Storm Water Management Report

PIE HILL WAREHOUSING

(NON-RESIDENTIAL SITE PLAN)

Project Location:
Tax Map 1010 Lot 79-17
46 Old Ferry Road
Methuen, Ma

Prepared for:
Triple G, LLC
46 Alsun Drive
Hollis, NH 03049

Date: April 4, 2022
Revised: August 4, 2022

COMMONWEALTH OF MASSACHUSETTS
CHAD E.
BRANON
CIVIL
No. 47425

8/4/2022

Surveying ◆ Engineering ◆ Land Planning ◆ Permitting ◆ Septic Designs

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206 Elm Street, Milford NH 03055
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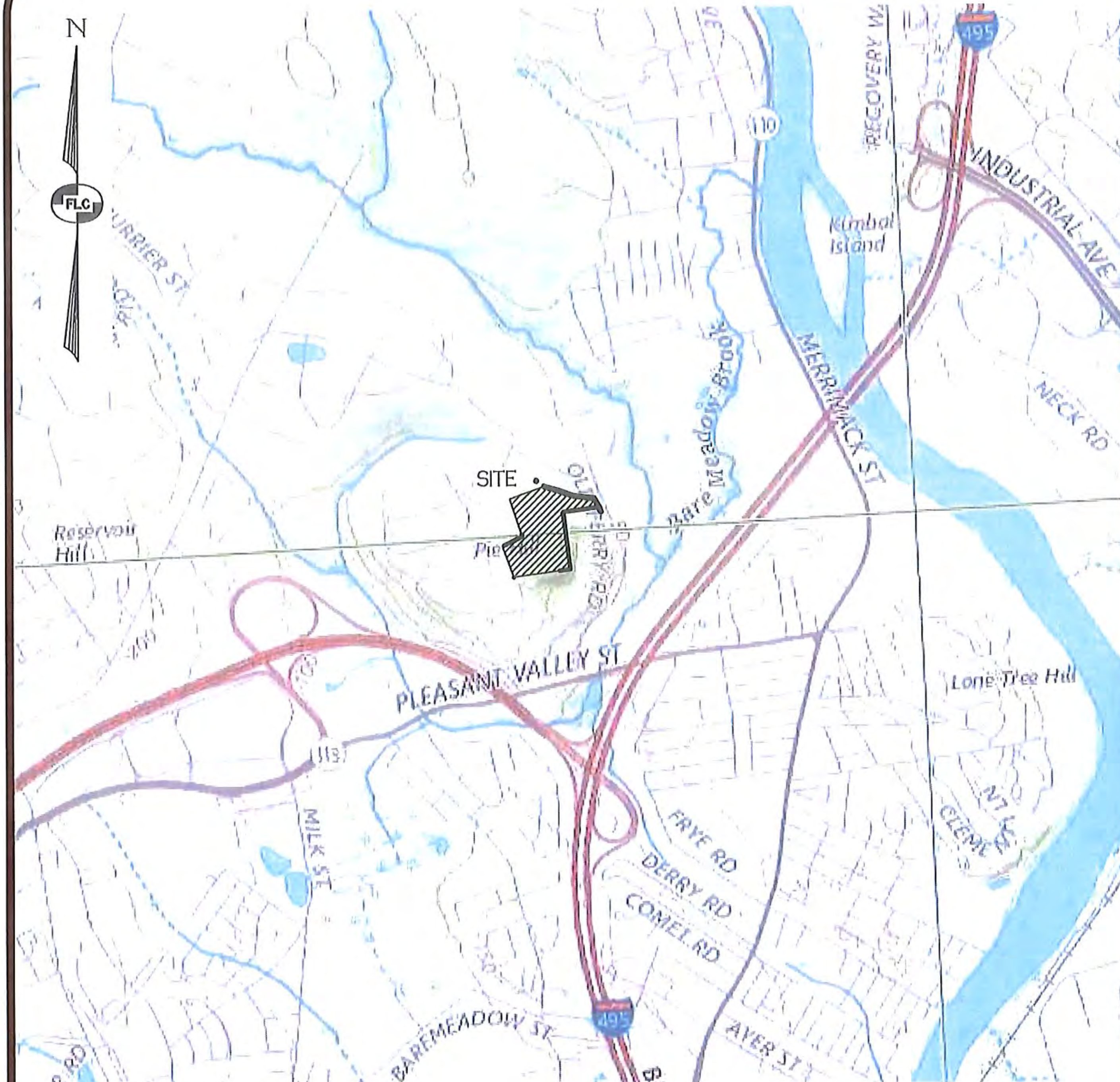

GRAPHIC SCALE

2,000' 1,000' 0 2,000'

IMPERIAL: 1" = 2,000'

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USGS MAP

TAX MAP PARCEL 1010-79-17
46 OLD FERRY ROAD
METHUEN, MA

SCALE: 1" = 2,000' OCTOBER 7, 2020

FILE: 2295MP00_USGS.dwg	PROJ. NO. 2295.00	SHEET NO. 1 OF 1

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STORM WATER MANAGEMENT REPORT
PIE HILL WAREHOUSING
METHUEN, MA

Prepared for:
Triple G, LLC

Date: April 4, 2022
Revised: August, 2022

I) INTRODUCTION

The following are storm water drainage calculations for a warehousing development at 46 Old Ferry Road. The project area is bordered by an automotive shop to the north, industrial property to the east, and MA electric company power lines to the west. The site is located on the west side of Old Ferry Road. Access to the project will be provided by a 30 foot wide, 1,100± foot drive. The project is situated on a 19.138 acre parcel known as Lot 79-17 on the City of Methuen's Assessor's Map 1010.

The purpose of this report is to analyze the qualitative and quantitative impacts of the proposed development project. The objective of the proposed storm water management system for this project is to mitigate any increases resulting from the proposed development and to meet the drainage guidelines set forth in the City of Methuen's storm water regulations.

II) SITE DESCRIPTION

The site is currently developed with equipment storage and recently graded areas. This area is accessed by a gravel drive off Old Ferry Road. The site is located on top of Pie Hill. The site slopes steeply to the east, west, and south. The south slope leads to wetlands. The flatter portion of the site at the top of the hill slopes southwest. There is a 50' gas easement running through the northwest portion of the site and under a Methuen Meter station. The easement then splits and heads east off the property. A 200' power line easement runs across the property as well from east to west. The perimeter of the lot is wooded with the exception being the driveway, recently graded area at the top of the hill, and power line easement. Runoff from the gravel drive flows through a 30" cast iron culvert and is collected in a 1'-3' wide rip-rap swale along Old Ferry Road.

NRCS soil survey maps indicated that the site consists of a variety of soils. Based on the NRCS maps the majority of the site consists of Hydraulic Soil Group "C" soils (Paxton Fine Sandy Loam, very stony) and a small area of Hydraulic Soil Group "A" soils (Udorthents, smoothed). The ksat value for the Paxton Fine Sandy Loam is 10 μm/sec which equates to 2 in/hr. Applying a factor of safety of two results in a design ksat of 1 in/hr.

III) METHODOLOGY

The quantity of runoff and the conveyance of that flow through the site are determined using the software package HydroCAD r 10.0 by HydroCAD Software Solutions, LLC. HydroCAD is a computer aided design program for modeling storm water hydrology based on the Soil Conservation Service (SCS) TR-20 method combined with standard hydraulics calculations. The peak flow rate and the associated times of concentration were determined using the United States Department of Agriculture's *Urban Hydrology for Small Watersheds* (TR55) per the Massachusetts Stormwater Handbook, Chapter 1. TR55 stipulates that the minimum time of concentration is 0.1 hour or 6 minutes.

Storm water management systems and erosion control outlet protection aprons (riprap aprons) are designed in accordance with the methodology for the "Best Management Practices" (BMP's), as outlined in the Massachusetts Stormwater Handbook, volume 2, chapter 2.

IV) DRAINAGE DESIGN

In accordance with the Massachusetts Stormwater Handbook, Standard 2 the two (2), and the ten (10) year frequency storm events have been evaluated, and the City of Methuen Storm Water Regulations require that the one-hundred (100) year frequency storm event be evaluated. These design storms have therefore been included to compare the pre and post-development peak flow rates for the site (see attached comparison tables).

The front access of the site is a redevelopment of the existing access drive. The top of the site is new development, however the site as a whole meets the Massashusetts Storwater Handbook requirements. To show compliance with these standards a groundwater recharge calculation, TSS calculation, and HydroCAD analysis have been included in this report.

<u>Pre-Development Drainage Conditions:</u>
As can be seen on the Pre-Development Drainage Plans, the project area drains away from the high point in the center of the lot. Observation Points 1 & 3 are identified as adjacent lots 1008-79-11F and 1010-79-17A respectively. Observation point 2 is the roadside swale along Old Ferry Road and observation point 4 is the wetlands to the south. The existing parcel is accessed by a gravel drive and has recently been graded. However, the regraded area was previously a mixture of wooded and grassed areas and has been modeled as such. The gravel drive however has been modeled as such.

<u>Post-Development Drainage Conditions:</u>
As can be seen on the Post-Development Drainage Plans, the proposed drive is treated by two wet basins (P19 & 21) and is treated before being released north to observation point 1 (OP1). The runoff from the parking and trailer staging areas to the north of the proposed building are captured

in catch basins and treated by an underground infiltration chamber system (P16) before being released into the proposed open drainage along the access drive. Sub catchment 303 will be nearly unchanged except that any disturbed areas shall be loamed and seeded before flowing downhill to OP3. In order to reduce flow from the paved areas and warehouse building at the top of the hill, a closed drainage system consisting of catch basins, manholes, and appropriate curbing are proposed to capture the runoff of the paved portion of the project and route it to a large underground infiltration chamber system (P14). The chamber system captures all of the sites impervious surface runoff and treats it before being outlet to the wetlands (OP4).

The net result is that paved areas will receive qualitative treatment and, due to the retention and infiltration capabilities of the wet ponds and storm chamber systems there will be a reduction of peak rates of runoff leaving this site for all storm events.

VI) SUMMARY

The intent of the storm water management system for this project is to address the qualitative and quantitative aspects of the storm water runoff so that there are no downstream adverse impacts created by the project. There are no increases in storm water runoff flow rates resulting from the proposed development.

The storm water management design for this project therefore complies with the storm water standards set forth in the City of Methuen and State of Massachusetts's Stormwater Regulations.

The following tables are a summary of the attached calculations and show a comparison of the peak flow rates at the outlet point for the site. The values presented are based on pre- and post-development conditions.

Table 1: Peak Flow Rates to Lot 1008-79-11F - OP1 - with Post-Development Infiltration

STORM FREQUENCY	PRE-DEV. RUNOFF (CFS)	POST-DEV. RUNOFF (CFS)	CHANGE (CFS)
2-YEAR	3.33	3.32	-0.01
10-YEAR	7.59	6.54	-1.05
100-YEAR	19.29	13.50	-5.79

Table 2: Peak Flow Rates to the Roadside Swale – OP2 - with Post-Development Retention

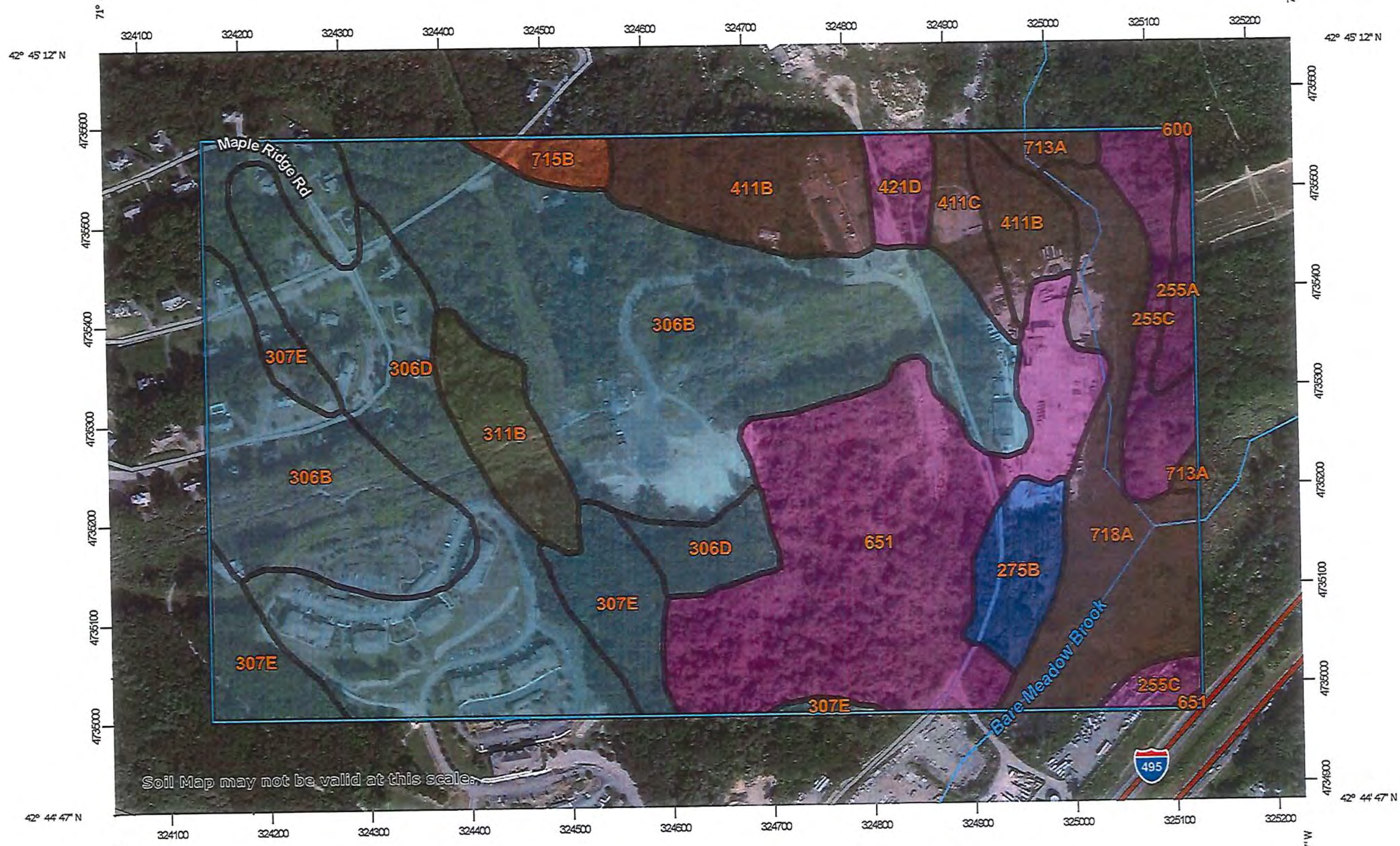
STORM FREQUENCY	PRE-DEV. RUNOFF (CFS)	POST-DEV. RUNOFF (CFS)	CHANGE (CFS)
2-YEAR	8.06	2.96	-5.10
10-YEAR	18.29	7.12	-11.17
100-YEAR	46.33	19.01	-27.32

Table 3: Peak Flow Rates to Lot 1010-79-17A– OP3

STORM FREQUENCY	PRE-DEV. RUNOFF (CFS)	POST-DEV. RUNOFF (CFS)	CHANGE (CFS)
2-YEAR	0.04	0.02	-0.02
10-YEAR	0.90	0.51	-0.39
100-YEAR	6.69	5.16	-1.53

Table 4: Peak Flow Rates to Wetlands – OP4 - with Post-Development Retention

STORM FREQUENCY	PRE-DEV. RUNOFF (CFS)	POST-DEV. RUNOFF (CFS)	CHANGE (CFS)
2-YEAR	6.45	3.26	-3.19
10-YEAR	15.97	12.70	-3.27
100-YEAR	43.20	41.77	-1.43



Map Scale: 1:5,410 if printed on A landscape (11" x 8.5") sheet.

