cf Inflow=4.54 cfs 15,868 cf
Outflow=3.77 cfs 14,099 cf

Pond IC: Infiltration Facility C Peak Elev=140.61' Storage=13,697 cf Inflow=14.76 cfs 65,780 cf
Discarded=0.72 cfs 40,367 cf Primary=8.60 cfs 25,448 cf Outflow=9.32 cfs 65,815 cf

Pond PDMH-06: PDMH-06 Peak Elev=142.84' Inflow=16.52 cfs 59,316 cf
Primary=6.05 cfs 46,538 cf Secondary=5.34 cfs 6,606 cf Tertiary=5.13 cfs 6,172 cf Outflow=16.52 cfs 59,316 cf

Link PA-1: Inflow=13.42 cfs 79,075 cf
Primary=13.42 cfs 79,075 cf

Link PA-2: Inflow=18.41 cfs 69,585 cf
Primary=18.41 cfs 69,585 cf

Total Runoff Area = 479,994 sf Runoff Volume = 197,268 cf Average Runoff Depth = 4.93"
43.73% Pervious = 209,906 sf 56.27% Impervious = 270,088 sf

Summary for Subcatchment AP: Additional parking area

Runoff = 16.52 cfs @ 12.09 hrs, Volume= 59,316 cf, Depth= 5.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.19"

Area (sf)	CN	Description
4,720	80	>75% Grass cover, Good, HSG D
84,164	98	Paved parking, HSG D
33,130	98	Roofs, HSG D
122,014	97	Weighted Average
4,720		3.87% Pervious Area
117,294		96.13% Impervious Area

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

Summary for Subcatchment ER: Entrance Road

Runoff = 3.18 cfs @ 12.09 hrs, Volume= 11,580 cf, Depth= 5.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.19"

Area (sf)	CN	Description
295	80	>75% Grass cover, Good, HSG D
23,053	98	Paved roads w/curbs & sewers, HSG D
23,348	98	Weighted Average
295		1.26% Pervious Area
23,053		98.74% Impervious Area

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

Summary for Subcatchment NP: New parking area

Runoff = 4.54 cfs @ 12.09 hrs, Volume= 15,868 cf, Depth= 5.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.19"

Area (sf)	CN	Description
5,000	80	>75% Grass cover, Good, HSG D
29,000	98	Paved parking, HSG D
34,000	95	Weighted Average
5,000		14.71% Pervious Area
29,000		85.29% Impervious Area

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

Summary for Subcatchment POST-1.0:

Runoff = 6.26 cfs @ 12.09 hrs, Volume= 22,817 cf, Depth= 5.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.19"

Area (sf)	CN	Description
0	80	>75% Grass cover, Good, HSG D
46,004	98	Paved roads w/curbs & sewers, HSG D
46,004	98	Weighted Average
46,004		100.00% Impervious Area

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

Summary for Subcatchment POST-2.0:

Runoff = 14.67 cfs @ 12.17 hrs, Volume= 55,486 cf, Depth= 3.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.19"

	Area (sf)	CN	Description
	0	30	Brush, Good, HSG A
	0	48	Brush, Good, HSG B
	16,409	73	Brush, Good, HSG D
	0	89	Dirt roads, HSG D
	0	91	Gravel roads, HSG D
	0	98	Paved roads w/curbs & sewers, HSG A
	2,000	98	Paved roads w/curbs & sewers, HSG D
*	0	78	Wetlands, HSG A
*	0	78	Wetlands, HSG D
	0	30	Woods, Good, HSG A
	0	55	Woods, Good, HSG B
	164,235	77	Woods, Good, HSG D
	182,644	77	Weighted Average
	180,644		98.90% Pervious Area
	2,000		1.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	15	0.0200	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.35"
3.9	166	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.9	181	Total			

Summary for Subcatchment R: Roof

Runoff = 3.58 cfs @ 12.09 hrs, Volume= 13,070 cf, Depth= 5.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.19"

Area (sf)	CN	Description
26,352	98	Roofs, HSG D
26,352		100.00% Impervious Area

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

Summary for Subcatchment WP: West Parking

Runoff = 5.74 cfs @ 12.09 hrs, Volume= 19,131 cf, Depth= 5.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.19"

Area (sf)	CN	Description
19,247	80	>75% Grass cover, Good, HSG D
26,385	98	Paved roads w/curbs & sewers, HSG D
45,632	90	Weighted Average
19,247		42.18% Pervious Area
26,385		57.82% Impervious Area

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

Summary for Pond GW-1: Gravel Wetland #1

Inflow Area = 68,980 sf, 71.67% Impervious, Inflow Depth = 6.49" for 25-year event
Inflow = 14.26 cfs @ 12.09 hrs, Volume= 37,318 cf
Outflow = 3.80 cfs @ 12.42 hrs, Volume= 30,811 cf, Atten= 73%, Lag= 20.0 min
Primary = 3.80 cfs @ 12.42 hrs, Volume= 30,811 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Peak Elev= 137.68' @ 12.42 hrs Surf.Area= 8,698 sf Storage= 22,634 cf
Flood Elev= 139.50' Surf.Area= 13,912 sf Storage= 42,211 cf

Plug-Flow detention time= 586.6 min calculated for 30,811 cf (83% of inflow)
Center-of-Mass det. time= 523.4 min (1,285.1 - 761.7)

Volume	Invert	Avail.Storage	Storage Description
#1	132.50'	42,211 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
132.50	4,937	0.0	0	0
134.85	4,937	40.0	4,641	4,641
135.50	5,159	100.0	3,281	7,922
136.00	5,907	100.0	2,767	10,688
137.00	7,230	100.0	6,569	17,257
138.00	9,405	100.0	8,318	25,574
139.00	11,275	100.0	10,340	35,914
139.50	13,912	100.0	6,297	42,211

Device	Routing	Invert	Outlet Devices
#1	Primary	135.20'	**24.0" Round Culvert** L= 19.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 135.20' / 135.15' S= 0.0026 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	135.20'	**2.5" Vert. Orifice/Grate** C= 0.600
#3	Device 1	137.25'	**4.0' long x 0.60' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	138.50'	**4.0" x 4.0" Horiz. Orifice/Grate X 106.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.77 cfs @ 12.42 hrs HW=137.67' TW=0.00' (Dynamic Tailwater)
↑**1=Culvert** (Passes 3.77 cfs of 15.33 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 0.25 cfs @ 7.41 fps)
3=Sharp-Crested Rectangular Weir (Weir Controls 3.52 cfs @ 2.13 fps)
4=Orifice/Grate (Controls 0.00 cfs)

Summary for Pond GW-2: Gravel Wetland #2

Inflow Area = 34,000 sf, 85.29% Impervious, Inflow Depth = 5.60" for 25-year event
Inflow = 4.54 cfs @ 12.09 hrs, Volume= 15,868 cf
Outflow = 3.77 cfs @ 12.15 hrs, Volume= 14,099 cf, Atten= 17%, Lag= 3.5 min
Primary = 3.77 cfs @ 12.15 hrs, Volume= 14,099 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 135.43' @ 12.15 hrs Surf.Area= 3,347 sf Storage= 4,378 cf
Flood Elev= 137.00' Surf.Area= 5,615 sf Storage= 11,376 cf

Plug-Flow detention time= 150.4 min calculated for 14,090 cf (89% of inflow)
Center-of-Mass det. time= 97.8 min (860.7 - 762.9)

Volume	Invert	Avail.Storage	Storage Description
#1	131.50'	11,376 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
131.50	1,810	0.0	0	0
133.85	1,810	40.0	1,701	1,701
134.50	2,175	10.0	130	1,831
135.00	2,765	100.0	1,235	3,066
136.00	4,120	100.0	3,443	6,508
137.00	5,615	100.0	4,868	11,376

Device	Routing	Invert	Outlet Devices
#1	Primary	134.20'	**24.0" Round Culvert** L= 19.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 134.20' / 134.15' S= 0.0026 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	134.20'	**2.5" Vert. Orifice/Grate** C= 0.600
#3	Device 1	135.00'	**4.0' long x 0.60' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	136.00'	**4.0" x 4.0" Horiz. Orifice/Grate X 106.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.75 cfs @ 12.15 hrs HW=135.43' TW=0.00' (Dynamic Tailwater)
↑**1=Culvert** (Passes 3.75 cfs of 5.11 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 0.17 cfs @ 5.10 fps)
3=Sharp-Crested Rectangular Weir (Weir Controls 3.58 cfs @ 2.14 fps)
4=Orifice/Grate (Controls 0.00 cfs)

Summary for Pond IC: Infiltration Facility C

Inflow Area = 148,366 sf, 96.82% Impervious, Inflow Depth = 5.32" for 25-year event
Inflow = 14.76 cfs @ 12.09 hrs, Volume= 65,780 cf
Outflow = 9.32 cfs @ 12.19 hrs, Volume= 65,815 cf, Atten= 37%, Lag= 6.6 min
Discarded = 0.72 cfs @ 9.55 hrs, Volume= 40,367 cf
Primary = 8.60 cfs @ 12.19 hrs, Volume= 25,448 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 140.61' @ 12.19 hrs Surf.Area= 13,840 sf Storage= 13,697 cf
Flood Elev= 141.33' Surf.Area= 13,840 sf Storage= 17,852 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 48.1 min (800.7 - 752.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	9,615 cf	**54.83'W x 252.40'L x 2.33'H Field A** 32,293 cf Overall - 8,255 cf Embedded = 24,038 cf x 40.0% Voids
#2A	139.50'	8,255 cf	**ADS_StormTech SC-310 +Cap** x 560 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 16 Rows of 35 Chambers

17,871 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 3	139.00'	**24.0" Round Culvert** L= 130.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.00' / 136.00' S= 0.0231 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Discarded	139.00'	**2.250 in/hr Exfiltration over Surface area**
#3	Primary	139.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.72 cfs @ 9.55 hrs HW=139.03' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.72 cfs)

Primary OutFlow Max=8.57 cfs @ 12.19 hrs HW=140.60' TW=0.00' (Dynamic Tailwater)
└**3=Sharp-Crested Rectangular Weir** (Passes 8.57 cfs of 9.86 cfs potential flow)
└**1=Culvert** (Outlet Controls 8.57 cfs @ 4.35 fps)

Summary for Pond PDMH-06: PDMH-06

Inflow Area = 122,014 sf, 96.13% Impervious, Inflow Depth = 5.83" for 25-year event
Inflow = 16.52 cfs @ 12.09 hrs, Volume= 59,316 cf
Outflow = 16.52 cfs @ 12.09 hrs, Volume= 59,316 cf, Atten= 0%, Lag= 0.0 min
Primary = 6.05 cfs @ 12.08 hrs, Volume= 46,538 cf
Secondary = 5.34 cfs @ 12.09 hrs, Volume= 6,606 cf
Tertiary = 5.13 cfs @ 12.09 hrs, Volume= 6,172 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 142.84' @ 12.09 hrs
Flood Elev= 142.85'

Device	Routing	Invert	Outlet Devices
#1	Primary	139.50'	**12.0" Round Culvert** L= 10.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.50' / 137.50' S= 0.2000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Secondary	140.35'	**12.0" Round Culvert** L= 25.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 140.35' / 137.50' S= 0.1140 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Tertiary	140.35'	**12.0" Round Culvert** L= 65.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 140.35' / 139.50' S= 0.0131 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=5.71 cfs @ 12.08 hrs HW=142.70' TW=140.42' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 5.71 cfs @ 7.27 fps)

Secondary OutFlow Max=5.20 cfs @ 12.09 hrs HW=142.74' TW=136.83' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 5.20 cfs @ 6.62 fps)

Tertiary OutFlow Max=5.01 cfs @ 12.09 hrs HW=142.74' TW=140.44' (Dynamic Tailwater)
↑—**3=Culvert** (Barrel Controls 5.01 cfs @ 6.38 fps)

Summary for Link PA-1:

Inflow Area = 263,350 sf, 90.79% Impervious, Inflow Depth = 3.60" for 25-year event
Inflow = 13.42 cfs @ 12.15 hrs, Volume= 79,075 cf
Primary = 13.42 cfs @ 12.15 hrs, Volume= 79,075 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link PA-2:

Inflow Area = 216,644 sf, 14.31% Impervious, Inflow Depth = 3.85" for 25-year event
Inflow = 18.41 cfs @ 12.16 hrs, Volume= 69,585 cf
Primary = 18.41 cfs @ 12.16 hrs, Volume= 69,585 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment AP: Additional parking Runoff Area=122,014 sf 96.13% Impervious Runoff Depth=8.32"
Tc=6.0 min CN=97 Runoff=23.26 cfs 84,592 cf

Subcatchment ER: Entrance Road Runoff Area=23,348 sf 98.74% Impervious Runoff Depth=8.44"
Tc=6.0 min CN=98 Runoff=4.46 cfs 16,421 cf

Subcatchment NP: New parking area Runoff Area=34,000 sf 85.29% Impervious Runoff Depth=8.08"
Tc=6.0 min CN=95 Runoff=6.43 cfs 22,890 cf

Subcatchment POST-1.0: Runoff Area=46,004 sf 100.00% Impervious Runoff Depth=8.44"
Tc=6.0 min CN=98 Runoff=8.79 cfs 32,355 cf

Subcatchment POST-2.0: Runoff Area=182,644 sf 1.10% Impervious Runoff Depth=5.90"
Flow Length=181' Slope=0.0200 '/' Tc=11.9 min CN=77 Runoff=23.54 cfs 89,824 cf

Subcatchment R: Roof Runoff Area=26,352 sf 100.00% Impervious Runoff Depth=8.44"
Tc=6.0 min CN=98 Runoff=5.04 cfs 18,534 cf

Subcatchment WP: West Parking Runoff Area=45,632 sf 57.82% Impervious Runoff Depth=7.48"
Tc=6.0 min CN=90 Runoff=8.34 cfs 28,428 cf

Pond GW-1: Gravel Wetland #1 Peak Elev=138.22' Storage=27,654 cf Inflow=20.70 cfs 56,154 cf
Outflow=9.52 cfs 49,641 cf

Pond GW-2: Gravel Wetland #2 Peak Elev=135.55' Storage=4,807 cf Inflow=6.43 cfs 22,890 cf
Outflow=5.43 cfs 21,122 cf

Pond IC: Infiltration Facility C Peak Elev=141.03' Storage=16,197 cf Inflow=20.39 cfs 91,821 cf
Discarded=0.72 cfs 47,608 cf Primary=14.05 cfs 44,222 cf Outflow=14.77 cfs 91,831 cf

Pond PDMH-06: PDMH-06 Peak Elev=145.21' Inflow=23.26 cfs 84,592 cf
Primary=8.15 cfs 63,191 cf Secondary=7.90 cfs 11,305 cf Tertiary=7.21 cfs 10,096 cf Outflow=23.26 cfs 84,592 cf

Link PA-1: Inflow=29.29 cfs 126,219 cf
Primary=29.29 cfs 126,219 cf

Link PA-2: Inflow=28.91 cfs 110,946 cf
Primary=28.91 cfs 110,946 cf

Total Runoff Area = 479,994 sf Runoff Volume = 293,044 cf Average Runoff Depth = 7.33"
43.73% Pervious = 209,906 sf 56.27% Impervious = 270,088 sf

Summary for Subcatchment AP: Additional parking area

Runoff = 23.26 cfs @ 12.09 hrs, Volume= 84,592 cf, Depth= 8.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.68"

Area (sf)	CN	Description
4,720	80	>75% Grass cover, Good, HSG D
84,164	98	Paved parking, HSG D
33,130	98	Roofs, HSG D
122,014	97	Weighted Average
4,720		3.87% Pervious Area
117,294		96.13% Impervious Area

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

Summary for Subcatchment ER: Entrance Road

Runoff = 4.46 cfs @ 12.09 hrs, Volume= 16,421 cf, Depth= 8.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.68"

Area (sf)	CN	Description
295	80	>75% Grass cover, Good, HSG D
23,053	98	Paved roads w/curbs & sewers, HSG D
23,348	98	Weighted Average
295		1.26% Pervious Area
23,053		98.74% Impervious Area

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

Summary for Subcatchment NP: New parking area

Runoff = 6.43 cfs @ 12.09 hrs, Volume= 22,890 cf, Depth= 8.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.68"

Area (sf)	CN	Description
5,000	80	>75% Grass cover, Good, HSG D
29,000	98	Paved parking, HSG D
34,000	95	Weighted Average
5,000		14.71% Pervious Area
29,000		85.29% Impervious Area

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

Summary for Subcatchment POST-1.0:

Runoff = 8.79 cfs @ 12.09 hrs, Volume= 32,355 cf, Depth= 8.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.68"

Area (sf)	CN	Description
0	80	>75% Grass cover, Good, HSG D
46,004	98	Paved roads w/curbs & sewers, HSG D
46,004	98	Weighted Average
46,004		100.00% Impervious Area

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

Summary for Subcatchment POST-2.0:

Runoff = 23.54 cfs @ 12.16 hrs, Volume= 89,824 cf, Depth= 5.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.68"

	Area (sf)	CN	Description
	0	30	Brush, Good, HSG A
	0	48	Brush, Good, HSG B
	16,409	73	Brush, Good, HSG D
	0	89	Dirt roads, HSG D
	0	91	Gravel roads, HSG D
	0	98	Paved roads w/curbs & sewers, HSG A
	2,000	98	Paved roads w/curbs & sewers, HSG D
*	0	78	Wetlands, HSG A
*	0	78	Wetlands, HSG D
	0	30	Woods, Good, HSG A
	0	55	Woods, Good, HSG B
	164,235	77	Woods, Good, HSG D
	182,644	77	Weighted Average
	180,644		98.90% Pervious Area
	2,000		1.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	15	0.0200	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.35"
3.9	166	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.9	181	Total			

Summary for Subcatchment R: Roof

Runoff = 5.04 cfs @ 12.09 hrs, Volume= 18,534 cf, Depth= 8.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.68"

Area (sf)	CN	Description
26,352	98	Roofs, HSG D
26,352		100.00% Impervious Area

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

Summary for Subcatchment WP: West Parking

Runoff = 8.34 cfs @ 12.09 hrs, Volume= 28,428 cf, Depth= 7.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.68"

Area (sf)	CN	Description
19,247	80	>75% Grass cover, Good, HSG D
26,385	98	Paved roads w/curbs & sewers, HSG D
45,632	90	Weighted Average
19,247		42.18% Pervious Area
26,385		57.82% Impervious Area

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

Summary for Pond GW-1: Gravel Wetland #1

Inflow Area = 68,980 sf, 71.67% Impervious, Inflow Depth = 9.77" for 100-year event
Inflow = 20.70 cfs @ 12.09 hrs, Volume= 56,154 cf
Outflow = 9.52 cfs @ 12.27 hrs, Volume= 49,641 cf, Atten= 54%, Lag= 10.8 min
Primary = 9.52 cfs @ 12.27 hrs, Volume= 49,641 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Peak Elev= 138.22' @ 12.27 hrs Surf.Area= 9,810 sf Storage= 27,654 cf
Flood Elev= 139.50' Surf.Area= 13,912 sf Storage= 42,211 cf

Plug-Flow detention time= 416.3 min calculated for 49,607 cf (88% of inflow)
Center-of-Mass det. time= 368.6 min (1,123.2 - 754.6)

Volume	Invert	Avail.Storage	Storage Description
#1	132.50'	42,211 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
132.50	4,937	0.0	0	0
134.85	4,937	40.0	4,641	4,641
135.50	5,159	100.0	3,281	7,922
136.00	5,907	100.0	2,767	10,688
137.00	7,230	100.0	6,569	17,257
138.00	9,405	100.0	8,318	25,574
139.00	11,275	100.0	10,340	35,914
139.50	13,912	100.0	6,297	42,211

Device	Routing	Invert	Outlet Devices
#1	Primary	135.20'	**24.0" Round Culvert** L= 19.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 135.20' / 135.15' S= 0.0026 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	135.20'	**2.5" Vert. Orifice/Grate** C= 0.600
#3	Device 1	137.25'	**4.0' long x 0.60' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	138.50'	**4.0" x 4.0" Horiz. Orifice/Grate X 106.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=9.49 cfs @ 12.27 hrs HW=138.21' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 9.49 cfs of 19.72 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.28 cfs @ 8.21 fps)
  ├**3=Sharp-Crested Rectangular Weir** (Orifice Controls 9.21 cfs @ 3.96 fps)
  └**4=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond GW-2: Gravel Wetland #2