Meters: 0 50 100 200 300

Feet: 0 250 500 1000 1500

N

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
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 16, Jun 9, 2020

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

Date(s) aerial images were photographed: Aug 28, 2019—Sep 20, 2019

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
255A	Windsor loamy sand, 0 to 3 percent slopes	A	1.5	1.1%
255C	Windsor loamy sand, 8 to 15 percent slopes	A	5.2	3.7%
275B	Agawam fine sandy loam, 3 to 8 percent slopes	B	3.3	2.3%
306B	Paxton fine sandy loam, 0 to 8 percent slopes, very stony	C	43.3	30.4%
306D	Paxton fine sandy loam, 15 to 25 percent slopes, very stony	C	22.7	15.9%
307E	Paxton fine sandy loam, 25 to 35 percent slopes, extremely stony	C	11.4	8.0%
311B	Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony	C/D	4.1	2.9%
411B	Sutton fine sandy loam, 0 to 8 percent slopes, very stony	B/D	9.3	6.5%
411C	Sutton fine sandy loam, 8 to 15 percent slopes, very stony	B/D	2.1	1.4%
421D	Canton fine sandy loam, 15 to 25 percent slopes, very stony	A	1.8	1.3%
600	Pits, gravel		0.0	0.0%
651	Udorthents, smoothed	A	23.7	16.6%
713A	Limerick and Rumney soils, 0 to 3 percent slopes	B/D	1.1	0.8%
715B	Ridgebury and Leicester fine sandy loams, 3 to 8 percent slopes, extremely stony	D	1.4	1.0%
718A	Saco variant silt loam, 0 to 3 percent slopes	B/D	11.8	8.3%
Totals for Area of Interest			**142.7**	**100.0%**

Description

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

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

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

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

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

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

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

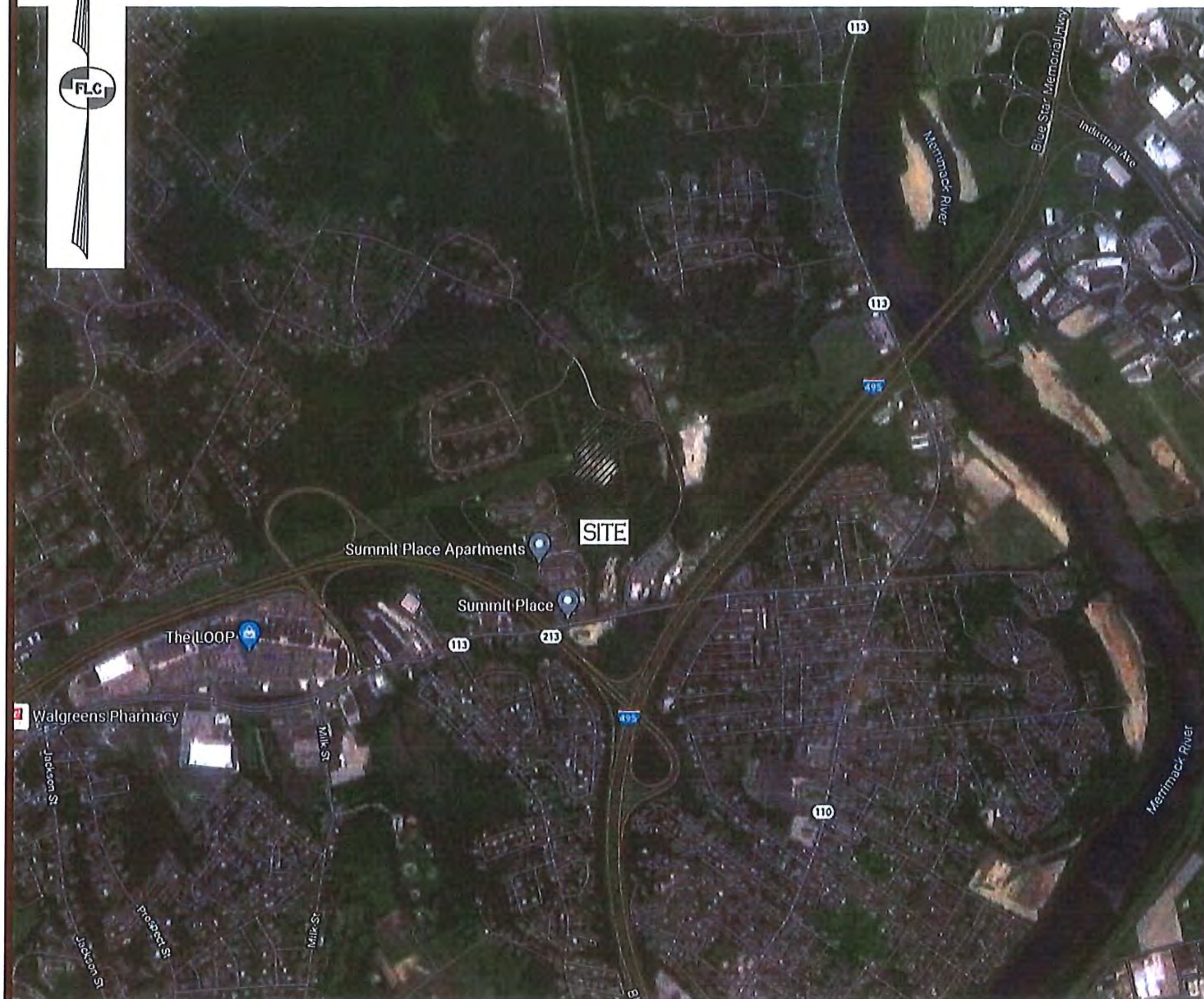
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

N



GRAPHIC SCALE

2,000' 1,000' 0 2,000'

IMPERIAL: 1" = 2,000'

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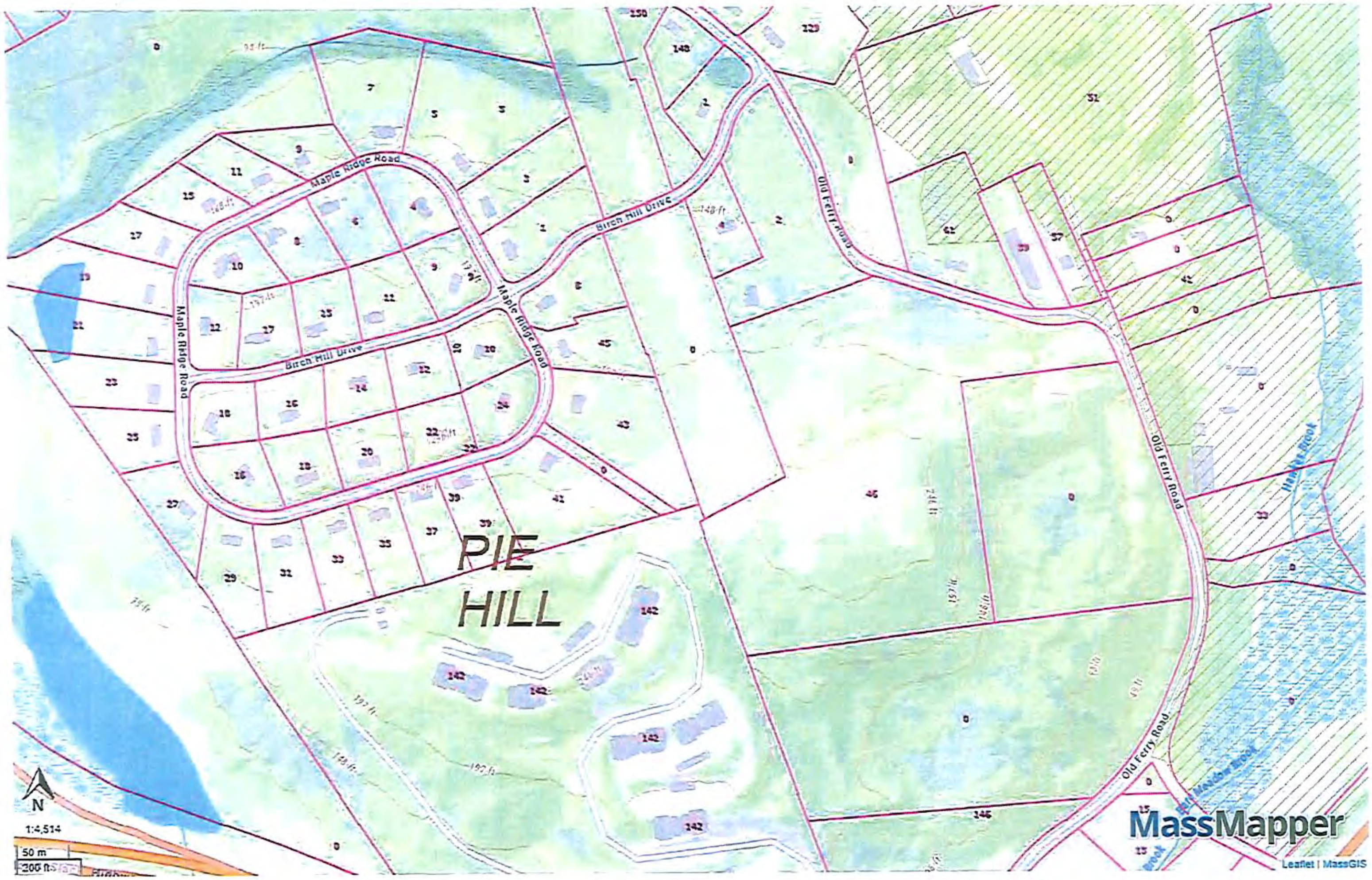
AERIAL MAP

TAX MAP PARCEL 1010-79-17
46 OLD FERRY ROAD
METHUEN, MA

SCALE: 1" = 2,000' OCTOBER 7, 2020

FILE: 2295MP00_USGS.dwg	PROJ. NO. 2295.00	SHEET NO. 1 OF 1



NHESP Estimated Habitats of Rare Wildlife

NHESP Certified Vernal Pools

NHESP Ecoregions

Areas of Critical Environmental Concern ACECs Boundaries

Areas of Critical Environmental Concern ACECs

Shellfish Sampling Stations

Public Water Supplies
- Communtiy Groundwater Well
- Non-Communtiy Groundwater Well
- Surface Water Intake
- Emergency Surface Water Intake
- Community Labels
- Non-Community Labels

Outstanding Resource Waters Outlines
- ACEC
- Cape Cod National Seashore
- Protected Shoreline
- Public Water Supply Watershed
- Retired Public Water Supply
- Scenic/Protected River
- Wildlife Refuge

Outstanding Resource Waters
- ACEC
- Cape Cod National Seashore
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- Retired Public Water Supply
- Scenic/Protected River
- Wildlife Refuge

DFW Coldwater Fisheries Resources

Property Tax Parcels

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	Massachusetts
Location	
Longitude	71.143 degrees West
Latitude	42.750 degrees North
Elevation	0 feet
Date/Time	Mon, 28 Sep 2020 14:08:15 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.27	0.41	0.51	0.68	0.84	1.07	**1yr**	0.73	1.01	1.24	1.58	2.02	2.59	2.80	**1yr**	2.29	2.70	3.14	3.81	4.45	**1yr**
2yr	0.33	0.51	0.64	0.84	1.05	1.33	**2yr**	0.91	1.22	1.54	1.95	2.46	3.11	3.44	**2yr**	2.75	3.31	3.83	4.54	5.18	**2yr**
5yr	0.39	0.61	0.76	1.02	1.31	1.67	**5yr**	1.13	1.52	1.95	2.47	3.13	3.96	4.41	**5yr**	3.50	4.24	4.87	5.77	6.53	**5yr**
10yr	0.44	0.69	0.87	1.19	1.55	2.00	**10yr**	1.33	1.81	2.34	2.97	3.76	4.75	5.32	**10yr**	4.21	5.12	5.85	6.93	7.79	**10yr**
25yr	0.52	0.83	1.05	1.45	1.93	2.51	**25yr**	1.66	2.26	2.95	3.77	4.79	6.06	6.82	**25yr**	5.36	6.56	7.44	8.83	9.84	**25yr**
50yr	0.58	0.94	1.20	1.69	2.28	3.00	**50yr**	1.97	2.69	3.55	4.55	5.77	7.28	8.24	**50yr**	6.44	7.93	8.93	10.60	11.75	**50yr**
100yr	0.67	1.08	1.40	1.98	2.70	3.58	**100yr**	2.33	3.19	4.24	5.45	6.93	8.75	9.96	**100yr**	7.75	9.58	10.73	12.75	14.04	**100yr**
200yr	0.76	1.24	1.61	2.31	3.19	4.27	**200yr**	2.75	3.79	5.08	6.55	8.34	10.53	12.04	**200yr**	9.32	11.57	12.89	15.33	16.78	**200yr**
500yr	0.91	1.50	1.96	2.85	4.00	5.39	**500yr**	3.45	4.77	6.44	8.34	10.64	13.45	15.47	**500yr**	11.90	14.88	16.44	19.58	21.24	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.24	0.37	0.45	0.61	0.74	0.88	**1yr**	0.64	0.86	1.09	1.34	1.63	2.40	2.58	**1yr**	2.12	2.48	2.90	3.47	4.07	**1yr**
2yr	0.32	0.49	0.61	0.82	1.01	1.21	**2yr**	0.87	1.18	1.38	1.82	2.33	3.01	3.34	**2yr**	2.67	3.21	3.73	4.42	5.05	**2yr**
5yr	0.37	0.57	0.71	0.97	1.23	1.45	**5yr**	1.06	1.41	1.64	2.12	2.71	3.70	4.09	**5yr**	3.27	3.93	4.55	5.38	6.11	**5yr**
10yr	0.41	0.63	0.78	1.09	1.41	1.66	**10yr**	1.22	1.62	1.86	2.39	3.04	4.29	4.74	**10yr**	3.79	4.56	5.29	6.25	7.03	**10yr**
25yr	0.47	0.72	0.89	1.28	1.68	1.96	**25yr**	1.45	1.92	2.19	2.78	3.53	5.20	5.76	**25yr**	4.61	5.54	6.47	7.61	8.43	**25yr**
50yr	0.52	0.80	0.99	1.43	1.92	2.25	**50yr**	1.66	2.20	2.47	3.13	3.97	6.02	6.69	**50yr**	5.33	6.43	7.54	8.86	9.66	**50yr**
100yr	0.59	0.89	1.12	1.61	2.21	2.56	**100yr**	1.91	2.50	2.80	3.52	4.45	6.75	7.74	**100yr**	5.97	7.45	8.79	10.32	11.07	**100yr**
200yr	0.66	0.99	1.26	1.82	2.54	2.92	**200yr**	2.19	2.85	3.16	3.95	5.01	7.76	9.00	**200yr**	6.87	8.65	10.25	12.02	12.66	**200yr**
500yr	0.77	1.15	1.48	2.15	3.06	3.48	**500yr**	2.64	3.40	3.71	4.61	5.86	9.30	10.99	**500yr**	8.23	10.57	12.58	14.72	15.13	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.30	0.46	0.56	0.76	0.93	1.09	**1yr**	0.80	1.07	1.26	1.67	2.13	2.79	3.02	**1yr**	2.47	2.90	3.37	4.06	4.78	**1yr**
2yr	0.34	0.53	0.65	0.88	1.09	1.29	**2yr**	0.94	1.27	1.49	1.95	2.49	3.23	3.57	**2yr**	2.86	3.43	3.96	4.69	5.38	**2yr**
5yr	0.42	0.65	0.81	1.11	1.42	1.67	**5yr**	1.22	1.64	1.93	2.49	3.16	4.23	4.74	**5yr**	3.74	4.56	5.22	6.19	6.97	**5yr**
10yr	0.51	0.79	0.98	1.36	1.76	2.05	**10yr**	1.52	2.00	2.35	3.01	3.80	5.22	5.89	**10yr**	4.62	5.66	6.44	7.64	8.55	**10yr**
25yr	0.66	1.00	1.24	1.77	2.33	2.68	**25yr**	2.01	2.62	3.07	3.88	4.84	6.92	7.86	**25yr**	6.12	7.56	8.50	10.11	11.22	**25yr**
50yr	0.79	1.20	1.49	2.14	2.88	3.28	**50yr**	2.49	3.21	3.75	4.70	5.82	8.56	9.80	**50yr**	7.58	9.42	10.49	12.50	13.79	**50yr**
100yr	0.95	1.44	1.81	2.61	3.58	4.02	**100yr**	3.09	3.93	4.61	5.70	7.01	10.97	12.20	**100yr**	9.71	11.73	12.94	15.47	16.97	**100yr**
200yr	1.15	1.73	2.19	3.17	4.43	4.94	**200yr**	3.82	4.83	5.66	6.91	8.43	13.66	15.19	**200yr**	12.09	14.61	15.96	19.13	20.90	**200yr**
500yr	1.48	2.21	2.84	4.12	5.86	6.48	**500yr**	5.06	6.33	7.43	8.92	10.78	18.28	20.33	**500yr**	16.18	19.55	21.06	25.34	27.57	**500yr**

Powered by ACIS
Northeast Regional Climate Center

Groundwater Recharge Volume (GRV) Calculation

0.23	ac	Area of HSG A soil that was replaced by impervious cover	0.40"
-	ac	Area of HSG B soil that was replaced by impervious cover	0.25"
5.38	ac	Area of HSG C soil that was replaced by impervious cover	0.10"
	ac	Area of HSG D soil or impervious cover that was replaced by impervious cover	0.0"
0.11	inches	Rd = weighted groundwater recharge depth	
0.632	ac-in	GRV = AI * Rd	
2,294	cf	GRV conversion (ac-in x 43,560 sf/ac x 1ft/12")	

Provide calculations below showing that the project meets the groundwater recharge requirements (Env-Wq 1507.04):

Stormtech Chamber System 1 (P14) has 17,150 cf of storage of storage below the lowest outlet.