Inflow Area = 34,000 sf, 85.29% Impervious, Inflow Depth = 8.08" for 100-year event
Inflow = 6.43 cfs @ 12.09 hrs, Volume= 22,890 cf
Outflow = 5.43 cfs @ 12.14 hrs, Volume= 21,122 cf, Atten= 16%, Lag= 3.3 min
Primary = 5.43 cfs @ 12.14 hrs, Volume= 21,122 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 135.55' @ 12.14 hrs Surf.Area= 3,516 sf Storage= 4,807 cf
Flood Elev= 137.00' Surf.Area= 5,615 sf Storage= 11,376 cf

Plug-Flow detention time= 125.6 min calculated for 21,107 cf (92% of inflow)
Center-of-Mass det. time= 84.9 min (840.2 - 755.4)

Volume	Invert	Avail.Storage	Storage Description
#1	131.50'	11,376 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
131.50	1,810	0.0	0	0
133.85	1,810	40.0	1,701	1,701
134.50	2,175	10.0	130	1,831
135.00	2,765	100.0	1,235	3,066
136.00	4,120	100.0	3,443	6,508
137.00	5,615	100.0	4,868	11,376

Device	Routing	Invert	Outlet Devices
#1	Primary	134.20'	**24.0" Round Culvert** L= 19.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 134.20' / 134.15' S= 0.0026 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	134.20'	**2.5" Vert. Orifice/Grate** C= 0.600
#3	Device 1	135.00'	**4.0' long x 0.60' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	136.00'	**4.0" x 4.0" Horiz. Orifice/Grate X 106.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=5.38 cfs @ 12.14 hrs HW=135.55' TW=0.00' (Dynamic Tailwater)
↑**1=Culvert** (Passes 5.38 cfs of 6.06 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 0.18 cfs @ 5.37 fps)
3=Sharp-Crested Rectangular Weir (Weir Controls 5.19 cfs @ 2.43 fps)
4=Orifice/Grate (Controls 0.00 cfs)

Summary for Pond IC: Infiltration Facility C

Inflow Area = 148,366 sf, 96.82% Impervious, Inflow Depth = 7.43" for 100-year event
Inflow = 20.39 cfs @ 12.09 hrs, Volume= 91,821 cf
Outflow = 14.77 cfs @ 12.17 hrs, Volume= 91,831 cf, Atten= 28%, Lag= 4.9 min
Discarded = 0.72 cfs @ 8.55 hrs, Volume= 47,608 cf
Primary = 14.05 cfs @ 12.17 hrs, Volume= 44,222 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 141.03' @ 12.17 hrs Surf.Area= 13,840 sf Storage= 16,197 cf
Flood Elev= 141.33' Surf.Area= 13,840 sf Storage= 17,852 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 47.4 min (794.3 - 746.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	9,615 cf	**54.83'W x 252.40'L x 2.33'H Field A** 32,293 cf Overall - 8,255 cf Embedded = 24,038 cf x 40.0% Voids
#2A	139.50'	8,255 cf	**ADS_StormTech SC-310 +Cap** x 560 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 16 Rows of 35 Chambers

17,871 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 3	139.00'	**24.0" Round Culvert** L= 130.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.00' / 136.00' S= 0.0231 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Discarded	139.00'	**2.250 in/hr Exfiltration over Surface area**
#3	Primary	139.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.72 cfs @ 8.55 hrs HW=139.03' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.72 cfs)

Primary OutFlow Max=13.82 cfs @ 12.17 hrs HW=141.01' TW=0.00' (Dynamic Tailwater)
└**3=Sharp-Crested Rectangular Weir** (Passes 13.82 cfs of 17.40 cfs potential flow)
└**1=Culvert** (Outlet Controls 13.82 cfs @ 5.43 fps)

Summary for Pond PDMH-06: PDMH-06

Inflow Area = 122,014 sf, 96.13% Impervious, Inflow Depth = 8.32" for 100-year event
Inflow = 23.26 cfs @ 12.09 hrs, Volume= 84,592 cf
Outflow = 23.26 cfs @ 12.09 hrs, Volume= 84,592 cf, Atten= 0%, Lag= 0.0 min
Primary = 8.15 cfs @ 12.08 hrs, Volume= 63,191 cf
Secondary = 7.90 cfs @ 12.09 hrs, Volume= 11,305 cf
Tertiary = 7.21 cfs @ 12.09 hrs, Volume= 10,096 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 145.21' @ 12.09 hrs
Flood Elev= 142.85'

Device	Routing	Invert	Outlet Devices
#1	Primary	139.50'	**12.0" Round Culvert** L= 10.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.50' / 137.50' S= 0.2000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Secondary	140.35'	**12.0" Round Culvert** L= 25.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 140.35' / 137.50' S= 0.1140 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Tertiary	140.35'	**12.0" Round Culvert** L= 65.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 140.35' / 139.50' S= 0.0131 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=7.71 cfs @ 12.08 hrs HW=144.96' TW=140.81' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 7.71 cfs @ 9.81 fps)

Secondary OutFlow Max=7.72 cfs @ 12.09 hrs HW=145.02' TW=137.80' (Dynamic Tailwater)
└**2=Culvert** (Inlet Controls 7.72 cfs @ 9.83 fps)

Tertiary OutFlow Max=6.83 cfs @ 12.09 hrs HW=144.97' TW=140.81' (Dynamic Tailwater)
└**3=Culvert** (Outlet Controls 6.83 cfs @ 8.70 fps)

Summary for Link PA-1:

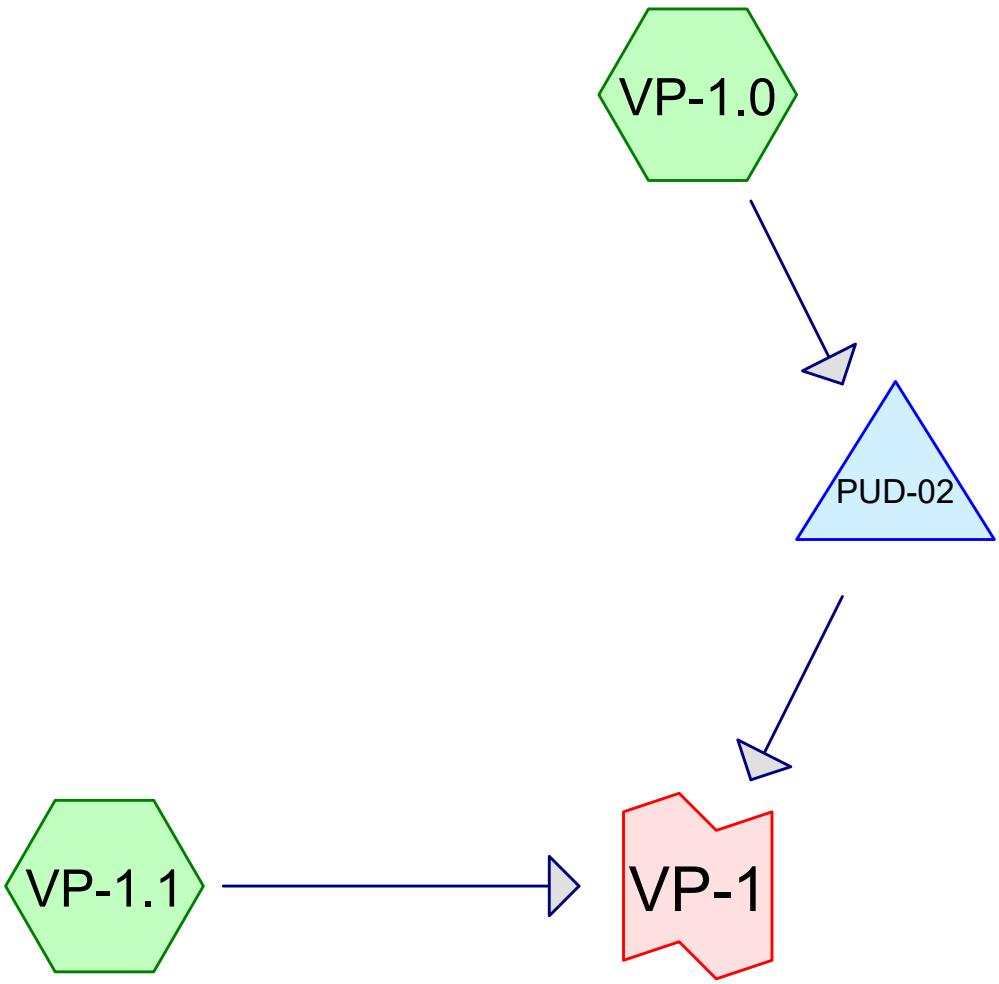
Inflow Area = 263,350 sf, 90.79% Impervious, Inflow Depth = 5.75" for 100-year event
Inflow = 29.29 cfs @ 12.15 hrs, Volume= 126,219 cf
Primary = 29.29 cfs @ 12.15 hrs, Volume= 126,219 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link PA-2:

Inflow Area = 216,644 sf, 14.31% Impervious, Inflow Depth = 6.15" for 100-year event
Inflow = 28.91 cfs @ 12.16 hrs, Volume= 110,946 cf
Primary = 28.91 cfs @ 12.16 hrs, Volume= 110,946 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs



Subcat Reach Pond Link

Routing Diagram for J5019-002_Post_BVW
Prepared by Tighe & Bond, Printed 2/19/2021

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
17,700	80	>75% Grass cover, Good, HSG D (VP-1.0, VP-1.1)
19,300	98	Paved parking, HSG D (VP-1.0)
47,750	78	Wetlands, HSG D (VP-1.1)
34,250	77	Woods, Good, HSG D (VP-1.1)
119,000	**81**	**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment VP-1.0: Runoff Area=26,800 sf 72.01% Impervious Runoff Depth=1.87"
Tc=6.0 min CN=93 Runoff=1.30 cfs 4,185 cf

Subcatchment VP-1.1: Runoff Area=92,200 sf 0.00% Impervious Runoff Depth=0.85"
Tc=6.0 min CN=78 Runoff=1.98 cfs 6,558 cf

Pond PUD-02: Peak Elev=135.96' Storage=1,845 cf Inflow=1.30 cfs 4,185 cf
Discarded=0.01 cfs 2,155 cf Primary=0.53 cfs 2,535 cf Outflow=0.54 cfs 4,690 cf

Link VP-1: Inflow=2.01 cfs 9,093 cf
Primary=2.01 cfs 9,093 cf

Total Runoff Area = 119,000 sf Runoff Volume = 10,742 cf Average Runoff Depth = 1.08"
83.78% Pervious = 99,700 sf 16.22% Impervious = 19,300 sf