Stormtech Chamber System 2 (P16) has 2,873 cf of storage of storage below the lowest outlet.

These underground infiltrations chamber systems provide the required volume for recharge.

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Pie Hill Warehousing

RIPRAP APRON DESIGN

Project: Pie Hill Warehousing
File: 2295.01_Riprap.xls
Date: 06/27/22
Design Eng: CLR
Revised:
Revised By:

This spreadsheet is based on the Dec. 2008 "New Hampshire Stormwater Management Manual, Volume 2, Post-Construction Best Management Practices: Selection And Design"

Nomenclature:

L = length of the apron (ft)
D_0 = max. inside width of outlet pipe or channel (ft)
Q = outlet discharge (cfs)
TW = tailwater depth (ft)
W_{in} = width of the apron at culvert outlet (ft)
W_{out} = width of the apron at the end of apron (ft)
D_{50} = median stone diameter (inches)

DESIGN CRITERIA

Design Storm: 10 Year

Riprap Apron Length:

$L=1.8Q/D_0^{1.5}+7D_0$ (when $TW<D_0/2$)
$L=3.0Q/D_0^{1.5}+7D_0$ (when $TW>D_0/2$)

Riprap Apron Width @ Culvert Outlet:

$W_{in}=3D_0$

Riprap Apron Width @ End of Apron (no defined channel):

$W_{out}=3D_0+L_a$ (when $TW<D_0/2$)
$W_{out}=3D_0+0.4L_a$ (when $TW>D_0/2$)

Riprap Apron Width @ End of Apron (defined channel):

$W_{out}>D_0$, Structural lining shall extend a min. of 1Ft. above the TW elevation but no lower than 2/3 the vertical conduit dimension above the conduit.

Riprap Diameter:

$D_{50}=[0.02Q^{1.3}/(TW*D_0)]*12$
50% of stone by weight should be smaller than D_{50}. The largest stone size in the mixture shall be 1.5 times D_{50}.

Location (STRUCT.)	Q (CFS)	D_0 (FT.)	TW (FT.)	OUTLET APRON DESIGN: L_a (FT.)	Width (FT) W_{in}	Width (FT) W_{out}	D_{50} (Dia. - INCHES)	Thickness (INCHES)
HW1	3.0	1.5	0.2	13	5	18	4	12
HW2	2.9	1.3	0.7	15	4	10	4	12
HW4	4.2	1.5	0.7	15	5	19	4	12
HW5	0.8	1.0	0.2	8	3	11	4	12
HW8	2.6	1.3	0.8	14	4	9	4	12
HW9	4.6	1.0	0.5	21	3	11	4	12

Stage-Area-Storage for Pond P14: SC-740 (1)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
234.00	20,090	0
234.10	20,090	804
234.20	20,090	1,607
234.30	20,090	2,411
234.40	20,090	3,214
234.50	20,090	4,018
234.60	20,090	4,822
234.70	20,090	5,625
234.80	20,090	6,429
234.90	20,090	7,232
235.00	40,153	8,036
235.10	40,153	8,839
235.20	40,153	9,641
235.30	40,153	10,444
235.40	40,153	11,246
235.50	40,153	12,049
235.60	40,153	13,756
235.70	40,153	15,458
235.80	40,153	17,150
235.90	40,153	18,830
236.00	40,253	20,497
236.10	40,281	22,161
236.20	40,311	23,812
236.30	40,345	25,448
236.40	40,383	27,071
236.50	40,423	28,678
236.60	40,467	30,268
236.70	40,514	31,838
236.80	40,565	33,387
236.90	40,619	34,915
237.00	40,676	36,419
237.10	40,736	37,898
237.20	40,800	39,344
237.30	40,867	40,753
237.40	40,938	42,125
237.50	41,011	43,454
237.60	41,088	44,729
237.70	41,169	45,930
237.80	41,252	47,023
237.90	41,339	48,026
238.00	41,429	48,979
238.10	41,523	49,914
238.20	41,620	50,858
238.30	41,720	51,812
238.40	41,823	52,776
238.50	41,930	53,751
238.60	42,040	53,934
238.70	42,153	54,129
238.80	42,624	54,352
238.90	43,145	54,625
239.00	43,715	54,952
239.10	44,335	55,339
239.20	45,005	55,790
239.30	45,724	56,311
239.40	46,494	56,906
239.50	47,313	57,580
239.60	48,181	58,339
239.70	49,100	59,187
239.80	50,068	60,130
239.90	51,086	61,172
240.00	52,153	62,318
240.10	53,239	63,572
240.20	54,371	64,937
240.30	55,551	66,417
240.40	56,777	68,018
240.50	58,051	69,744
240.60	59,371	71,599
240.70	60,739	73,589
240.80	62,153	75,718
240.90	63,827	78,001
241.00	65,561	80,454
241.10	67,357	83,084
241.20	69,214	85,897
241.30	71,133	88,899
241.40	73,112	92,095
241.50	**75,153**	**95,492**

Stage-Area-Storage for Pond P16: SC-740 (2)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
232.50	3,095	0	237.80	3,195	6,878
232.60	3,095	124	237.90	3,195	6,888
232.70	3,095	248	238.00	3,195	6,898
232.80	3,095	371	238.10	3,195	6,908
232.90	3,095	495	238.20	3,195	6,918
233.00	3,095	619	238.30	3,195	6,928
233.10	3,095	876	238.40	3,195	6,938
233.20	3,095	1,132	238.50	3,195	6,948
233.30	3,095	1,387	238.60	3,195	6,958
233.40	3,095	1,640	238.70	3,195	6,968
233.50	3,095	1,892	238.80	3,231	6,980
233.60	3,095	2,141	238.90	3,272	6,995
233.70	3,095	2,387	239.00	3,319	7,015
233.80	3,095	2,631	239.10	3,372	7,040
233.90	3,095	2,873	239.20	3,430	7,071
234.00	3,095	3,112	239.30	3,494	7,108
234.10	3,095	3,347	239.40	3,563	7,151
234.20	3,095	3,579	239.50	3,638	7,202
234.30	3,095	3,807	239.60	3,718	7,260
234.40	3,095	4,031	239.70	3,804	7,327
234.50	3,095	4,251	239.80	3,895	7,402
234.60	3,095	4,467	239.90	3,992	7,487
234.70	3,095	4,676	240.00	4,095	7,582
234.80	3,095	4,879	240.10	4,246	7,689
234.90	3,095	5,076	240.20	4,409	7,812
235.00	3,095	5,265	240.30	4,582	7,952
235.10	3,095	5,446	240.40	4,766	8,110
235.20	3,095	5,614	240.50	4,961	8,287
235.30	3,095	5,765	240.60	5,166	8,484
235.40	3,095	5,901	240.70	5,382	8,702
235.50	3,195	6,029	240.80	5,609	8,942
235.60	3,195	6,163	240.90	5,846	9,205
235.70	3,195	6,297	241.00	**6,095**	**9,492**
235.80	3,195	6,430			
235.90	3,195	6,564			
236.00	3,195	6,698			
236.10	3,195	6,708			
236.20	3,195	6,718			
236.30	3,195	6,728			
236.40	3,195	6,738			
236.50	3,195	6,748			
236.60	3,195	6,758			
236.70	3,195	6,768			
236.80	3,195	6,778			
236.90	3,195	6,788			
237.00	3,195	6,798			
237.10	3,195	6,808			
237.20	3,195	6,818			
237.30	3,195	6,828			
237.40	3,195	6,838			
237.50	3,195	6,848			
237.60	3,195	6,858			
237.70	3,195	6,868			

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

INFILTRATION PRACTICE CRITERIA (Env-Wq 1508.06)

Type/Node Name: **SC-740 (2) (Node P16) Chamber System**

Enter the type of infiltration practice (e.g., basin, trench) and the node name in the drainage analysis, if applicable

Y		Have you reviewed Env-Wq 1508.06(a) to ensure that infiltration is allowed?	
1.10	ac	A = Area draining to the practice	
0.96	ac	A_I = Impervious area draining to the practice	
0.87	decimal	I = percent impervious area draining to the practice, in decimal form	
0.84	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.92	ac-in	WQV= 1" x Rv x A	
3,336	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
834	cf	25% x WQV (check calc for sediment forebay volume)	
Isolator Row		Method of pretreatment? (not required for clean or roof runoff)	
	cf	V_{SED} = sediment forebay volume, if used for pretreatment	← ≥ 25%WQV
4,250	cf	V = volume[1] (attach a stage-storage table)	← ≥ WQV
1,620	sf	A_{SA} = surface area of the bottom of the pond	
1.00	iph	$Ksat_{DESIGN}$ = design infiltration rate[2]	
24.7	hours	T_{DRAIN} = drain time = V / (A_{SA} * I_{DESIGN})	← ≤ 72-hrs
233.00	feet	E_{BTM} = elevation of the bottom of the basin	
227.50	feet	E_{SHWT} = elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
227.50	feet	E_{ROCK} = elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
5.50	feet	D_{SHWT} = separation from SHWT	← ≥ *[3]
5.5	feet	D_{ROCK} = separation from bedrock	← ≥ *[3]
	ft	D_{amend} = Depth of amended soil, if applicable due high infiltation rate	← ≥ 24"
	ft	D_T = depth of trench, if trench proposed	← 4 - 10 ft
Y	Yes/No	If a trench or underground system is proposed, observation well provided[4]	
Chambers & Stone		If a trench is proposed, material in trench	
		If a basin is proposed, basin floor material	
	Yes/No	If a basin is proposed, the perimeter should be curvilinear, basin floor shall be flat.	
	:1	If a basin is proposed, pond side slopes	← ≥3:1
234.72	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
235.03	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
235.50	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
YES		10 peak elevation ≤ Elevation of the top of the trench?[5]	← yes
YES		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

1. Volume below the lowest invert of the outlet structure and excludes forebay volume
2. $Ksat_{DESIGN}$ includes a factor of safety. See Env-Wq 1504.14 for requirements for determining the infiltr. rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.
4. Clean, washed well graded diameter of 1.5 to 3 inches above the in-situ soil.
5. If 50-year peak elevation exceeds top of trench, the overflow must be routed in HydroCAD as secondary discharge.

Designer's Notes: Elevation of the top of practice is the top of the stormtech chamber .

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

INFILTRATION PRACTICE CRITERIA (Env-Wq 1508.06)

Type/Node Name: SC-740 (2) (Node P16) Chamber System

Enter the type of infiltration practice (e.g., basin, trench) and the node name in the drainage analysis, if applicable

Y		Have you reviewed Env-Wq 1508.06(a) to ensure that infiltration is allowed?	
1.10	ac	A = Area draining to the practice	
0.96	ac	A_I = Impervious area draining to the practice	
0.87	decimal	I = percent impervious area draining to the practice, in decimal form	
0.84	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.92	ac-in	WQV= 1" x Rv x A	
3,336	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
834	cf	25% x WQV (check calc for sediment forebay volume)	
Isolator Row		Method of pretreatment? (not required for clean or roof runoff)	
	cf	V_{SED} = sediment forebay volume, if used for pretreatment	← ≥ 25%WQV
4,250	cf	V = volume[1] (attach a stage-storage table)	← ≥ WQV
1,620	sf	A_{SA} = surface area of the bottom of the pond	
1.00	iph	$Ksat_{DESIGN}$ = design infiltration rate[2]	
24.7	hours	T_{DRAIN} = drain time = V / (A_{SA} * I_{DESIGN})	← ≤ 72-hrs
233.00	feet	E_{BTM} = elevation of the bottom of the basin	
227.50	feet	E_{SHWT} = elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
227.50	feet	E_{ROCK} = elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
5.50	feet	D_{SHWT} = separation from SHWT	← ≥ *[3]
5.5	feet	D_{ROCK} = separation from bedrock	← ≥ *[3]
	ft	D_{amend} = Depth of amended soil, if applicable due high infiltation rate	← ≥ 24"
	ft	D_T = depth of trench, if trench proposed	← 4 - 10 ft
Y	Yes/No	If a trench or underground system is proposed, observation well provided[4]	
Chambers & Stone		If a trench is proposed, material in trench	
		If a basin is proposed, basin floor material	
	Yes/No	If a basin is proposed, the perimeter should be curvilinear, basin floor shall be flat.	
	:1	If a basin is proposed, pond side slopes	← ≥3:1
234.72	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
235.03	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
235.50	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
YES		10 peak elevation ≤ Elevation of the top of the trench?[5]	← yes
YES		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

1. Volume below the lowest invert of the outlet structure and excludes forebay volume
2. $Ksat_{DESIGN}$ includes a factor of safety. See Env-Wq 1504.14 for requirements for determining the infiltr. rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.
4. Clean, washed well graded diameter of 1.5 to 3 inches above the in-situ soil.
5. If 50-year peak elevation exceeds top of trench, the overflow must be routed in HydroCAD as secondary discharge.

Designer's Notes: Elevation of the top of practice is the top of the stormtech chamber .

STORMWATER POND DESIGN CRITERIA

Env-Wq 1508.03

Type/Node Name: **Wet Basin 1 (P19)**

Enter the type of stormwater pond (e.g., Wet Pond) and the node name in the drainage analysis, if applicable

Value	Unit	Description	Check
2.59	ac	A = Area draining to the practice	
1.26	ac	A_I = Impervious area draining to the practice	
0.49	decimal	I = percent impervious area draining to the practice, in decimal form	
0.49	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
1.26	ac-in	WQV= 1" x Rv x A	
4,587	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
459	cf	10% x WQV (check calc for sediment forebay and micropool volume)	
2,293	cf	50% x WQV (check calc for extended detention volume)	
745	cf	V_{SED} = sediment forebay volume	← ≥ 10%WQV
4,687	cf	V_{PP} = permanent pool volume (volume below the lowest invert of the outlet structure) Attach stage-storage table.	
no	cf	Extended Detention?[1]	← ≤ 50% WQV
-		V_{ED} = Volume of Extended detention (if "yes is given in box above)	
		E_{ED} = elevation of WQV if "yes" is given in box above[2]	
-	cfs	$2Q_{avg} = 2^* V_{ED}$ / 24 hrs * (1hr / 3600 sec) (used to check against Q_{EDmax} below)	
	cfs	Q_{EDmax} = discharge at the E_{ED} (attach stage-discharge table)	← $<2Q_{avg}$
-	hours	T_{ED} = drawdown time of extended detention = $2V_{ED}/Q_{EDmax}$	← ≥ 24-hrs
3.00	:1	Pond side slopes	← ≥3:1
196.00	ft	Elevation of seasonal high water table	
193.20	ft	Elevation of lowest pond outlet	
190.20	ft	Max floor = maximum elevation of pond bottom (ft)	
185.20	ft	Minimum floor (to maintain depth at less than 8')	← ≤ 8 ft
190.00	ft	Elevation of pond floor[3]	← ≤ Max floor and > Min floor
65.00	ft	Length of the flow path between the inlet and outlet at mid-depth	
45.00	ft	Average Width ([average of the top width + average bottom width]/2)	
1.44	:1	Length to Average Width ratio	← ≥ 3:1
	Yes/No	The perimeter should be curvilinear.	
yes	Yes/No	The inlet and outlet should be located as far apart as possible.	
no	Yes/No	Is there a manually-controlled drain to dewater the pond over a 24hr period?	
	If no state why:		
NA, 8" orifice		What mechanism is proposed to prevent the outlet structure from clogging (applicable for orifices/weirs with a dimension of <6")?	
197.70	ft	Peak elevation of the 50-year storm event	
200.00	ft	Berm elevation of the pond	
YES		50 peak elevation ≤ the berm elevation?	← yes

1. If the entire WQV is stored in the perm. pool, there is no extended det., and the following five lines do not apply.
2. This is the elevation of WQV if the hydrologic analysis is set up to include the permanent pool storage in the node description.
3. If the pond floor elevation is above the max floor elev., a hydrologic budget must be submitted to demonstrate that a minimum depth of 3 feet can be maintained. (First check whether a revised "lowest pond outlet" elev. will resolve the issue.)

Designer's Notes:

System will be lined.

STORMWATER POND DESIGN CRITERIA

Env-Wq 1508.03

Type/Node Name: **Wet Basin 2 (P21)**

Enter the type of stormwater pond (e.g., Wet Pond) and the node name in the drainage analysis, if applicable

Value	Units	Description	Criteria
1.49	ac	A = Area draining to the practice	
0.36	ac	A_I = Impervious area draining to the practice	
0.24	decimal	I = percent impervious area draining to the practice, in decimal form	
0.27	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.40	ac-in	WQV= 1" x Rv x A	
1,440	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
144	cf	10% x WQV (check calc for sediment forebay and micropool volume)	
720	cf	50% x WQV (check calc for extended detention volume)	
425	cf	V_{SED} = sediment forebay volume	← ≥ 10%WQV
1,825	cf	V_{PP} = permanent pool volume (volume below the lowest invert of the outlet structure) Attach stage-storage table.	
no	cf	Extended Detention?[1]	← ≤ 50% WQV
-		V_{ED} = Volume of Extended detention (if "yes is given in box above)	
		E_{ED} = elevation of WQV if "yes" is given in box above[2]	
-	cfs	$2Q_{avg} = 2^* V_{ED}$ / 24 hrs * (1hr / 3600 sec) (used to check against Q_{EDmax} below)	
	cfs	Q_{EDmax} = discharge at the E_{ED} (attach stage-discharge table)	← $<2Q_{avg}$
-	hours	T_{ED} = drawdown time of extended detention = $2V_{ED}/Q_{EDmax}$	← ≥ 24-hrs
3.00	:1	Pond side slopes	← ≥3:1
158.50	ft	Elevation of seasonal high water table	
153.00	ft	Elevation of lowest pond outlet	
150.00	ft	Max floor = maximum elevation of pond bottom (ft)	
145.00	ft	Minimum floor (to maintain depth at less than 8')	← ≤ 8 ft
150.00	ft	Elevation of pond floor[3]	← ≤ Max floor and > Min floor
45.00	ft	Length of the flow path between the inlet and outlet at mid-depth	
20.00	ft	Average Width ([average of the top width + average bottom width]/2)	
2.25	:1	Length to Average Width ratio	← ≥ 3:1
yes	Yes/No	The perimeter should be curvilinear.	
yes	Yes/No	The inlet and outlet should be located as far apart as possible.	
no	Yes/No	Is there a manually-controlled drain to dewater the pond over a 24hr period?	
If no state why:			
NA, 12" orifice		What mechanism is proposed to prevent the outlet structure from clogging (applicable for orifices/weirs with a dimension of <6")?	
157.23	ft	Peak elevation of the 50-year storm event	
160.00	ft	Berm elevation of the pond	
YES		50 peak elevation ≤ the berm elevation?	← yes

1. If the entire WQV is stored in the perm. pool, there is no extended det., and the following five lines do not apply.
2. This is the elevation of WQV <u>if</u> the hydrologic analysis is set up to include the permanent pool storage in the node description.
3. If the pond floor elevation is above the max floor elev., a hydrologic budget must be submitted to demonstrate that a minimum depth of 3 feet can be maintained. (First check whether a revised "lowest pond outlet" elev. will resolve the issue.)

Designer's Notes:

System will be lined.

ILLICIT DISCHARGE COMPLIANCE STATEMENT

SITE ADDRESS: 46 OLD FERRY ROAD, METHUEN, MASSACHUSETTS

OWNER: TRIPLE G, LLC

PLAN REFERENCE: GRADING & DRAINAGE PLAN PREPARED BY FIELDSTONE LAND CONSULTANTS, PLLC.

DATE: JUNE 21, 2022

As required by Standard 10 of the Massachusetts Stormwater Standards, I, the undersigned, being the authorized owner/responsible party of the above referenced property do hereby certify that no illicit discharges exist on the site and that the stormwater management system, as shown on the above referenced plan, does not contain or permit any illicit discharges to enter the stormwater management system. Furthermore discharges from interior building drains or plumbing within the buildings are prohibited. Illicit discharges do not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents.

The pollution prevention plan measures to implements in this project to prevent illicit discharges to the stormwater management system, including wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease, include:

1. Identifying the responsible personnel for the implementation of an effective Illicit Discharge Detection and Elimination [IDDE] program.
2. Identify potential sources of Illicit Discharges.
3. Implement the Spill Prevention and Control Plan contained in the property Stormwater Pollution Prevention Plan [SWPPP].

Further, I certify that the stormwater management system as shown on the referenced plan will be maintained in accordance with the conditions of the Long Term Pollution Prevention Plan.

NAME: ____________________

SIGNED: ____________________

DATE: ____________________

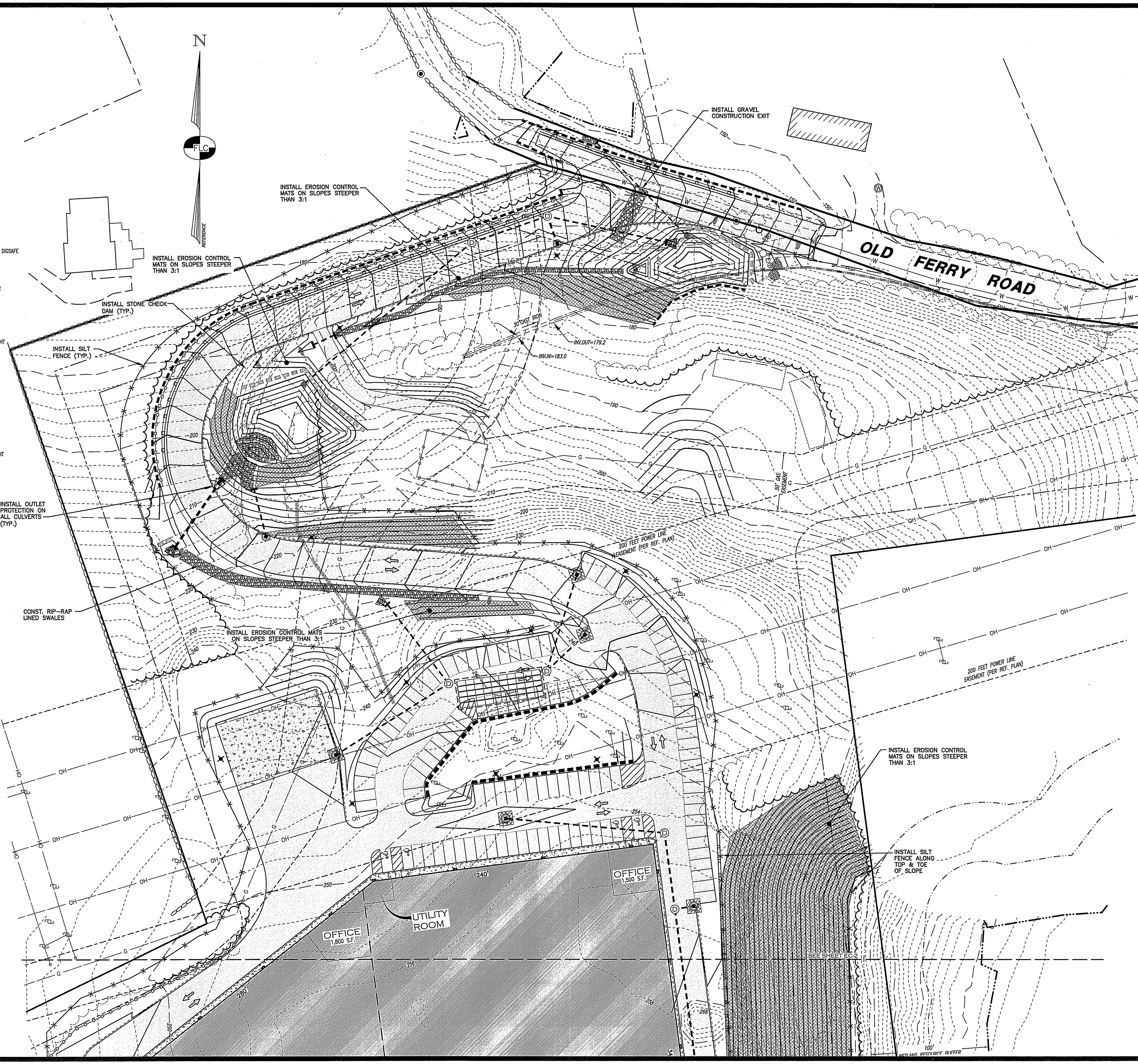
LEGEND:

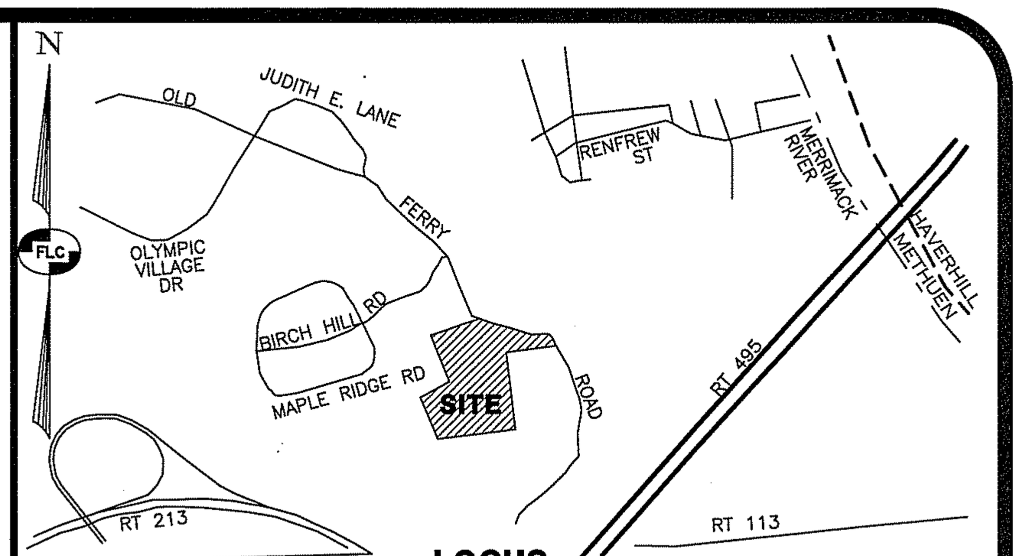
EXISTING FEATURES

- RIGHT-OF-WAY LINE
- BOUNDARY LINE
- ABUTTING LOT LINE
- BUILDING SETBACK LINE
- EXISTING EASEMENT LINE
- EDGE OF PAVED ROAD
- EDGE OF GRAVEL ROAD
- STONE WALL
- EDGE OF TREE LINE
- EDGE OF WETLANDS
- WETLANDS BUFFER LINE
- 300 — 10' CONTOUR INTERVAL
- 302 — 2' CONTOUR INTERVAL
- CHAIN-LINK FENCE
- STOCKADE FENCE
- CULVERT
- OH — OVERHEAD UTILITY LINE
- UGE — UNDERGROUND ELECTRIC DIGSAFE
- UG — UNDERGROUND GAS LINE
- W — WATER LINE
- 1010-79-17 — TAX MAP & LOT NUMBER
- G.B.(F) — GRANITE BOUND FOUND
- D.H.(F) — DRILL HOLE FOUND
- I.PIN(F) — IRON PIN FOUND
- UTILITY POLE, GUY & LIGHT
- CATCH BASIN (SQUARE)
- WATER HYDRANT
- WV — WATER VALVE
- WSO — WATER SHUT-OFF
- WELL
- SIGN WITH TWO POSTS
- RIP RAP
- ROCK
- BOLLARD 8" DIA 3' HEIGHT
- TP: L= S= — TEST PIT NUMBER, LEDGE, SEASONAL HIGH WATER

PROPOSED FEATURES

- EDGE OF PAVEMENT
- 2 FT. CONTOUR
- 10 FT. CONTOUR
- SILT FENCE
- PRIMARY SEPTIC AREA
- RESERVE SEPTIC AREA
- SILT SACK
- CATCH BASIN
- PAVED AREA
- BUILDING
- STONE CHECK DAM
- EROSION CONTROL MAT





LOCUS
SCALE: 1"=2,000'±

NOTES:

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4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACT "DIGSAFE" AT LEAST 72 HOURS PRIOR TO THE START OF CONSTRUCTION (1-888-344-7233)
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12. CONTRACTOR SHALL OBTAIN STRUCTURAL DESIGN PLANS, DETAILS AND SPECIFICATIONS FOR ALL RETAINING WALLS SHOWN ON THIS PLAN PRIOR TO CONSTRUCTION.