Summary for Subcatchment VP-1.0:

Runoff = 1.30 cfs @ 12.09 hrs, Volume= 4,185 cf, Depth= 1.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2.6 Inch Rainfall=2.60"

	Area (sf)	CN	Description
	7,500	80	>75% Grass cover, Good, HSG D
	19,300	98	Paved parking, HSG D
*	0	78	Wetlands, HSG D
*	0	77	Woods, Good, HSG D
	26,800	93	Weighted Average
	7,500		27.99% Pervious Area
	19,300		72.01% Impervious Area

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

Summary for Subcatchment VP-1.1:

Runoff = 1.98 cfs @ 12.10 hrs, Volume= 6,558 cf, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2.6 Inch Rainfall=2.60"

	Area (sf)	CN	Description
	10,200	80	>75% Grass cover, Good, HSG D
	0	98	Paved parking, HSG D
*	47,750	78	Wetlands, HSG D
*	34,250	77	Woods, Good, HSG D
	92,200	78	Weighted Average
	92,200		100.00% Pervious Area

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

Summary for Pond PUD-02:

Inflow Area = 26,800 sf, 72.01% Impervious, Inflow Depth = 1.87" for 2.6 Inch event
Inflow = 1.30 cfs @ 12.09 hrs, Volume= 4,185 cf
Outflow = 0.54 cfs @ 12.32 hrs, Volume= 4,690 cf, Atten= 58%, Lag= 13.6 min
Discarded = 0.01 cfs @ 0.00 hrs, Volume= 2,155 cf
Primary = 0.53 cfs @ 12.32 hrs, Volume= 2,535 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Starting Elev= 135.25' Surf.Area= 2,518 sf Storage= 504 cf
Peak Elev= 135.96' @ 12.32 hrs Surf.Area= 2,518 sf Storage= 1,845 cf (1,342 cf above start)
Flood Elev= 137.08' Surf.Area= 2,518 sf Storage= 3,196 cf (2,692 cf above start)

Plug-Flow detention time= 394.3 min calculated for 4,184 cf (100% of inflow)
Center-of-Mass det. time= 297.4 min (1,097.4 - 800.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	134.75'	1,784 cf	**21.50'W x 117.12'L x 2.33'H Field A** 5,876 cf Overall - 1,415 cf Embedded = 4,460 cf x 40.0% Voids
#2A	135.25'	1,415 cf	**ADS_StormTech SC-310 +Cap** x 96 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 6 Rows of 16 Chambers
		3,199 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	135.25'	**15.0" Round Culvert** L= 35.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 135.25' / 135.00' S= 0.0071 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	135.25'	**1.2" Vert. Orifice/Grate** C= 0.600
#3	Device 1	135.85'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Discarded	134.75'	**0.250 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 0.00 hrs HW=135.25' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.52 cfs @ 12.32 hrs HW=135.96' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.52 cfs of 1.68 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.03 cfs @ 3.92 fps)
  └**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.49 cfs @ 1.09 fps)

Summary for Link VP-1:

Inflow Area = 119,000 sf, 16.22% Impervious, Inflow Depth = 0.92" for 2.6 Inch event
Inflow = 2.01 cfs @ 12.10 hrs, Volume= 9,093 cf
Primary = 2.01 cfs @ 12.10 hrs, Volume= 9,093 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

STORMWATER POND DESIGN CRITERIA

Env-Wq 1508.03

Type/Node Name:

Enter the type of stormwater pond (e.g., Wet Pond) and the node name in the drain

0.62	ac	A = Area draining to the practice
0.46	ac	A_I = Impervious area draining to the practice
0.74	decimal	I = Percent impervious area draining to the practice, in decimal form
0.72	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)
0.45	ac-in	WQV= 1" x Rv x A
1,615	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")
162	cf	10% x WQV (check calc for sediment forebay and micropool volume)
808	cf	50% x WQV (check calc for extended detention volume)
-	cf	V_{SED} = Sediment forebay volume
-	cf	V_{PP} = Permanent pool volume (volume below the lowest invert of the out stage-storage table.
yes	cf	Extended Detention?[1]
1,615		V_{ED} = Volume of extended detention (if "yes" is given in box above)
135.84		E_{ED} = Elevation of WQV if "yes" is given in box above[2]
0.04	cfs	$2Q_{avg}$ = 2* V_{ED} / 24 hrs * (1hr / 3600 sec) (used to check against Q_{EDmax} be
0.03	cfs	Q_{EDmax} = Discharge at the E_{ED} (attach stage-discharge table)
29.91	hours	T_{ED} = Drawdown time of extended detention = $2V_{ED}/Q_{EDmax}$
	:1	Pond side slopes
	ft	Elevation of seasonal high water table
	ft	Elevation of lowest pond outlet
-5.00	ft	Max floor = Maximum elevation of pond bottom (ft)
-8.00	ft	Minimum floor (to maintain depth at less than 8')
	ft	Elevation of pond floor[3]
	ft	Length of the flow path between the inlet and outlet at mid-depth
	ft	Average width ([average of the top width + average bottom width]/2)
-	:1	Length to average width ratio
	Yes/No	Is the perimeter curvilinear.
	Yes/No	Are the inlet and outlet located as far apart as possible.
	Yes/No	Is there a manually-controlled drain to dewater the pond over a 24hr per
If no state why:		
		What mechanism is proposed to prevent the outlet structure from cloggi orifices/weirs with a dimension of <6")?
	ft	Peak elevation of the 50-year storm event
	ft	Berm elevation of the pond
-		50 peak elevation ≤ the berm elevation?

1. If the entire WQV is stored in the perm. pool, there is no extended det., and the following five lines do n

2. This is the elevation of WQV **if** the hydrologic analysis is set up to include the permanent pool storage in

3. If the pond floor elevation is above the max floor elev., a hydrologic budget must be submitted to demo depth of 3 feet can be maintained. (First check whether a revised "lowest pond outlet" elev. will resolve th

Designer's Notes:

2.4 Peak Rate Comparisons

The following table summarizes and compares the pre- and post-development peak runoff rates and total volume for the 2-year, 10-year, 25-year and 100-year storm events at PA-1 and PA-2.

Table 2.4.1 – Comparison of Peak Flow Rates & Total Volume						
Point of Analysis – 1 (PA-1)						
	Existing Conditions		Proposed Conditions		Net Change	
Storm Frequency	Peak Runoff (CFS)	Total Volume (CF)	Peak Runoff (CFS)	Total Volume (CF)	Peak Runoff (CFS)	Total Volume (CF)
2-Year	*8.58*	*30,174*	3.95	29,294	-4.63	-880
10-Year	*16.65*	*57,392*	9.55	56,565	-7.10	-827
25-Year	*23.18*	*80,091*	13.42	79,075	-9.76	-1016
100-Year	*36.53*	*127,821*	29.29	126,219	-7.24	-1602
Point of Analysis – 2 (PA-2)						
	Existing Conditions	Proposed Conditions	Proposed Conditions		Net Change	
Storm Frequency	Peak Runoff (CFS)	Total Volume (CF)	Peak Runoff (CFS)	Total Volume (CF)	Peak Runoff (CFS)	Total Volume (CF)
2-Year	*6.88*	*26,390*	6.27	26,234	-0.61	-156
10-Year	*13.28*	*50,195*	13.26	49,900	-0.02	-295
25-Year	*18.49*	*70,048*	18.41	69,585	-0.08	-463
100-Year	*29.15*	*111,792*	28.91	110,946	-0.24	-846

2.5 Mitigation Description

2.0.1 Mitigation Calculations

The proposed project area has been evaluated to provide treatment for the required water quality volume (WQV) and groundwater recharge volume (GRV) per the requirements of the Massachusetts DEP Stormwater Handbook. These calculations have been provided above. The required groundwater recharge volumes (GRV) and water quality volumes (WQV) have been provided below outlets.

2.0.2 Pre-Treatment Methods for Protecting Water Quality

Pre-treatment for the proposed gravel wetland is provided by deep sump catchbasins with hoods and a sediment forebay. Pre-treatment for the underground infiltration chamber system includes deep sump catchbasins with hoods and proprietary separators.

2.0.3 Treatment Methods for Protecting Water Quality

Treatment for the increased impervious area comes from one gravel wetland and one subsurface infiltration chamber system. Water quality volume (WQV) calculations for each treatment system are below:

Table 2.5.1 – Proposed Treatment Areas Water Quality Volume Calculations	
DESCRIPTION	VALUE
On-Site Required Water Quality Volume	**24,500 CF**
Water Quality Volume, Gravel Wetland #1	**17,257 CF**
Water Quality Volume, Gravel Wetland #2	**2,412CF**
Water Quality Volume, Infiltration Chambers	**5,560 CF**
Total Water Quality Volume	**25,229 CF**

2.6 BVW Analysis Volume Comparison

The following table summarizes and compares the pre- and post-development runoff volume for 2.6 inch 24-hour design storm event for runoff directed to the BVW containing a vernal pool.

Table 2.6.1 – Comparison of Volume to BVW		
	Existing Conditions Volume (CF)	Proposed Conditions Volume (CF)
2.6" Storm	9,317	9,093

As depicted in the table above the post-development condition was designed to most nearly match the total pre-development runoff volume directed to the BVM in the post-development condition. Additional proposed impervious area in the post-development condition is first directed through a proprietary stormwater treatment unit before it is sent through a level spreader to reduce the point discharge to sheet flow before it enters the BVM.

In addition to designing the stormwater system to match volumes directed to the vernal pool an underground detention system was also implemented to provide extended detention and temperature reduction for post development runoff directed to the vernal pool The detention system provides ±30 hour drawdown time of the required Water Quality Volume as shown in the enclosed HydroCAD. In addition to the HydroCAD analysis a stormwater BMP worksheet (provided by the New Hampshire Department of Environmental Services) is also unclosed. This BMP worksheet was used as an aid in designing the detention system to provide adequate extended detention

2.7 Conclusion

Based on the HydroCAD analysis for the 2, 10, 25 and 100-year storm events, the peak rate of runoff and total runoff volume has decreased from the existing to the proposed condition. Furthermore, the required Water Quality Volume and Recharge Volume have been and infiltrated and treated thereby promoting/preserving the natural hydrologic conditions. In addition to these improvements, all 10 of the DEP Stormwater Standards have been met. Also, the post development stormwater system was designed such that

the pre-development and post-development runoff volumes directed to BVW containing a vernal pool are approximately equal. Furthermore, the required Water Quality Volume and Recharge Volume have been infiltrated and treated thereby promoting/preserving the natural hydrologic conditions. In addition to these improvements, all 10 of the DEP Stormwater Standards have been met.