GRAPHIC SCALES

40' 20' 0 40' 80' 120'

IMPERIAL: 1"=40'

REV.	DATE	DESCRIPTION	C/O	DR	CK

POLLUTION PREVENTION PLAN

PIE HILL WAREHOUSING

TAX MAP 1010 LOT 79-17
(46 OLD FERRY ROAD)
METHUEN, MASSACHUSETTS

PREPARED FOR AND LAND OF:
TRIPLE G, LLC
59 BONANNO COURT, METHUEN, MA 01844

SCALE: 1" = 40' APRIL 4, 2022

Surveying ✦ Engineering ✦ Land Planning ✦ Permitting ✦ Septic Designs

FIELDSTONE LAND CONSULTANTS, PLLC

206 Elm Street, Milford, NH 03055
Phone: (603) 672-5456 Fax: (603) 413-5456
www.FieldstoneLandConsultants.com

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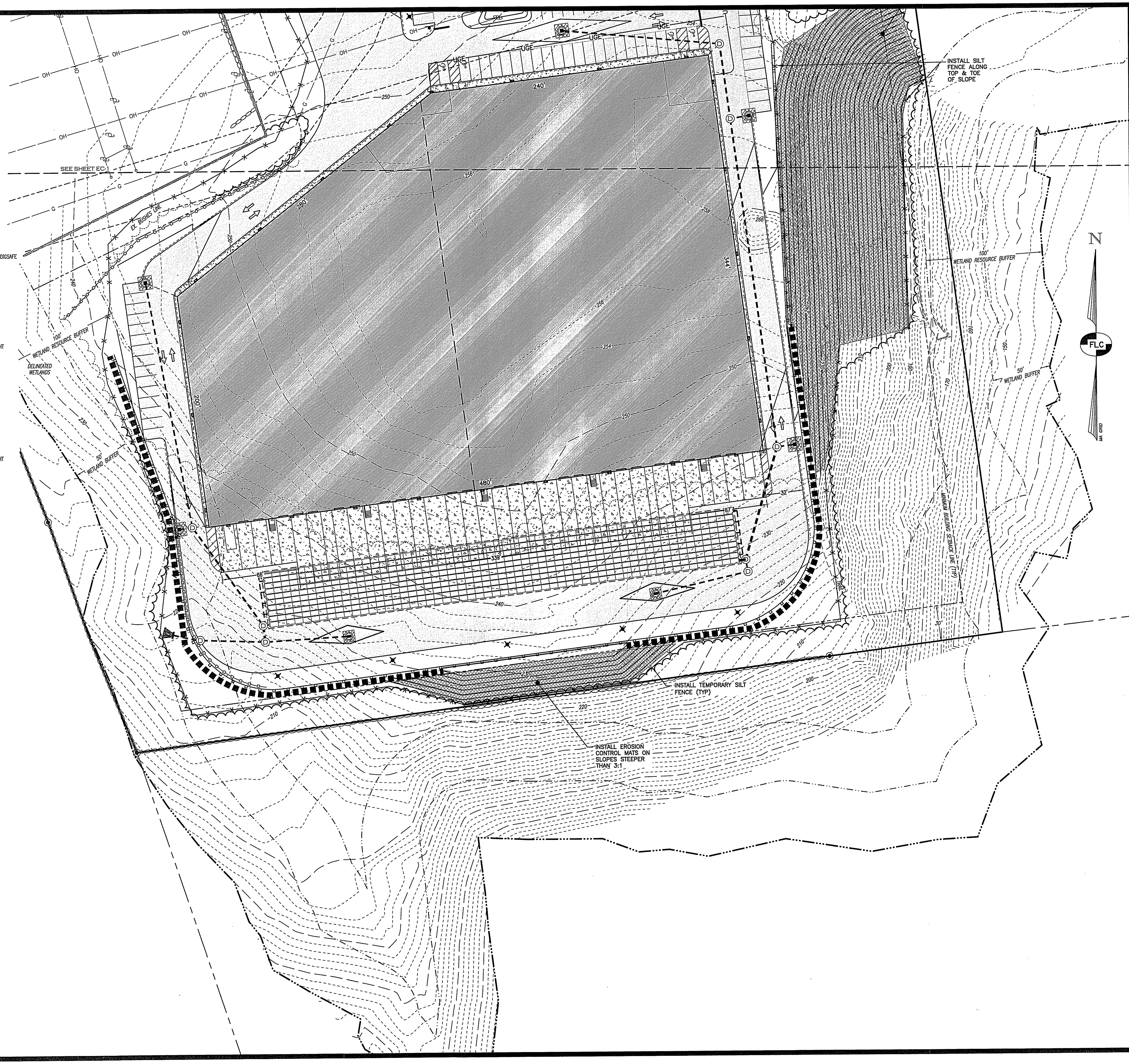
LEGEND:

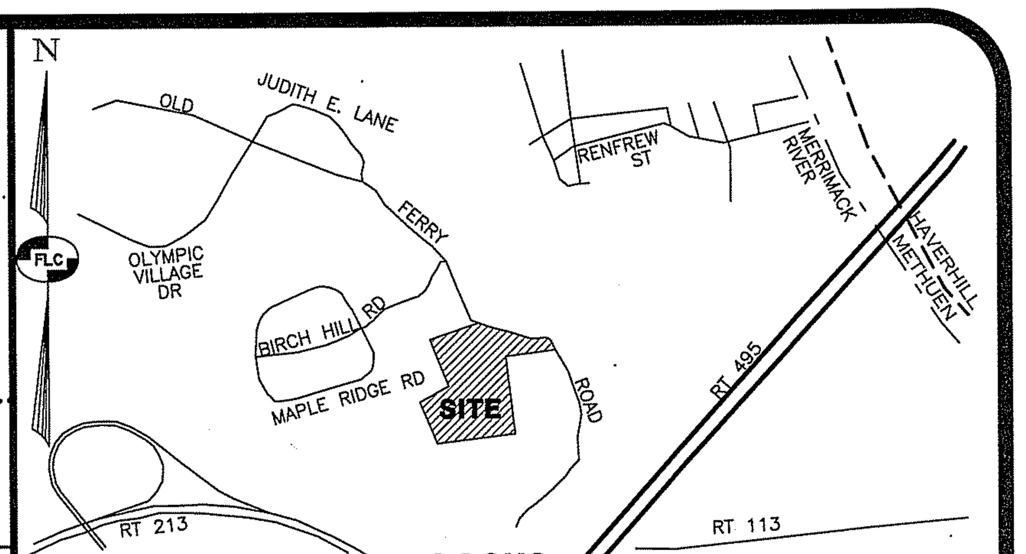
EXISTING FEATURES

- RIGHT-OF-WAY LINE
- BOUNDARY LINE
- ABUTTING LOT LINE
- BUILDING SETBACK LINE
- EXISTING EASEMENT LINE
- EDGE OF PAVED ROAD
- EDGE OF GRAVEL ROAD
- STONE WALL
- EDGE OF TREE LINE
- EDGE OF WETLANDS
- WETLANDS BUFFER LINE
- 300 — 10' CONTOUR INTERVAL
- 302 — 2' CONTOUR INTERVAL
- CHAIN-LINK FENCE
- STOCKADE FENCE
- CULVERT
- OH — OVERHEAD UTILITY LINE
- UGE — UNDERGROUND ELECTRIC DIGSAFE
- UG — UNDERGROUND GAS LINE
- W — WATER LINE
- 1010-79-17 — TAX MAP & LOT NUMBER
- G.B.(F) — GRANITE BOUND FOUND
- D.H.(F) — DRILL HOLE FOUND
- I.P.IN(F) — IRON PIN FOUND
- UTILITY POLE, GUY & LIGHT
- CATCH BASIN (SQUARE)
- WATER HYDRANT
- WV — WATER VALVE
- WATER SHUT-OFF
- WELL
- SIGN WITH TWO POSTS
- RIP RAP
- ROCK
- BOLLARD 8" DIA 3' HEIGHT
- TP: L= S= — TEST PIT NUMBER, LEDGE, SEASONAL HIGH WATER

PROPOSED FEATURES

- EDGE OF PAVEMENT
- 2 FT. CONTOUR
- 10 FT. CONTOUR
- SILT FENCE
- PRIMARY SEPTIC AREA
- RESERVE SEPTIC AREA
- SILT SACK
- CATCH BASIN
- PAVED AREA
- BUILDING
- STONE CHECK DAM
- EROSION CONTROL MAT





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GEOTECHNICAL REPORT

PIE HILL INDUSTRIAL DEVELOPMENT
46 OLD FERRY ROAD
METHUEN, MASSACHUSETTS

May 3, 2022

GSI Project No. 222138

Prepared for:

Mr. Ben Jager
Project Manager
CMGC Building Corp.
360 Harvey Road
Manchester, NH 03103

Prepared by:

Harry K. Wetherbee, P.E.
Geotechnical Services, Inc.
55 North Stark Highway
Weare, NH 03281

Geotechnical Services Inc.

Geotechnical Engineering ◣ Environmental Studies ◣ Materials Testing ◣ Construction Monitoring

GEOTECHNICAL SERVICES INC.
Geotechnical Engineering ◢ Environmental Studies ◢ Materials Testing ◢ Construction Monitoring

May 3, 2022

Ben Jager
Project Manager
CMGC Building Corp.
360 Harvey Road
Manchester, NH 03103

RE: Geotechnical Report
Pie Hill Industrial Development
Old Ferry Road
Methuen, Massachusetts

GSI Project No. 222138

This report presents the results of a geotechnical investigation completed by Geotechnical Services, Inc. (GSI) for the construction of the proposed development on Old Ferry Road in Methuen, Massachusetts. The objective of the geotechnical investigation was to explore subsurface conditions within the proposed development area and formulate geotechnical engineering recommendations for the design and construction of foundations, and floor slabs. Included are the findings of our subsurface exploration program and an engineering evaluation of the subsurface conditions encountered. The contents of this report are subject to the **Limitations** included in Appendix A.

PURPOSE AND SCOPE

The scope of services performed by GSI to meet the above-stated objectives for geotechnical engineering services included the following:

1. Coordination and observation of nine (9) test borings at the locations illustrated on the attached Figure 2;

2. Evaluation of appropriate foundation systems based on subsurface conditions encountered. Formulation of design parameters for spread footing foundation and slab-on-grade construction, including allowable bearing pressure and prediction of long-term settlement values;

3. Formulation of earthwork and foundation construction procedures to be followed during the construction phase of this project;

4. Establishment of seismic design parameters and liquefaction potential based on the subsurface profile and the proposed structure;

◢ 55 North Stark Highway Weare NH ◢ 603/529/7766 ◢ FAX 603/529/7080

◢ 30 Newbury Street, Boston, MA ◢ 617/861/2617

5. Preparation of this geotechnical engineering report which summarizes our findings and recommendations.

SITE AND PROJECT INFORMATION

The property is located at 46 Old Ferry Road in Methuen, Massachusetts, and is abutted by Old Ferry Road to the north, Summit Place Apartments to the west, and woodland to the east and south. The property consists of a large, heavily wooded, plot of land, which has been partially cleared. Site topography slopes downward from the north to south, and steeply downward from west to east, east of the proposed building toward Old Ferry Road. Historical Google satellite imagery indicates sporadic use of the site since 1992 potentially as vehicle storage and as a gravel pit. Clearing of trees from the southern portion of the site may have occurred at some point during 2018.

The proposed development includes the construction of a new 139, 900 square foot industrial building. The proposed building is expected to be of steel frame construction with masonry block walls founded upon a conventional shallow concrete frost wall and spread footing with a concrete slab-on-grade. Paved parking will be provided along the exterior of the new building. The construction will require a cut from existing grade, and on-site retaining walls will be constructed to accommodate the change in grades. Limited site and structural details were provided by the Drawing, "Warehouse Concept Plan – Pie Hill Industrial Park," prepared by Fieldstone Land Consultants, Inc. of Milford, Massachusetts dated January 26, 2022.

SUBSURFACE INVESTIGATION

Nine (9) test borings designated GSI-1 through GSI-9 were advanced for the purpose of evaluating the geotechnical properties of the existing soils. The test borings were advanced within the proposed building footprint to depths of 9 to 14 feet below existing grade. The subsurface explorations classified the on-site soils according to their color, grain size, and other material properties. The test boring program was conducted by Technical Drilling Services, Inc. utilizing a track mounted drill rig.

Soil explorations were performed in accordance with methods prescribed by ASTM D1586. Soil samples were obtained at the surface and at two to five-foot intervals with a 1⅜ inch diameter split-spoon sampler. Standard Penetration Tests (SPTs) were performed at the sampling intervals in accordance with ASTM D1586. Field descriptions of the soils encountered, observed depth to groundwater while drilling when observed, and other pertinent observations are contained in the attached test boring logs. The test boring locations are illustrated on Figure 2 of this report. GSI test boring logs are presented in Appendix B.

SUBSURFACE CONDITIONS

Sand and Gravel

The initial sampling interval at ground surface at test boring locations GSI-1 through GSI-3 consisted of Sand and Gravel, classified as loose to medium dense, light brown or orange brown, fine to medium Sand, little to some Gravel, little Silt, with SPT "N" values of 7 to 25 blows per foot. The Sand and Gravel was present within the uppermost 4 to 5 feet of soil and contained frequent small cobbles and boulders.

Sand

Test borings GSI-4 through GSI-9, encountered Sand within the surficial sampling interval, which was classified as loose to dense, orange brown or olive brown, fine to medium Sand, trace to some Silt, trace Gravel. SPT "N" values within the Sands were typically 2 to 12 blows per foot, with an SPT "N" value of 31 observed at GSI-8, likely due to a pushed stone. The Sands transitioned to glacial till by a depth of 4 feet.

Glacial Till

Glacial till was observed by a depth of 5 feet at all nine test boring locations. Glacial till is a non-sorted, non-stratified natural deposit of sand, silt, gravel, and boulders, mixed in various proportions and deposited directly by the glaciers in a non-aqueous depositional environment. The till soils were visually classified as medium dense to very dense, olive brown, fine to medium Sand, some Silt, trace to some Gravel. SPT "N" values within the till varied from 20 to over 100 blows per foot. The till soils continued to test boring termination at depths of 9 to 20 feet below existing grades without encountering refusal.

Refusal/Bedrock

Test boring refusal was encountered at 8 of the 9 test boring locations at depths of 9 to 18 feet below grade. Refusal is defined as the inability of the augers to advance despite increasing torque and downward pressure applied by the drill rig. Split spoon refusal is defined as either 100 blows or more required to drive the split spoon sampler 12 inches with a 140-lb. hammer falling 30 inches; 50 blows for less than 6 inches of advancement; or 10 blows with no discernable, vertical movement of the split spoon sampler. Refusal may be caused by nested cobbles, very dense soils, boulders, obstructions, or bedrock.

GROUNDWATER

Groundwater was not observed possibly due to the density of the in-situ glacial till soils. Groundwater observations should not be considered long-term, equilibrated groundwater levels, but rather an approximate indication of the likely groundwater elevation during construction. Groundwater levels should be anticipated to fluctuate from those measured during drilling operations in response to differences in equilibrated time, rainfall, snowmelt, and seasonal changes.

FOUNDATION DESIGN RECOMMENDATIONS

GSI recommends that building walls, columns and other structural elements be supported by reinforced concrete spread or strip footings bearing directly upon the native soils described above or structural fill in fill areas. An allowable bearing pressure of 2 tons per square foot (4,000psf) may then be assumed for design. In areas where the foundation will bear on rock, the allowable bearing capacity may be increased to 3 tons per square foot (6,000 psf) (See below).

With regards to footing geometry, the minimum footing width of column and strip footings should be 4 feet and 2 feet, respectively. The spread footings should be founded at least 4 feet below exterior grade to obviate frost action in the bearing strata. If the construction occurs during the winter months it will be necessary to provide temporary insulation and/or heat application to the foundations. Any topsoil, fill, or organic soils encountered during subgrade excavation shall be removed per the attached Figure 3: Foundation Zone of Influence. The designer shall also verify that the proposed footing will not impact the slope on the eastern side of the property.

At the recommended bearing pressures, we anticipate that the total settlement of individual footings under static loading conditions and constructed as recommended herein, will not exceed 1 in., with differential settlements between adjacent footings not exceeding ¾ in. Most of the settlement will likely occur elastically during construction as structure dead loads are placed on the foundations. The live load contribution to foundation settlement is expected to be less than 50% of the dead load thus post construction settlements are not expected to be problematic.

ENGINEERING PARAMETERS OF ON-SITE SOILS

Based on results of our subsurface exploration program, the following engineering properties of soils that will be supporting foundation elements are estimated as follows:

TABLE ONE
SOIL ENGINEERING DESIGN PARAMETERS

Soil Type	Friction Angle φ, (degrees)	Cohesion c, (psf)	Unit Weight γ, (pcf)	Coeff. of Sliding Friction Soil to Concrete (tan δ)
Glacial Till	34	0	125	0.45
Structural Fill	32	0	125	0.40
Bedrock	50	0	150	0.75

SEISMIC DESIGN PARAMETERS

The seismic design parameters have been reviewed with respect to the 9th Edition of the Massachusetts Building Code. Upon review of the subsurface soils data and considering information gathered from projects with similar subsurface profiles, the site is to be associated with Site Class "C" and the design of structural elements should reflect this distinction. The subsurface conditions are also not deemed susceptible to earthquake induced "liquefaction." A Summary of USGS Design Maps are included as Appendix D.

CONCRETE FLOOR SLAB

We recommend that slabs be designed as slabs-on-grade designed in accordance with ACI 360R-10. The slab should bear directly upon a 6-inch (minimum) layer of compacted Base Course Soil. The subgrade will consist of compacted structural fill or proof-compacted undisturbed soil. The floor slab may thus be designed following the ACI "elastic support" approach, using a modulus of subgrade reaction value, k on subbase = 250 pci.

Slabs should be designed to act independent of foundation walls and column footings with isolation joints. Shrinkage cracking may be controlled with welded wire fabric, reinforcing steel, or contraction joints. Contraction joints in plain concrete should not be spaced a distance greater than 30 times the slab thickness. Saw cuts should be made within 12 hours of slab finishing and penetrate at least ¼ the slab thickness or a minimum of 1 inch. Welded wire fabric or reinforcing steel may also be used to widen the control joint spacing.

For moisture sensitive environments, ACI 302.1R-15 indicates that a subslab vapor retarder be used beneath the concrete slab. The vapor retarder should be at a minimum; 10-mil polyethylene with joints lapped a minimum of 12 inches. It is emphasized that these are recommendations and that the final decision on the use and location of the subslab vapor retarder whether in direct contact with the slab or beneath the layer of compacted Structural Fill should be made considering specific conditions for the project. Factors which may affect this decision include moisture sensitivity of the planned floor finishes, anticipated moisture conditions, including precipitation and exposure before the slab is constructed, and the potential effects of slab curling and cracking. Design guidance is provided in ACI 360R-2010, *Design of Slabs on Grade,* Figure 3-7.

LATERAL EARTH PRESSURE

The proposed development will incorporate on site retaining walls. Lateral earth pressure recommendations are provided for design and construction of the walls, which will support lateral soil pressures. These walls should be designed to resist lateral earth loads resulting from earth pressures, as well as those imparted by any surcharge loadings adjacent to the wall. A diagram of the effects of lateral earth pressures is provided as Figure 4.

Lateral earth forces are computed by the general formula $P = \frac{1}{2}K\gamma H^2$.

Where: P = lateral earth force (pounds per linear foot of wall)
K = lateral earth pressure coefficient
γ = unit weight of soil (pounds per cubic foot)
H = height of wall (feet)

The lateral earth pressure coefficient is based on Rankine lateral earth pressure theory for the active (K_A), passive (K_P), and at-rest (K_0) conditions. The active condition exists when the top of the wall is free to deflect, reducing the lateral earth pressure. The at-rest condition exists when the wall is restrained from deflecting by lateral bracing such as a basement wall. The passive condition exists when the wall deflects against a soil, and the soil mass resists wall deflection. It is recommended to compute lateral earth pressures based on an equivalent fluid weight equal to $K\gamma$.

The following equivalent fluid weights should be utilized for design: 40 pounds per cubic foot (pcf) equivalent fluid weight (efw) (active), 375 pcf efw (passive), 60 pcf efw (at-rest). Lateral pressures exerted from surcharge pressures such as traffic, floor loads, etc. should be applied as a uniform pressure equal in magnitude to 0.3q and 0.5q for the active and at-rest conditions respectively. These equivalent fluid pressures do not include hydrostatic forces, as it is presumed that drainage will be provided behind the wall. Lateral loads imposed from seismic ground acceleration should be computed as $0.045\gamma H^2$. Assuming a unit weight of 125 pcf, this translates to $6H^2$ psf. The lateral seismic load should be applied as an inverted triangle over the height of the wall.

FOUNDATION DRAINAGE, ROOF DRAINAGE, AND SLAB-ON-GRADE DAMP PROOFING RECOMMENDATIONS

Foundation drains are not required as below grade space is not expected to be incorporated into proposed building as a perimeter drive is to be provided. The ground surface immediately adjacent to the foundation should be sloped away from the building to allow for positive drainage. It is recommended that the surficial materials adjacent to the building be relatively impermeable to reduce the volume of precipitation infiltrating into the subsurface. Such impermeable materials may include Portland cement concrete, bituminous concrete or vegetated silty topsoil. Roof drainage is recommended for the collection of run off as a result of stormwater. It is recommended that roof drainage and stormwater features not discharge into foundation drains.

CONCRETE SIDEWALKS

Where concrete exterior sidewalks are provided, they shall be formed upon a minimum of 12 inches of slab base course or structural fill, which shall be increased to a minimum of 18 inches in the vicinity of exterior doorways, ramps, or other openings for frost protection at building entry points.

BEDROCK EXCAVATION

Eight of nine test borings encountered refusal at depths of 9 to 18 feet below grade, therefore, it is possible that bedrock may be encountered prior to reaching the proposed subgrade depths. It may be possible that a portion of this excavation may be accomplished conventionally using a toothed backhoe bucket, ripper tooth on a large bulldozer, hydraulic ram rock excavation techniques or drilling and blasting. The method selected will depend on the type, nature, and required excavated quantities of rock encountered in the project. For example, highly weathered rock that is fractured or weakly jointed is expected to be removed with using excavators and/or bulldozers, and should be treated as soil excavation for contract payment purposes. While impact is expected to be minimal, protection of nearby structures from blasting induced vibrations should be evaluated. If necessary, pre-construction surveys of some of the structures (facilities) may need to be implemented.

Bedrock that cannot be excavated conventionally as soils excavation will require removal through the use of a hydraulic ram and/or controlled blasting, using gelatin-based explosives, or, if the bedrock is not excessively jointed, ANFO type demolition agents may be used. Upon encountering bedrock during excavation for footings or utilities, the earthwork Contractor should expose those portions of the bedrock surface which may potentially require excavation. The rock surface should then be surveyed by an independent surveyor and the quantity of rock excavation should be mutually agreed upon by the Contractor, Architect, and Engineer prior to excavation.

We recommend that potential contractors should review the project requirements with an engineer having experience and expertise in drilling and blasting. We recommend that controlled blasting methods be employed utilizing delay charges and appropriate powder factors to minimize the generation of vibrations. Powder factors may be calculated using the principle of scaled distances assuming an allowable Peak Particle Velocity (PPV) of 2 inches per second at the nearest structure to be protected.

In order to facilitate controlled blasting, pre-splitting may be performed. Pre-splitting consists of drilling of a row of holes along the final excavation line. The holes are intended to create a weakened plane along the excavation limit upon which the rock will split during production blasting. Following drilling, the holes are loaded with a special grade of explosive with a reduced powder and energy factor than the production holes. The blasts may be performed prior top or concurrently with the production blasting. Typically, pre-splitting is performed in 3-inch diameter holes with a loading rate of 0.25 pounds of explosive per linear foot of borehole. Spacing of the typical holes would be between 24 to 36 inches. It is the Contractor's responsibility to prepare a blasting plan based on an evaluation of the site and subsurface conditions.

We recommend that the Contractor be required to provide a drilling-blasting plan for review prior to bedrock excavation. In addition, the Contractor should contact the local fire department to establish the blasting regulations applicable to the project.

Upon encountering bedrock during excavation, the Contractor should expose that portion of the bedrock surface that requires blasting. The rock surface then should be surveyed by a licensed surveyor retained by the Contractor, and the volume of intended rock excavation estimated prior to actual drilling and blasting.

Given the nature of shallow blasting techniques with intersecting conical rupture radii, it is not feasible to produce a flat, level subgrade free of over blast material. A certain amount of overblast should be anticipated. In order to prevent unforeseen cost over-runs, and to give the Contractor an incentive for limiting the amount of overblast, we recommend that a pay limit be set below (beyond) which the Contractor would be entitled to no additional compensation for excess rock excavation. The pay limit line should be fixed at 1.0 foot below bottom of footings, slab, and the parking area subgrade. Similarly, for lateral excavation in rock the pay limit line should be fixed at 2.0 ft beyond the proposed lateral limits.

Blasting Criteria

Criteria for blasting adjacent to freshly placed concrete should be established to reflect two types of concrete, Type A and B concrete. Type A concrete refers to "mass" concrete, which will not undergo structural bending whereas Type B concrete refers to "structural" concrete which could go structural bending. Preliminary blasting criteria for each concrete type are provided below in the technical specifications relative to "concrete age" and "maximum peak particle velocity of the induced stress wave."

Type A Concrete Criteria

Concerns for blasting induced vibrations adjacent to Type A concrete are more related to the integrity of the rock mass below the concrete rather than the concrete itself. If a constructed footing is bearing on or near a rock mass being excavated, blasting may open joints or fractures, heaving the rock. Heaving could result in subsequent settlement of the footings bearing on the rock.

Concrete should not be poured within approximately 50 feet of where blasting is planned; unless the Engineer reviews the Contractor's proposed blasting procedures (including charge weights and delays), the nature of the rock to be blasted, and geometry (elevation and distance) of the rock to be blasted relative to the concrete under consideration.

Maximum vibration limits (Peak Particle Velocity, PPV) recommended for Type A concrete are as follows:

Concrete Age	*PPV*
0 to 24 hours old	1.0 in/sec
1 to 7 days old	3.0 in/sec
Greater than 7 days old	4.0 in/sec

Type B Concrete Criteria

Concerns for Type B concrete are related primarily to the ability of the new concrete structure to undergo vibration-induced bending. To limit the potential for damage, while allowing flexibility in construction sequencing, maximum vibration limits (PPV) recommended for Type B concrete are as follows:

Concrete Age	*PPV*
0 to 24 hours old	0.5 in/sec
1 to 7 days old	2.0 in/sec
Greater than 7 days old	3.0 in/sec

EARTHWORK RECOMMENDATIONS

Foundation Subgrade Preparation

Prior to foundation construction, any topsoil, subsoil, or loose soils encountered should be removed. Foundation and floor slab subgrades should be proof compacted using a heavy vibratory plate or drum roller, as described below, prior to foundation construction or placing additional fill in order to densify disturbed soils resulting from excavation and preload the subgrade.

Recommended proof compaction should include 4 coverages (2 in each orthogonal direction) with a minimum of a 10-ton vibratory roller. During the proof rolling process, the subgrade should be observed by a qualified Geotechnical Engineer to identify areas exhibiting weaving or excessive reaction. Any soils exhibiting excessive reaction should be locally excavated and replaced with free-draining structural fill or crushed stone.

Protection of Foundation Subgrades

The contractor should be required to maintain stable, dewatered subgrades for foundations, pavement areas, and utility trenches. Subgrades may be disturbed by improper excavation methods, moisture, precipitation, groundwater control, and construction activities. The contractor should take precautions to protect the bearing subgrade against disturbance from construction traffic and weathering. If necessary, dewatering can be accomplished via open pumping utilizing submersible pumps and temporary stone lined sump pits.

A lift of compacted crushed stone may be utilized to protect the subgrade surface from wear and disturbance should water be present within the excavation. The subgrade must still be verified for competency prior to the placement of concrete or backfill materials within the building footprint. If construction activities are to take place during winter months, the contractor should protect the work area from freezing, which may necessitate the use of soil blankets or tents and heaters to protect the subgrade surface.

Construction Dewatering

The site contractor should be prepared to remove any standing water from foundation excavations. If the sumps are unable to control the development of groundwater within the excavation, supplemental dewatering in the form of deep wells or wellpoints may be required. Stormwater runoff developed from storm events should be diverted away from excavation areas to minimize any impoundment in the excavation or disturbance to the foundation subgrades. It is anticipated that groundwater and stormwater may be controlled by localized dewatering efforts employing sumps and pumps.

The groundwater elevation should be maintained at least 12 inches below the foundation grade until backfilling is complete. A lift of crushed stone or free draining structural fill at foundation grade may be utilized to facilitate dewatering and provide a dry and stable subgrade during construction.

Backfilling

Backfill in the building area should be placed and compacted in lifts immediately after final excavation to limit disturbance to the subgrade surface. Except for zones requiring special backfill such as directly beneath pavements or exterior slabs, the exterior of foundation walls and other site areas may be backfilled with Common Fill.

Placement of compacted fills should proceed with caution when air temperatures are low enough (approximately 30°F, or below) to cause freezing of the moisture in the fill during or before placement. Fill materials should not be placed on snow, ice or uncompacted frozen soil. Compacted fill should not be placed on frozen soil.

No fill should be allowed to freeze prior to compaction. At the end of each day's operations, the last lift of fill, after compaction, should be rolled by a smooth-wheeled roller to eliminate ridges of uncompacted soil.

Minimum compaction requirements for all fill materials are as follows:

TABLE TWO
MINIMUM COMPACTION REQUIREMENTS

Location or Area	Standard Proctor Density ASTM698	Modified Proctor Density ASTM D1557	Testing Frequency One Test Per Lift Per
Structures and Walkways	95%	92%	2,000 ft^2
Retaining Walls	95%	92%	1,000 ft^2
Pavements below 18 inches of Subgrade	95%	92%	5,000 ft^2
Trenches	95%	92%	150 lineal feet
Lawns and Unimproved Areas	92%	90%	20,000 ft^2
Building and Pavement Subgrades	100%	95%	1,000 ft^2

Structural Fill

Structural Fill should consist of clean sand and gravel free of organic material, snow, ice, or other objectionable materials and should be well-graded within the following limits:

Sieve Size	Percent Finer by Weight
6 in.	100
No. 4	30-70
No. 40	10-50
No. 200	0-10

Structural Fill should be placed in lift thickness not exceeding 12 in. loose measure. Cobbles and boulders having a size exceeding 2/3 of the loose lift thickness should be removed prior to compaction. Compaction in open areas should consist of self-propelled vibratory rollers such as a BoMag BW-60S or equivalent. In confined areas, hand guided equipment such as a large vibratory plate compactor, should be used and the loose lift thickness should not exceed 6 in. A minimum of four systematic passes of the compaction equipment should be used to compact each lift. Compaction effort should be verified by field density testing.

Common Fill

Common fill may be used to raise grades in paved and landscaped areas, subject to pavement design criteria and landscape planting or drainage requirements. Common fill should be granular mineral soil free from organic materials, loam, wood, trash, snow, ice, frozen soil, and other compressible materials. Common fill should not contain stones larger than 2/3 of the placement lift thickness, and have a maximum 80 percent passing the No. 40 sieve, and a maximum of 30 percent passing the No. 200 sieve. These soils typically would require moisture control during placement and compaction.

Slab Base Course

Slab Base Course beneath building slabs should consist of bank-run sand and gravel, free of organic material, snow, ice, or other unsuitable materials and should be well-graded within the following limits:

Sieve Size	Percent Finer by Weight
4 in.	100
No. 4	40-70
No. 40	25-45
No. 200	0-10

Other materials could be acceptable for compacted Slab Base Course and should be evaluated by the Geotechnical Engineer on a case-by-case basis if proposed by the Contractor.

Slab Base Course should be placed in lift thicknesses not exceeding 8-inches loose measure. In confined areas, hand-guided equipment such as a vibratory plate compactor should be used and the loose lift thickness should not exceed 6 inches. A minimum of four systematic passes of the compaction equipment should be used to compact each lift.

CONSTRUCTION MONITORING

It is recommended that a qualified geotechnical engineer be retained to observe foundation construction, subgrade preparation, backfilling, and compaction in conformance with the requirements of local building codes. GSI has the geotechnical personnel trained and experienced in monitoring earthwork excavation and testing, as well as a full-service Soils and Materials laboratory.

CLOSURE

We trust that you find this report consistent with your needs. Should you have any questions with regard to this report, please do not hesitate to contact our office.