Section 3
Long Term Pollution Prevention, Operation & Maintenance Plan

It is the intent of this Long-Term Pollution Prevention, Operation and Maintenance Plan to identify the areas of this site that need special attention and consideration, as well as implementing a plan to assure routine maintenance. By identifying the areas of concern as well as implementing a frequent and routine maintenance schedule the site will maintain a high-quality stormwater runoff.

To keep the Stormwater Management System functioning properly and to ensure that the stormwater Total Suspended Solids (TSS) are reduced, a long-term pollution prevention is required. The owner/operator of the facility is responsible for the adherence to this long-term plan. The following is a guideline of the specific requirements of the plan to maintain the long-term viability of the stormwater management system.

3.1 Contact/Responsible Party

Jones Street Residential
100 High Street, Suite 2500
Boston, Massachusetts 02110

(Note: The contact information for the Contact/Responsible Party shall be kept current. If ownership changes, the Operation and Maintenance Plan must be transferred to the new party.)

3.2 Maintenance Items

Maintenance of the following items shall be recorded:

- Litter/Debris Removal
- Landscaping
- Catch basin Cleaning
- Pavement Sweeping
- Gravel Wetland Maintenance
- Underground Chamber System

The following maintenance items and schedule represent the minimum action required. Monthly site inspections shall be conducted, and all measures must be maintained in effective operating condition. The following items shall be observed during site inspection and maintenance:

- Inspect vegetated areas, particularly slopes and embankments for areas of erosion. Replant and restore as necessary
- Inspect catch basins for sediment buildup
- Inspect site for trash and debris

3.3 Overall Site Operation & Maintenance Schedule

Overall Site Operation and Maintenance Schedule		
Maintenance Item	**Frequency of Maintenance**	**Operation**
Litter/Debris Removal	Weekly	Management Company
Pavement Sweeping - Sweep impervious areas to remove sand and litter.	Annually	Parking Lot Sweeper
Sediment Forebay - Trash and debris to be removed including at check dam. - Embankment to be mowed. - Any required maintenance shall be addressed. - Inspect sediment accumulation and clean as needed.	Periodically (At least two (2) times annually)	Management Company
Gravel wetland - Trash and debris to be removed including at outlet structure. - Embankment to be mowed. - Any required maintenance shall be addressed.	Periodically (At least two (2) times annually)	Management Company
Rip Rap Aprons - Trash and debris to be removed. - Any required maintenance shall be addressed.	Annually	Management Company
Catch Basin (CB) Cleaning - CB to be cleaned of solids and oils. - Remove any accumulated debris from the grates - Inspect hood to ensure that it is properly secured.	Quarterly Inspect sumps for accumulated sediment. If sediment has reached a depth of eighteen inches (18”), remove via clamshell bucket or vacuum truck.	Vacuum Truck
Landscaping - Landscaped islands to be maintained and mulched.	Maintained as required and mulched each Spring	Management Company

Sediment Forebay Inspection/Maintenance Requirements		
Inspection/ Maintenance	**Frequency**	**Action**
Monitor Sediment Accumulation	Annually	- Install and maintain a staff gage or other measuring devise, to indicate depth of sediment accumulation and level at which clean-out is required
Visual inspection	Annually	- Remove trash and debris as needed - Remove any woody vegetation - Inspect and repair embankments - Inspect check dam
Mowing	Periodically (At least two (2) times annually)	- Embankments shall be mowed

Proprietary Separators Inspection/Maintenance Requirements		
Inspection/ Maintenance	**Frequency**	**Action**
- All operation and maintenance to follow Proprietary Separator Manufacturer's guidelines. - Sediment to be removed once it reaches approximately 15% of unit storage capacity. - Units to be cleaned immediately after an oil, fuel, or chemical spill.		
Monitor Sediment Accumulation	Quarterly	- Inspect structure for accumulated sediment and oil. Remove sediment if sediment has reached maximum depth. If oil is present, pump off oil layer.
Visual inspection	Annually	- Inspect structure for accumulated sediment and oil. Remove sediment if sediment has reached maximum depth. If oil is present, pump off oil layer.

Gravel Wetland Inspection/Maintenance Requirements		
Inspection/ Maintenance	**Frequency**	**Action**
Monitor to ensure that Gravel Wetland functions effectively after storms	Four (4) times annually (quarterly) and after any rainfall event exceeding 2.5" in a 24-hr period	- Trash and debris to be removed - Any required maintenance shall be addressed
Inspect Vegetation	Annually	- Inspect the condition of all gravel wetland vegetation - Prune back overgrowth - Replace dead vegetation - Remove any invasive species -Coordinate with UNH Stormwater Center for further vegetation management guidelines
Inspect Drawdown Time - The system shall drawdown within 48-hours following a rainfall event.	Annually	- Hire qualified professional to assess the condition of the facility to determine measures required to restore the filtration function, including but not limited to removal of accumulated sediments or reconstruction of the filter.

Additional Gravel Wetland Operation and Maintenance Requirements:

- ***1st Year Post-Construction:*** Inspection frequency shall be after every storm in the first year following construction.
- Inspect to be certain system drains within 24 - 48 hours (within the design period, but also not so quickly as to minimize stormwater treatment).
- Watering plants as necessary during the first growing season.
- Re-vegetating poorly established areas as necessary.
- Treating diseased vegetation as necessary.
- Inspect soil and repair eroded areas, especially on slopes, at a minimum quarterly.
- Check inlets, outlets, and overflow spillway for blockage, structural integrity and evidence of erosion.

Cleaning Criteria for Gravel Wetland Treatment Cells: Sediment shall be removed from the gravel wetland surface when it accumulates to a depth of several inches (>10 cm) across the wetland surface. Materials shall be removed with rakes rather than heavy construction equipment to avoid compaction of the gravel wetland surface. Heavy equipment may be used if the equipment is located outside the gravel wetland, while a backhoe shovel reaches inside the gravel wetland to remove sediment. Removed sediments shall be dewatered (if necessary) and disposed of in accordance with all local, state and federal requirements. Removal of vegetation within the gravel wetland shall

occur every three (3) growing seasons, or the end of the summer of the third year. This is to prevent decay and release of nutrients from accumulated biomass.

Underground Chamber System Inspection/Maintenance Requirements		
Inspection/ Maintenance	**Frequency**	**Action**
Monitor inlet and outlet structures for sediment accumulation	Two (2) times annually	- Trash, debris and sediment to be removed - Any required maintenance shall be addressed
Deep Sump Catchbasins	Two (2) times annually	- Removal of sediment as warranted by inspection - No less than once annually
Monitor detention system for sediment accumulation	Two (2) times annually	- Trash, debris and sediment to be removed via vacuum truck. - Any required maintenance shall be addressed

Rip Rap Inspection/Maintenance Requirements		
Inspection/ Maintenance	**Frequency**	**Action**
General Maintenance	Two (2) times annually	- During the fall and the spring remove any accumulated leaves or large debris.
Visual Inspection	Annually	- Visually inspect for damage and deterioration - Remove any branches, trash or other large debris that could interfere with the proper operation of the inlet or outlet of the basin. Remove any accumulated sediment, by the use of hand tools (shovels, rakes, wheelbarrows, etc.) when it exceeds three-inches (3") but not less than annually. - Repair damages immediately

3.3.1 Good Housekeeping Practices

Employees shall be instructed in the importance of not spilling fluids and chemicals such as oil, antifreeze, etc. onto the bare ground. All areas exposed to the weather shall be kept clean.

3.3.2 Provisions for Storing Materials and Waste Products Inside or Under Cover

Liquid waste products shall be captured when draining from vehicles and stored in sealed containers under cover until they are disposed of. Waste products shall be disposed of in a legal manner, at a state licensed recycling center or landfill.

3.3.3 Requirements for Storage and Use of Fertilizers, Herbicides, and Pesticides

Fertilizers shall not be used within 25 feet of the wetland resource areas. Excess fertilizers shall be swept up from all impervious surfaces and not allowed to run into the drainage system.

All fertilizer, herbicides, and pesticides shall be stored at least 100 feet away from the wetland line. If stored on site, these materials should be kept in a wrapped or sealed container and kept under cover out of the rain and snow.

3.3.4 Spill Prevention and Response Plan

Oil booms shall be kept on site in a readily accessible area in the event of an oil spill. If an oil spill occurs, the booms shall be placed and secured at the overflow spillway and in front of the entrance to the Stormceptors.

First responders	Phone Numbers
Rockland Fire Department	911 if emergency or (781) 878-2123
Rockland Police Department	911 if emergency or (781) 871-3890
Mass Department of Environmental Protection Emergency Response	1-888-304-1133

3.3.5 Disposal Requirements

Disposal of debris, trash, sediment and other waste material should be done at suitable disposal/recycling sites and in compliance with all applicable local, state and federal waste regulations.

Solid waste shall be collected at a minimum of once per week and disposed of in an appropriate dumpster or garbage truck. Waste shall be disposed of in a legal manner, at a state licensed recycling center or landfill.

3.3.6 Snow & Ice Management for Standard Asphalt and Walkways

Snow storage areas shall be located such that no direct untreated discharges are possible to receiving waters from the storage site (snow storage areas have been shown on the Site Plan).

Salt shall not be used at this site.