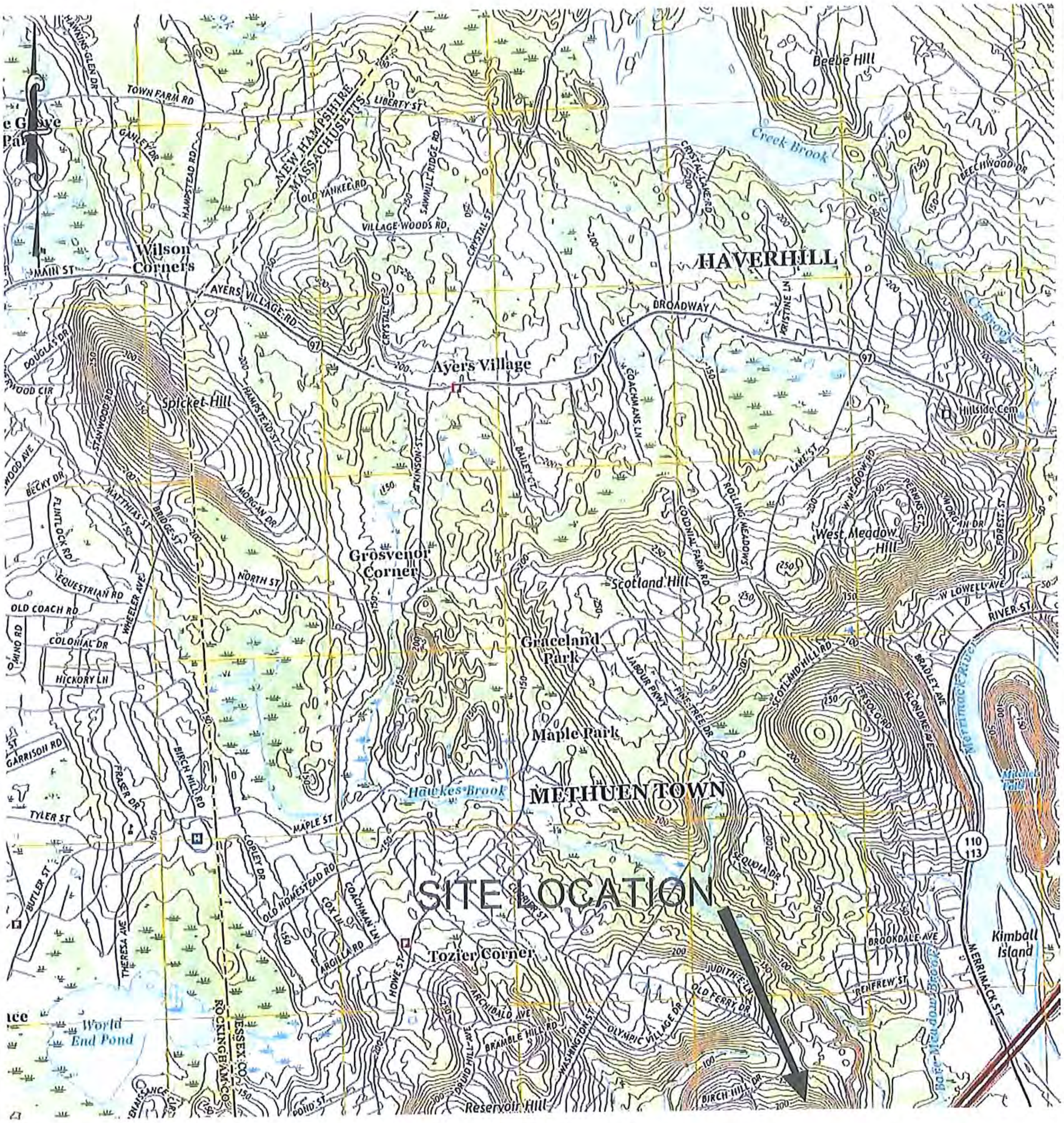
Very truly yours,

GEOTECHNICAL SERVICES, INC.

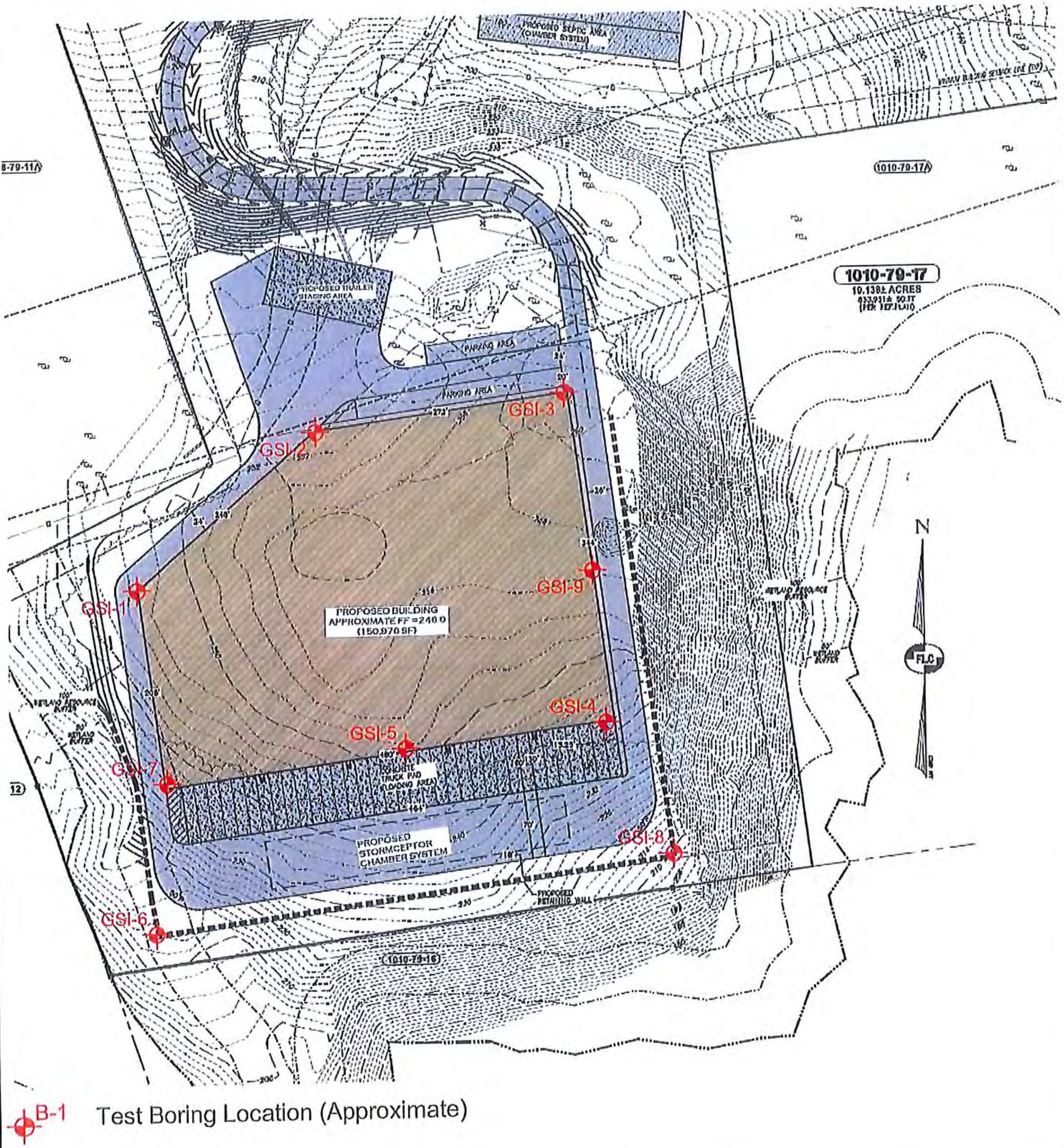
Harry K. Wetherbee, P.E.
Principal Engineer

Attachments:
Figure 1: Locus Plan
Figure 2: Exploration Location Plan
Figure 3: Foundation Zone of Influence
Figure 4: Lateral Earth Pressure Diagram

Appendix A: Limitations
Appendix B: Exploration Logs
Appendix C: Subsurface Exploration Key
Appendix D: USGS Seismic Design Maps
Appendix E: Draft Earthwork Specifications



LOCUS MAP	GEOTECHNICAL SERVICES INC. 55 NORTH STARK HIGHWAY, WEARE, NH 03281 TEL. (603) 529-7766 FAX. (603) 529-7780		
Pie Hill Industrial Development Methuen, Massachusetts	DRAWN BY: KJM	DATE: May 2022	FIGURE NO. 1
	CHECKED BY: HKW	SCALE: 1" = @1500'	
	FILE NAME: Pie Hill Industrial.dwg	PROJECT NO.: 222138	

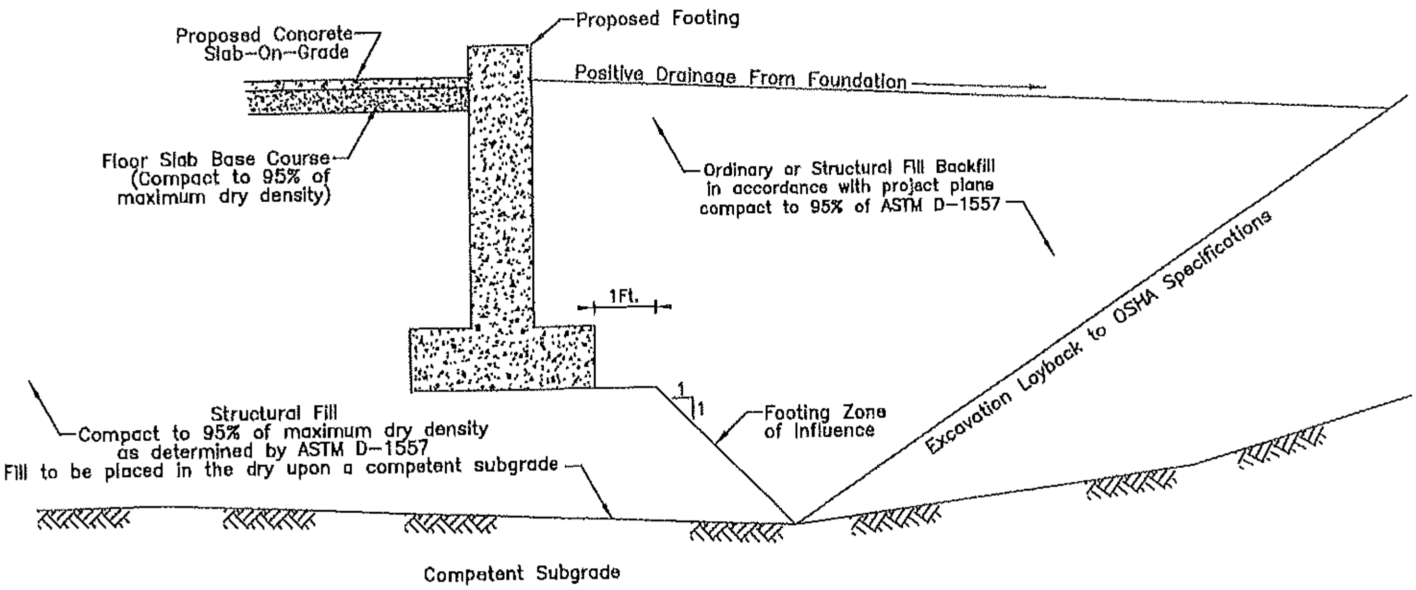


EXPLORATION LOCATION PLAN

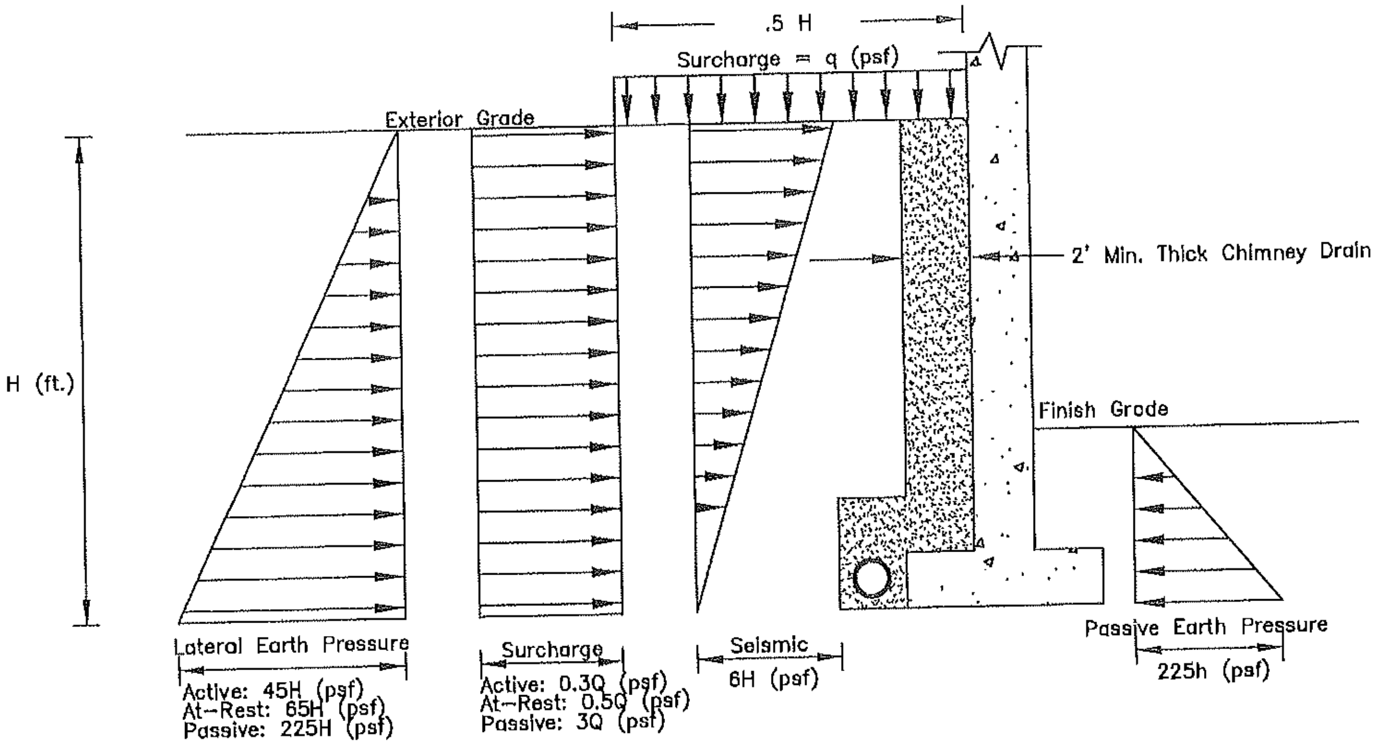
GEOTECHNICAL SERVICES INC.
55 NORTH STARK HIGHWAY, WEARE, NH 03281
TEL. (603) 529-7766 FAX. (603) 529-7780

Pie Hill Industrial Development
Methuen, Massachusetts

DRAWN BY: KJM	DATE: May 2022	FIGURE NO. 2
CHECKED BY: HKW	SCALE: 1"=@150'	
FILE NAME: Pie Hill Industrial.dwg	PROJECT NO.: 222138	



FOUNDATION ZONE OF INFLUENCE	GEOTECHNICAL SERVICES INC. 56 NORTH STARK HIGHWAY, WEARE, NH 03281 TEL. (603) 529-7766 FAX. (603) 529-7780		
Pie Hill Industrial Development Methuen, Massachusetts	DRAWN BY: KJM	DATE: May 2022	FIGURE NO. 3
	CHECKED BY: HKW	SCALE: NTS	
	FILE NAME: Pie Hill Industrial.dwg	PROJECT NO.: 222138	



Note:

1. Lateral earth pressure diagram is based on no permanent hydrostatic pressures (i.e. groundwater) behind the wall and construction of a subdrainage system behind the wall, as shown hereon, to relieve hydrostatic pressures.