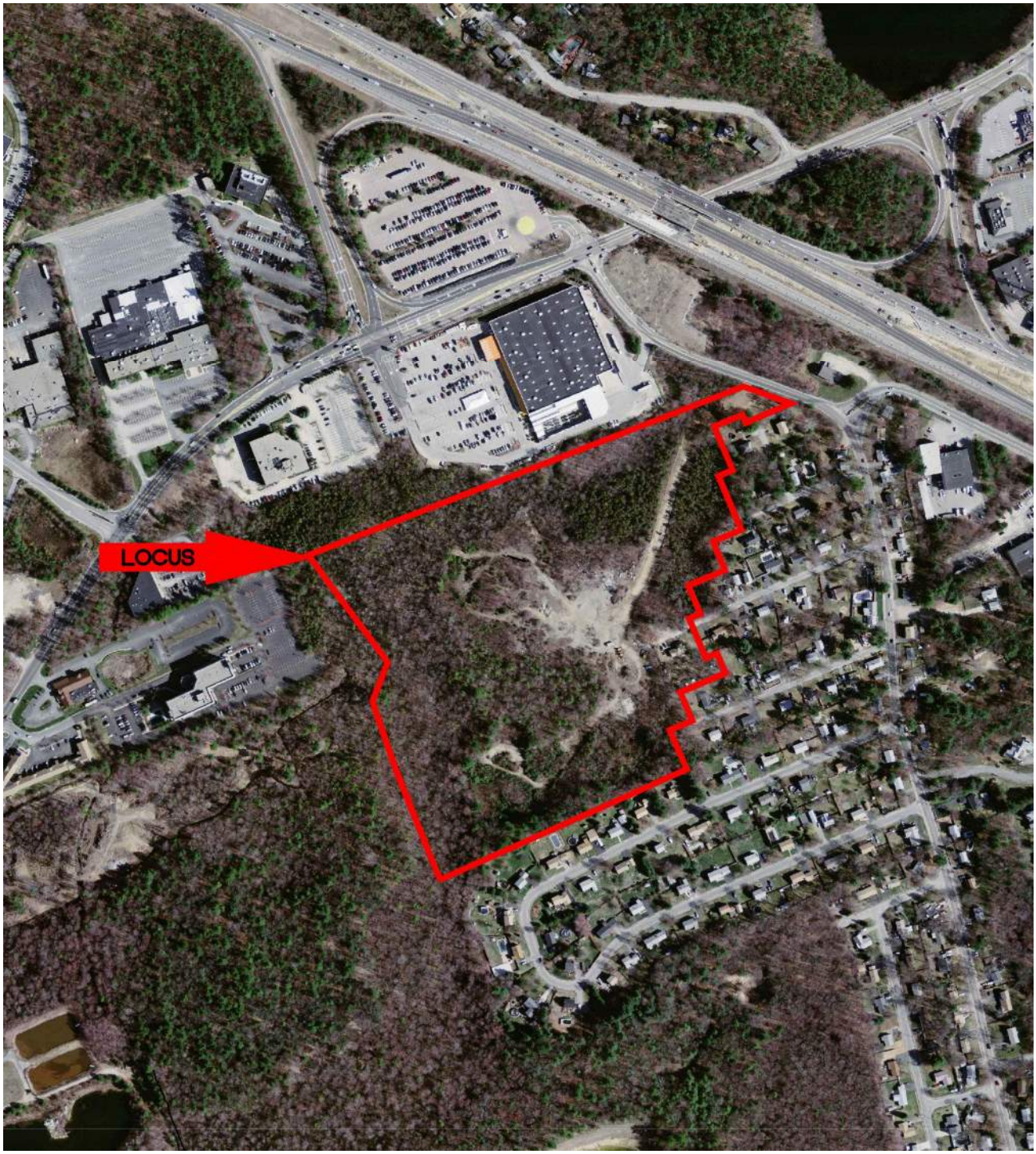
3.3.7 Annual Updates and Log Requirements

The Owner and/or Contact/Responsible Party shall review this Operation and Maintenance Plan once per year for its effectiveness and adjust the plan and deed as necessary.

A log of all preventative and corrective measures for the stormwater system shall be kept on-site and be made available upon request by any public entity with administrative, health environmental or safety authority over the site.

Stormwater Management Report						
Project Name		**Shingle Mill Apartments**				
BMP Description	**Date of Inspection**	**Inspector**	**BMP Installed and Operating Properly?**	**Cleaning / Corrective Action Needed**	**Date of Cleaning / Repair**	**Performed By**
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			

List of Figures



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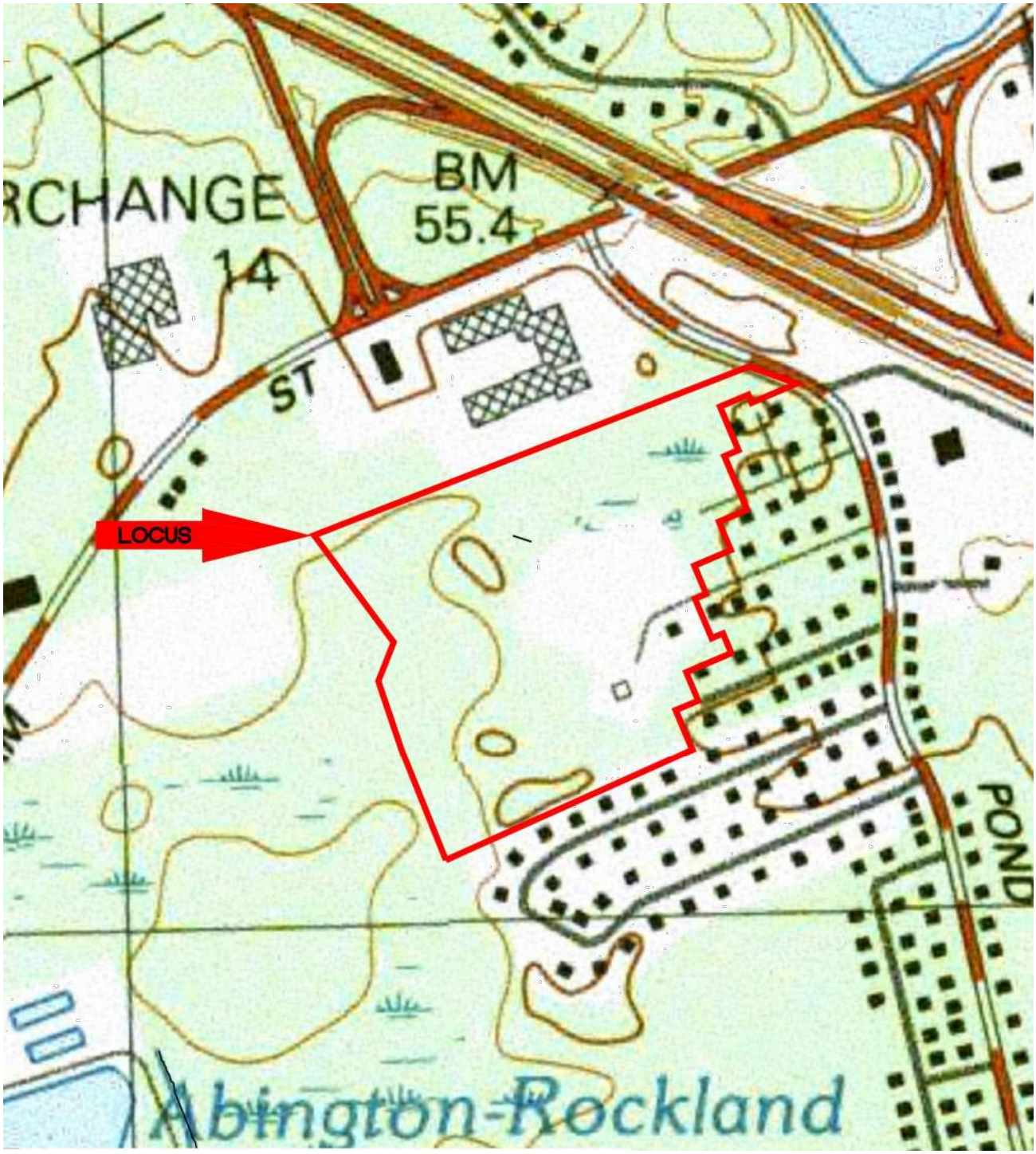
FIG□RE □
AERIAL MAP

Proposed Multi-Family Development
Jones Street
Rockland, Massachusetts

July 2020

Tighe&Bond



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Tighe&Bond

FIG□RE □
□SGS TOPOGRAP□I□ MAP

Proposed Multi-Family Development
Jones Street
Rockland, Massachusetts

July 2020

FLOOD ZONE X, AREAS BETWEEN THE LIMITS OF 100–YEAR AND 500–YEAR FLOODS

FLOODWAY AREAS IN ZONE AE

FLOOD ZONE AE, AREAS OF 100–YEAR FLOOD, BASE FLOOD ELEVATIONS DETERMINED

FLOOD ZONE A, AREAS OF 100–YEAR FLOOD, BASE FLOOD ELEVATIONS NOT DETERMINED

NOTE□
FLOOD □O□NDAR□ INFORMATION ON T□IS PLAN WAS FO□ND ON FEMA FLOOD INS□RAN□E RATE MAP FOR PL□MO□T□ □O□NT□ □OMM□NIT□ MAP NO□□□□□□□□□□□□□□ EFFE□TI□E □□L□ □□□□□□□□□ALONG WIT□ □PDATED PER LETTER OF MAP RE□ISION □□-□□-□□□□P EFFE□TI□E APRIL □□□□□□□□

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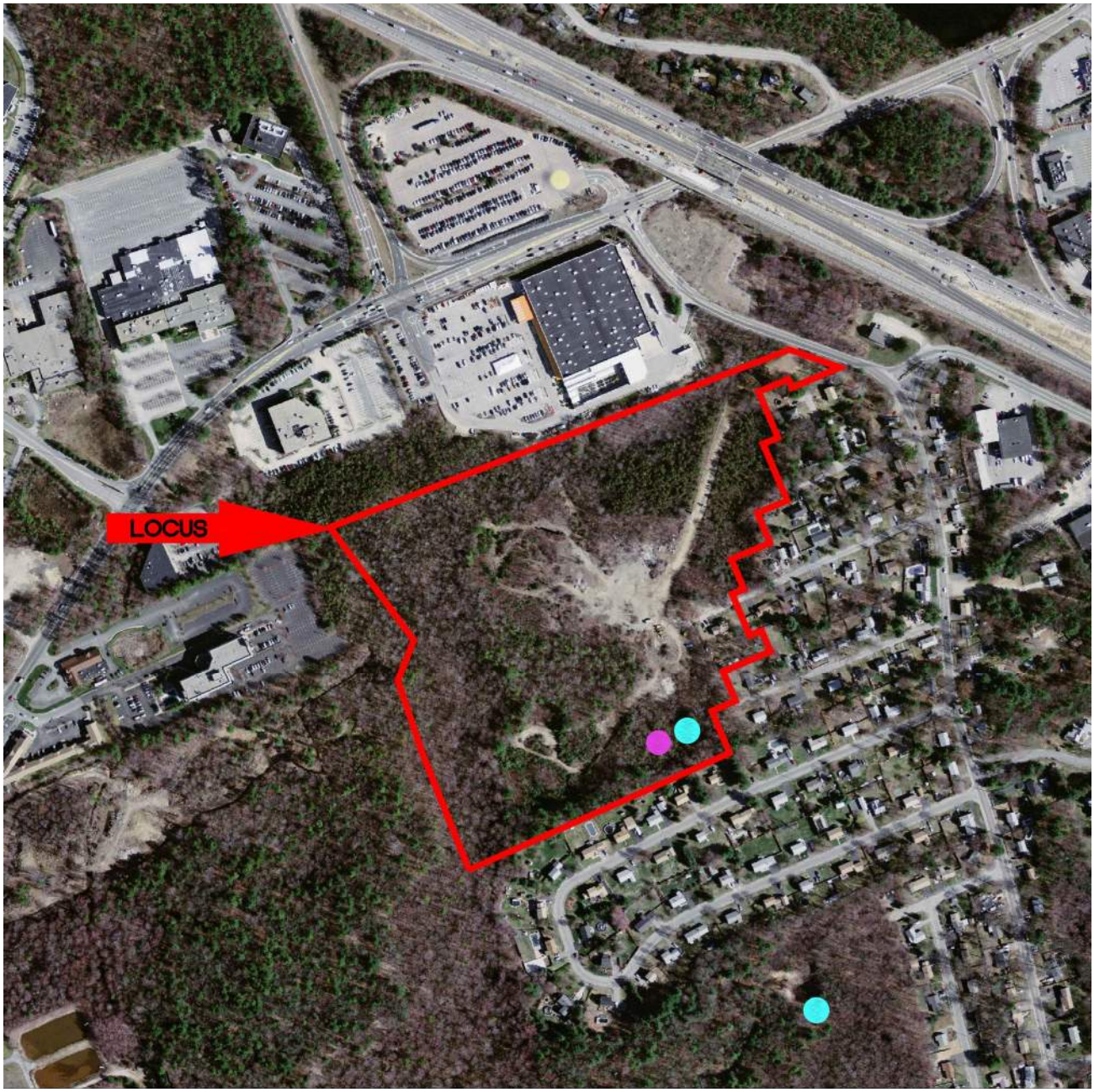
Tighe&Bond

FIG□RE □
FLOOD INS□RAN□E RATE MAP

Proposed Multi-Family Development
Jones Street
Rockland, Massachusetts

July 2020



PRIORITY HABITAT OF RARE SPECIES

ESTIMATED HABITATS OF RARE WILDLIFE

CERTIFIED VERNAL POOLS

POTENTIAL VERNAL POOLS

NOTES□

□□ ESTIMATED □A□ITATS OF RARE WILDLIFE AND PRIORIT□ □A□ITATS OF RARE SPE□IES □AME FROM MASSGIS DATA□ASE LAST □PDATED A□G□ST □□□□□

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Tighe&Bond

FIG□RE □
NAT□RAL □ERITAGE MAP

Proposed Multi-Family Development
Jones Street
Rockland, Massachusetts

July 2020

AREAS OF CRITICAL ENVIRONMENTAL CONCERN

WELLHEAD PROTECTION AREAS

OUTSTANDING RESOURCE WATERS

SURFACE WATER SUPPLY PROTECTION

NOTES□

□□ AREAS OF □RITI□AL EN□IRONMENTAL □ON□ERN WERE TA□EN FROM MASSGIS DATA□ASE□LAST □PDATED APRIL □□□□□

□□ WELL□EAD PROTE□TION AREAS WERE TA□EN FROM MASSGIS DATA□ASE□LAST □PDATED APRIL □□□□□

□□ O□TSTANDING RESO□R□E WATERS WERE TA□EN FROM MASSGIS DATA□ASE□ LAST □PDATED MAR□□ □□□□□

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Tighe&Bond

FIG□RE □
□RITI□AL AREAS

Proposed Multi-Family Development
Jones Street
Rockland, Massachusetts

July 2020

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FIG□RE □
SOIL S□R□E□ MAP

Proposed Multi-Family Development
Jones Street
Rockland, Massachusetts

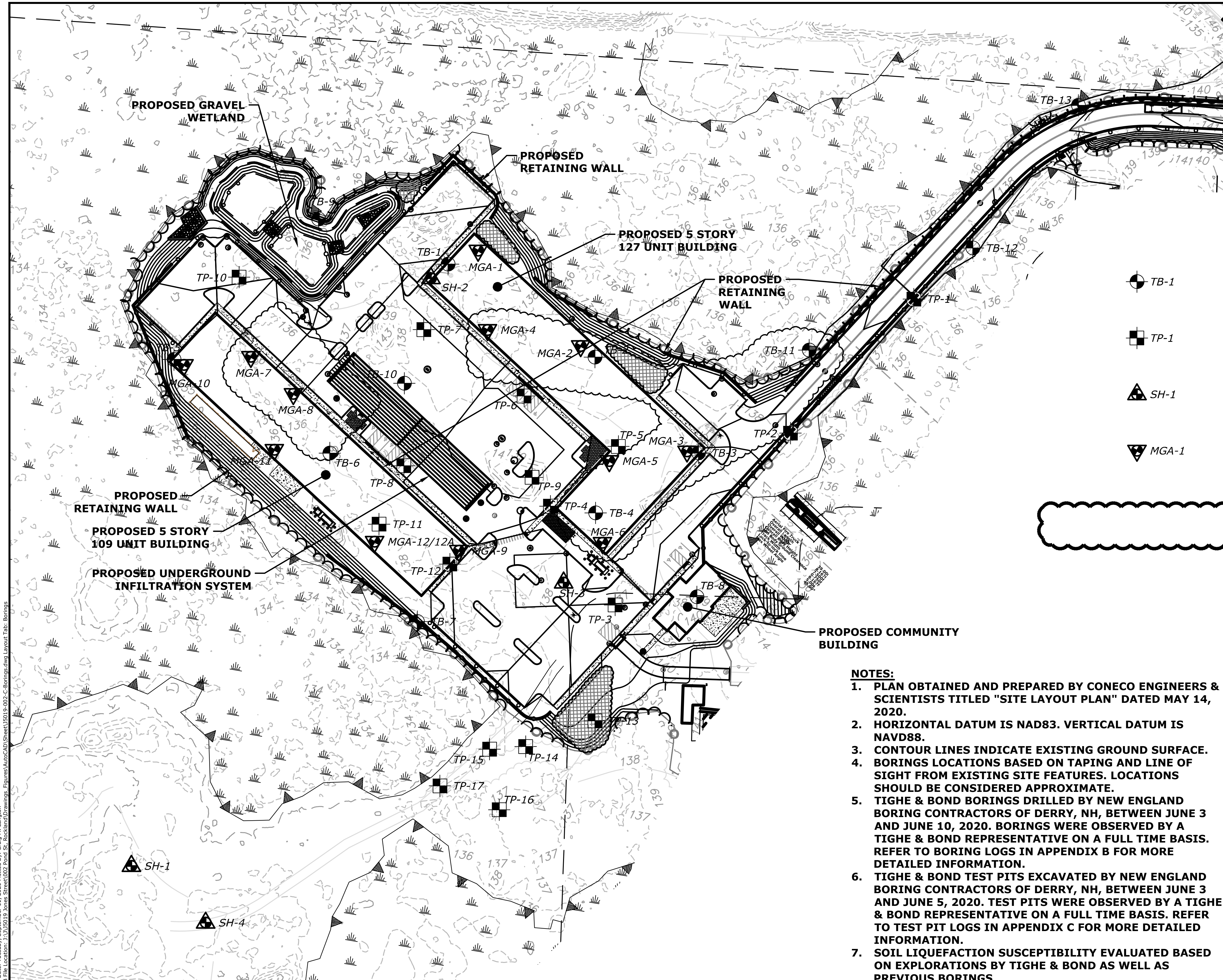
July 2020

Appendices

Appendix A Test Pit Logs

Appendix B NRCS Web Soils Map

Appendix C Pipe Sizing Calculations



LEGEND

TB-1	APPROXIMATE LOCATION OF BORINGS PERFORMED BY TIGHE & BOND
TP-1	APPROXIMATE LOCATION OF TEST PITS PERFORMED BY TIGHE & BOND
SH-1	APPROXIMATE LOCATION OF BORINGS PERFORMED BY SANBORN HEAD
MGA-1	APPROXIMATE LOCATION OF BORINGS PERFORMED BY McARDLE GANNON ASSOCIATES
	APPROXIMATE EXTENT OF AREA OF LIQUEFACTION SUSCEPTIBLE SOIL (NATURALLY DEPOSITED SOIL WITH FACTOR OF SAFETY AGAINST LIQUEFACTION LESS THAN, OR EQUAL TO ONE)

NOTES:

1. PLAN OBTAINED AND PREPARED BY CONECO ENGINEERS & SCIENTISTS TITLED "SITE LAYOUT PLAN" DATED MAY 14, 2020.
2. HORIZONTAL DATUM IS NAD83. VERTICAL DATUM IS NAVD88.
3. CONTOUR LINES INDICATE EXISTING GROUND SURFACE.
4. BORINGS LOCATIONS BASED ON TAPING AND LINE OF SIGHT FROM EXISTING SITE FEATURES. LOCATIONS SHOULD BE CONSIDERED APPROXIMATE.
5. TIGHE & BOND BORINGS DRILLED BY NEW ENGLAND BORING CONTRACTORS OF DERRY, NH, BETWEEN JUNE 3 AND JUNE 10, 2020. BORINGS WERE OBSERVED BY A TIGHE & BOND REPRESENTATIVE ON A FULL TIME BASIS. REFER TO BORING LOGS IN APPENDIX B FOR MORE DETAILED INFORMATION.
6. TIGHE & BOND TEST PITS EXCAVATED BY NEW ENGLAND BORING CONTRACTORS OF DERRY, NH, BETWEEN JUNE 3 AND JUNE 5, 2020. TEST PITS WERE OBSERVED BY A TIGHE & BOND REPRESENTATIVE ON A FULL TIME BASIS. REFER TO TEST PIT LOGS IN APPENDIX C FOR MORE DETAILED INFORMATION.
7. SOIL LIQUEFACTION SUSCEPTIBILITY EVALUATED BASED ON EXPLORATIONS BY TIGHE & BOND AS WELL AS PREVIOUS BORINGS.

SCALE IN FEET

0 100' 200'

GRAPHIC SCALE

PROPOSED MULTIFAMILY RESIDENTIAL DEVELOPMENT

ROCKLAND, MASSACHUSETTS

EXPLORATION LOCATION PLAN

FIGURE:	2
DATE:	8/31/2020
DRAWN BY:	CML
CHECKED BY:	MR
APPROVED BY:	MAA

Tighe&Bond
Engineers | Environmental Specialists

Last Save Date: September 1, 2020 12:19 AM By: CML
Plot Date: Tuesday, September 01, 2020 Plotted By: Craig M. Langton
T&B File Location: J:\J\J5019 Jones Street\002 Pond St, Rockland\Drawings_Figures\AutoCAD\Sheet\J5019-002-C-Borings.dwg Layout Tab: Borings

Tighe&Bond

Project/Site Information

Geo-Environmental Investigation
Jones Street Residential
Rockland, Massachusetts

Test Pit No. **TP-8**
Page No. 1 of 1
File No. J-5019-002
Checked By:

T&B Rep.	M. Trovato	Contractor	New England Boring Contractors			Date	06/03/20
		Operator	Manly Thompson			Ground Elev.	138±
Weather	77 Degrees - Sunny	Make	Kubota	Model	KX-080-4	Time Started	15:40
		Capacity	0.3 yd^3	Reach	15.1 ft.	Time Completed	16:15

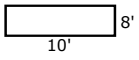
Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0				E	A (5%)	
1'				E	A (5%)	
2'	Light brown, fine to coarse SAND, little fine to coarse Gravel, little Silt, dry	S-1	0.0	E	A (5%)	
3'				E	A (5-10%)	
4'				E	A (5%)	1
5'	4.9'					
	Light brown, fine to coarse SAND and SILT, trace fine Gravel, wet	S-2	0.0	E	A (5%)	
6'				E	A (5%)	
7'				E	A (5%)	2
8'	8'					
	Bottom of exploration at 8 feet					
9'						
10'						
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1) Groundwater observed to infiltrate test pit at approximately 5 feet below surface grade.

2) Bottom of exploration at 8 feet below grade due to sidewall collapse.

Test Pit Plan



Volume = 22.1 cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
0.25	5'

J:\J\J5019 Jones Street\002 Pond St, Rockland\Environmental\Test Pits\Explorations\[Test Pit Log TP-7.xls]TP-8

TP # 7

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-113	Fill			60" to organic fill, roots at 86"	Depth		Mottling	
113-123	Ab	Loamy Sand	10YR 2/1		0-15 Min.			
123-131	Cg	Sand	5GY 5/2	10% Gravel, 5% Cob./Stones	15-30 Min.		Weeping	54"
					30-45 Min.			
					45-60 Min.		Standing	123"
					60-75 Min.			
					Rate	"/hr		

TP # 8

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-3	A	Sand	10YR 3/1	30% Gravel	Depth		Mottling	47"
3-6	Bw	Sand	10YR 4/4	20% Gravel, 30% Cob./Stones	0-15 Min.			
6-95	C1	Coarse Sand	2.5Y 5/4	20% Gravel, 30% Cob./Stones	15-30 Min.		Weeping	
					30-45 Min.			
					45-60 Min.		Standing	59"
					60-75 Min.			
					Rate	"/hr		

TP # 10

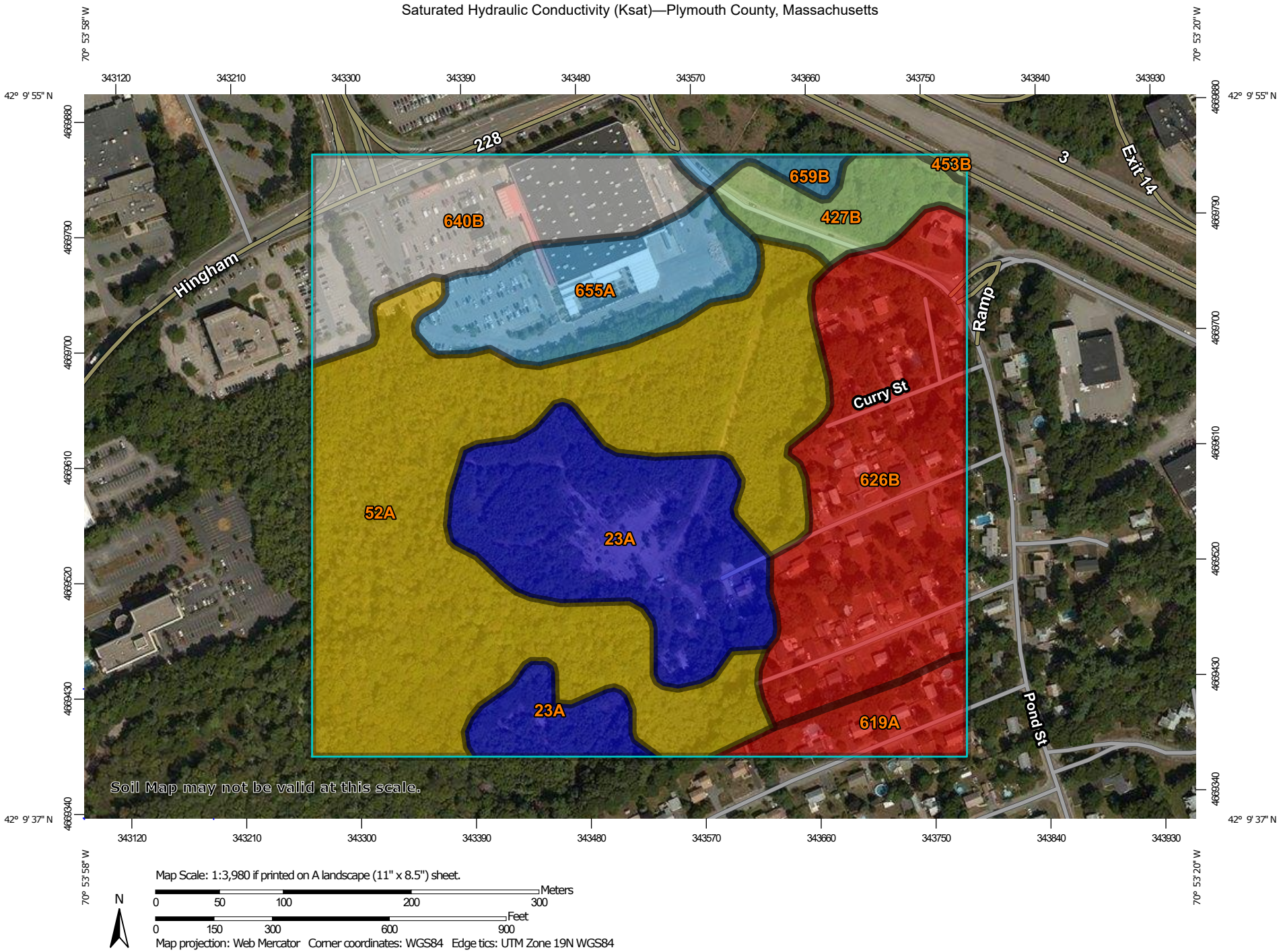
Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-31	Fill			20% Gravel, 30% Cob./Stones	Depth		Mottling	45"
31-100	C1	Sand	2.5Y 5/2	10% Gravel, 10% Cob./Stones	0-15 Min.			
					15-30 Min.		Weeping	
					30-45 Min.			
					45-60 Min.		Standing	59"
					60-75 Min.			
					Rate	"/hr		

TP # 12

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-27	Fill				Depth		Mottling	42"
27-29	Ab	Loamy Sand			0-15 Min.			
29-42	Bw	Loamy Sand	10YR 5/6	10% Gravel, 10% Cob./Stones	15-30 Min.		Weeping	84"
42-56	C	Sand	10YR 4/2	10% Gravel, 10% Cob./Stones	30-45 Min.			
56-100	2C	Coarse Sand	10YR 6/1	10% Gravel, 10% Cob./Stones	45-60 Min.		Standing	90"
					60-75 Min.			
					Rate	"/hr		

TP # 13

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-10	Fill				Depth		Mottling	28"
10-17	Ab	Fine Sand	10YR 2/1	Heavy organic	0-15 Min.			
17-31	Bw	Sand	10YR 5/8		15-30 Min.		Weeping	48"
31-76	C1	Coarse Sand	2.5Y 4/4		30-45 Min.			
76-92	C2	Coarse Sand	2.5Y 5/1	10% Gravel, 30% Cob./Stones, 10% Small Boulders	45-60 Min.		Standing	48"
					60-75 Min.			
					Rate	"/hr		



Map Scale: 1:3,980 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- <= 0.0050
- > 0.0050 and <= 1.4588
- > 1.4588 and <= 5.6865
- > 5.6865 and <= 10.0000
- > 10.0000 and <= 31.9144
- Not rated or not available

Soil Rating Lines

- <= 0.0050
- > 0.0050 and <= 1.4588
- > 1.4588 and <= 5.6865
- > 5.6865 and <= 10.0000
- > 10.0000 and <= 31.9144
- Not rated or not available

Soil Rating Points

- <= 0.0050
- > 0.0050 and <= 1.4588
- > 1.4588 and <= 5.6865
- > 5.6865 and <= 10.0000
- > 10.0000 and <= 31.9144
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Plymouth County, Massachusetts
Survey Area Data: Version 12, Sep 12, 2019

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

Date(s) aerial images were photographed: Aug 26, 2014—Sep 4, 2014

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

Saturated Hydraulic Conductivity (Ksat)

Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
23A	Tihonet coarse sand, 0 to 3 percent slopes	31.9144	9.8	16.5%
52A	Freetown muck, 0 to 1 percent slopes	1.4588	21.4	35.8%
427B	Newfields fine sandy loam, 3 to 8 percent slopes, extremely stony	5.6865	2.5	4.1%
453B	Gloucester - Canton complex, 3 to 8 percent slopes, extremely bouldery	4.4243	0.1	0.2%
619A	Deerfield-Urban land complex, 0 to 3 percent slopes	0.0050	2.1	3.4%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	0.0050	11.6	19.4%
640B	Urban land, till substratum, 0 to 8 percent slopes		6.7	11.2%
655A	Udorthents, wet substratum, 0 to 3 percent slopes	10.0000	5.0	8.3%
659B	Udorthents, 0 to 8 percent slopes, gravelly	10.0000	0.7	1.1%
Totals for Area of Interest			**59.8**	**100.0%**

Description

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits.

Rating Options

Units of Measure: micrometers per second

Aggregation Method: Minimum or Maximum

Component Percent Cutoff: None Specified

Tie-break Rule: Slowest

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): All Layers (Weighted Average)