2. Refer to the project geotechnical report for additional information.

LATERAL EARTH PRESSURES

GEOTECHNICAL SERVICES INC.
55 NORTH STARK HIGHWAY, WEARE, NH 03281
TEL. (603) 529-7766 FAX. (603) 529-7780

Pie Hill Industrial Development
Methuen, Massachusetts

DRAWN BY: KJM	DATE: May 2022	FIGURE NO. 4
CHECKED BY: HKW	SCALE: NTS	
FILE NAME: Pie Hill Industrial.dwg	PROJECT NO.: 222138	

APPENDIX A

LIMITATIONS

LIMITATIONS

Explorations

1. The analyses, recommendations, and designs submitted in this report are based in part upon the data obtained from preliminary subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretation of widely spaced explorations and samples; actual soil transitions are probably more gradual. For specific information, refer to the individual test pit and/or boring logs.

3. Water level readings have been made in the test pits and/or test borings under conditions stated on the logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the time the measurements were made.

Review

4. It is recommended that this firm be given the opportunity to review final design drawings and specifications to evaluate the appropriate implementation of the recommendations provided herein.

5. In the event that any changes in the nature, design, or location of the proposed areas are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of the report modified or verified in writing by Geotechnical Services, Inc.

Construction

6. It is recommended that this firm be retained to provide geotechnical engineering services during the earthwork phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

Use of Report

7. This report has been prepared for the exclusive use of the above and their assigns, in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

8. This report has been prepared for this project by Geotechnical Services, Inc. This report was completed for preliminary design purposes and may be limited in its scope to complete an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to evaluation considerations only.

APPENDIX B

EXPLORATION LOGS

Geotechnical Services, Inc. 55 North Stark Highway, Weare, NH 03281 Phone 603/529-7766 Fax 603/5297080 - 30 Newbury St. 3rd Floor, Boston, MA 02116 Phone 617/455-4248 Fax 617/745-4308

GSI

TEST BORING LOG

Boring No. GSI-1

Project	Pie Hill Industrial Development	GSI Project No.	222138	Elevation	E.G.
Location	Methuen, MA	Project Mgr.	HKW	Datum	-
Client	CMGC Building Corp.	Inspector	KJM	Date Started	4/27/2022
Contractor	TDS	Checked By	HKW	Date Finished	4/27/2022
Driller	Brett Balyk	Rig Make & Model	Diedrich	Rig Model	D-50

Item:	Auger	Casing	Sampler	Core Barrel
Type	HSA		SS	
Inside Diameter (in.)	4"		1-3/8"	
Hammer Weight (lb)			140	
Hammer Fall (in.)			30"	

☐ Truck ☑ Track ☐ Bomb. ☐ Tripod ☐ Skid ☐ ATV ☐ Geoprobe ☐ Other

Hammer Type: ☐ Safety Hammer ☐ Doughnut ☑ Automatic

☑ Winch ☐ Cat Head ☑ Roller Bit ☐ Cutting Head

Depth (ft)	Casing (Blows/ft)	No.	Depth (ft)	Rec (in.)	SPT (Bl./6-in.)	"N" Value	PID Rdg. (ppm)	Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
0		S-1	0-2	15	2 4 21 34	25			Medium dense, light brown, fine to medium Sand, some Gravel, little Silt
5		S-2	5-7	1	8 12 17 18	29			Rock in tip
10		S-3	10-12	8	7 12 50/2"	100+			Very dense, olive brown, fine to medium Sand, some Gravel, little to some Silt (glacial till) Auger Refusal 1: 11 feet Auger Refusal 2: 10.5 feet
15									
20									

Water Level Data

Date	Time	Bott. of Casing	Bott. of Hole	Water
4/27	E.O.D	-	11'	None

Sample Identification
O = Open Ended Rod
U = Undisturbed Sampl
S = Split Spoon
C = Rock Core
G = Geoprobe

Cohesive Soils N-Value
0 to 2: Very Soft
2 to 4: Soft
4 to 8: Medium Stiff
8 to 15: Stiff
15 to 30 Very Stiff
Over 30: Hard

Granular Soils N- Value
0 to 4: Very Loose
4 to 10: Loose
11 to 30: Medium Dense
31 to 50: Dense
Over 50: Very Dense

Trace (0 to 10%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

Notes:
Start Time:
Finish Time:

GSI-1

TEST BORING LOG

Boring No. GSI-2

Project	Pie Hill Industrial Development	GSI Project No.	222138	Elevation	E.G.
Location	Methuen, MA	Project Mgr.	HKW	Datum	-
Client	CMGC Building Corp.	Inspector	KJM	Date Started	4/27/2022
Contractor	TDS	Checked By	HKW	Date Finished	4/27/2022
Driller	Brett Balyk	Rig Make & Model	Diedrich	Rig Model	D-50

Item:	Auger	Casing	Sampler	Core Barrel
Type	HSA		SS	
Inside Diameter (in.)	4"		1-3/8"	
Hammer Weight (lb)			140	
Hammer Fall (in.)			30"	

☐ Truck ☑ Track ☐ Bomb. ☐ Tripod ☐ Skid ☐ ATV ☐ Geoprobe ☐ Other

Hammer Type: ☐ Safety Hammer ☐ Doughnut ☑ Automatic

☑ Winch ☐ Cat Head ☑ Roller Bit ☐ Cutting Head

Depth (ft)	Casing (Blows/ft)	No.	Depth (ft)	Rec (in.)	SPT (Bl./ 6-in.)	"N" Value	PID Rdg. (ppm)	Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
0		S-1	0-2	22	6 7 10 15	17			Medium dense, light brown, fine to medium Sand, some Gravel, little Silt
5		S-2	5-7	20	78 38 21 20	58			Very dense, olive brown, fine to medium Sand, some Gravel, little to some Silt (glacial till)
10									Auger Refusal 1: 8.9 feet Auger Refusal 2: 11.7 feet Auger Refusal 3: 9.2 feet
15									
20									

Water Level Data

Date	Time	Bott. of Casing	Bott. of Hole	Water
4/27	E.O.D	-	11.7'	None

Sample Identification
O = Open Ended Rod
U = Undisturbed Sampl
S = Split Spoon
C = Rock Core
G = Geoprobe

Cohesive Soils N-Value
0 to 2: Very Soft
2 to 4: Soft
4 to 8: Medium Stiff
8 to 15: Stiff
15 to 30 Very Stiff
Over 30: Hard

Granular Soils N- Value
0 to 4: Very Loose
4 to 10: Loose
11 to 30: Medium Dense
31 to 50: Dense
Over 50: Very Dense

Trace (0 to 10%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

Notes:
Start Time:
Finish Time:

GSI-2

Geotechnical Services, Inc. 55 North Stark Highway, Weare, NH 03281 Phone 603/529-7766 Fax 603/5297080 - 30 Newbury St. 3rd Floor, Boston, MA 02116 Phone 617/455-4248 Fax 617/745-4308

TEST BORING LOG

Boring No. **GSI-3**

Page 1 of 1

Project	Pie Hill Industrial Development	GSI Project No.	222138	Elevation	E.G.
Location	Methuen, MA	Project Mgr.	HKW	Datum	-
Client	CMGC Building Corp.	Inspector	KJM	Date Started	4/27/2022
Contractor	TDS	Checked By	HKW	Date Finished	4/27/2022
Driller	Brett Balyk	Rig Make & Model	Diedrich	Rig Model	D-50

Item:	Auger	Casing	Sampler	Core Barrel
Type	HSA		SS	
Inside Diameter (in.)	4"		1-3/8"	
Hammer Weight (lb)			140	
Hammer Fall (in.)			30"	

☐ Truck ☐ Skid
☑ Track ☐ ATV
☐ Bomb. ☐ Geoprobe
☐ Tripod ☐ Other
☑ Winch ☐ Cat Head ☑ Roller Bit ☐ Cutting Head

Hammer Type:
☐ Safety Hammer
☐ Doughnut
☑ Automatic

Depth (ft)	Casing (Blows/ft)	No.	Depth (ft)	Rec (in.)	SPT (Bl./ 6-in.)	"N" Value	PID Rdg. (ppm)	Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
0		S-1	0-2	18	2 2 5 12	7			Loose, orange brown, fine to medium Sand, little to some Silt, trace to little Gravel
5		S-2	5-7	12	10 91 22 27	100+			Very dense, olive brown, fine to medium Sand, some Gravel, little to some Silt (glacial till)
10		S-3	10-12	15	16 56 26 19	82			Very dense, olive brown, fine to medium Sand, some Gravel, some Silt (glacial till) Auger Refusal 12.8 feet
15									
20									

Water Level Data

Date	Time	Depth (ft) to: Bott. of Casing	Bott. of Hole	Water
4/27	E.O.D	-	12.8'	None

Sample Identification
O = Open Ended Rod
U = Undisturbed Sampl
S = Split Spoon
C = Rock Core
G = Geoprobe

Cohesive Soils N-Value
0 to 2: Very Soft
2 to 4: Soft
4 to 8: Medium Stiff
8 to 15: Stiff
15 to 30 Very Stiff
Over 30: Hard

Granular Soils N- Value
0 to 4: Very Loose
4 to 10: Loose
11 to 30: Medium Dense
31 to 50: Dense
Over 50: Very Dense

Trace (0 to 10%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

Notes:
Start Time:
Finish Time:

GSI-3

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GSI

TEST BORING LOG

Boring No. GSI-4

Project	Pie Hill Industrial Development	GSI Project No.	222138	Elevation	E.G.
Location	Methuen, MA	Project Mgr.	HKW	Datum	-
Client	CMGC Building Corp.	Inspector	KJM	Date Started	4/27/2022
Contractor	TDS	Checked By	HKW	Date Finished	4/27/2022
Driller	Brett Balyk	Rig Make & Model	Diedrich	Rig Model	D-50

Item:	Auger	Casing	Sampler	Core Barrel
Type	HSA		SS	
Inside Diameter (in.)	4"		1-3/8"	
Hammer Weight (lb)			140	
Hammer Fall (in.)			30"	

☐ Truck ☑ Track ☐ Bomb. ☐ Tripod ☐ Skid ☐ ATV ☐ Geoprobe ☐ Other

Hammer Type: ☐ Safety Hammer ☐ Doughnut ☑ Automatic

☑ Winch ☐ Cat Head ☑ Roller Bit ☐ Cutting Head

Depth (ft)	Casing (Blows/ft)	No.	Depth (ft)	Rec (in.)	SPT (Bl./6-in.)	"N" Value	PID Rdg. (ppm)	Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
		Sample Data							
0		S-1	0-2	16	3 3 4 5	7			Loose, orange brown, fine to medium Sand, little Silt
5		S-2	5-7	20	14 28 24 25	52			Very dense, olive brown, fine to medium Sand, little to some Silt, little Gravel (glacial till)
10		S-3	10-12	18	16 24 38 33	62			Very dense, olive brown, fine to medium Sand, some Gravel, some Silt (glacial till) Auger Refusal 13.75 feet
15									
20									

Water Level Data

Date	Time	Depth (ft) to: Bott. of Casing	Bott. of Hole	Water
4/27	E.O.D	-	13.75'	None

Sample Identification
O = Open Ended Rod
U = Undisturbed Sampl
S = Split Spoon
C = Rock Core
G = Geoprobe

Cohesive Soils N-Value
0 to 2: Very Soft
2 to 4: Soft
4 to 8: Medium Stiff
8 to 15: Stiff
15 to 30 Very Stiff
Over 30: Hard

Granular Soils N- Value
0 to 4: Very Loose
4 to 10: Loose
11 to 30: Medium Dense
31 to 50: Dense
Over 50: Very Dense

Trace (0 to 10%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

Notes:
Start Time:
Finish Time:

GSI-4

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GSI

TEST BORING LOG

Boring No. **GSI-5**

Project	Pie Hill Industrial Development	GSI Project No.	222138	Elevation	E.G.
Location	Methuen, MA	Project Mgr.	HKW	Datum	-
Client	CMGC Building Corp.	Inspector	KJM	Date Started	4/27/2022
Contractor	TDS	Checked By	HKW	Date Finished	4/27/2022
Driller	Brett Balyk	Rig Make & Model	Diedrich	Rig Model	D-50

Item:	Auger	Casing	Sampler	Core Barrel
Type	HSA		SS	
Inside Diameter (in.)	4"		1-3/8"	
Hammer Weight (lb)			140	
Hammer Fall (in.)			30"	

☐ Truck ☑ Track ☐ Bomb. ☐ Tripod ☐ Skid ☐ ATV ☐ Geoprobe ☐ Other

Hammer Type: ☐ Safety Hammer ☐ Doughnut ☑ Automatic

☑ Winch ☐ Cat Head ☑ Roller Bit ☐ Cutting Head

Depth (ft)	Casing (Blows/ft)	Sample Data: No.	Depth (ft)	Rec (in.)	SPT (Bl./6-in.)	"N" Value	PID Rdg. (ppm)	Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
0		S-1	0-2	9	2 2 5 13	7			Loose, olive brown, fine to medium Sand, little Silt, trace Gravel
5		S-2	5-7	19	21 19 24 31	43			Dense, olive brown, fine to medium Sand, little Silt, trace Gravel Auger Refusal 9 feet
10									
15									
20									

Water Level Data

Date	Time	Depth (ft) to: Bott. of Casing	Bott. of Hole	Water
4/27	E.O.D	-	9'	None

Sample Identification
- O = Open Ended Rod
- U = Undisturbed Sampl
- S = Split Spoon
- C = Rock Core
- G = Geoprobe

Cohesive Soils N-Value
- 0 to 2: Very Soft
- 2 to 4: Soft
- 4 to 8: Medium Stiff
- 8 to 15: Stiff
- 15 to 30 Very Stiff
- Over 30: Hard

Granular Soils N- Value
- 0 to 4: Very Loose
- 4 to 10: Loose
- 11 to 30: Medium Dense
- 31 to 50: Dense
- Over 50: Very Dense

Trace (0 to 10%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

Notes:
Start Time:
Finish Time:

GSI-5

Geotechnical Services, Inc. 55 North Stark Highway, Weare, NH 03281 Phone 603/529-7766 Fax 603/5297080 - 30 Newbury St. 3rd Floor, Boston, MA 02116 Phone 617/455-4248 Fax 617/745-4308

GSI

TEST BORING LOG

Boring No. **GSI-6**

Project	Pie Hill Industrial Development	GSI Project No.	222138	Elevation	E.G.
Location	Methuen, MA	Project Mgr.	HKW	Datum	-
Client	CMGC Building Corp.	Inspector	ASH	Date Started	4/28/2022
Contractor	TDS	Checked By	HKW	Date Finished	4/28/2022
Driller	Brett Balyk	Rig Make & Model	Diedrich	Rig Model	D-50

Item:	Auger	Casing	Sampler	Core Barrel
Type	HSA		SS	
Inside Diameter (in.)	4"		1-3/8"	
Hammer Weight (lb)			140	
Hammer Fall (in.)			30"	

☐ Truck ☐ Skid ☑ Track ☐ ATV ☐ Bomb. ☐ Geoprobe ☐ Tripod ☐ Other ☑ Winch ☐ Cat Head ☑ Roller Bit ☐ Cutting Head

Hammer Type: ☐ Safety Hammer ☐ Doughnut ☑ Automatic

Depth (ft)	Casing (Blows/ft)	No.	Depth (ft)	Rec (in.)	SPT (Bl./6-in.)	"N" Value	PID Rdg. (ppm)	Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
0		S-1	0-2	8	1 1 1 2	2			4" top soil overlaying very loose, brown, fine to medium Sand, little Silt, trace Gravel
5		S-2	5-7	0	52	50+			No Recovery
10		S-3	10-12	16	9 20 28 23	50+			Very dense, olive brown, fine to medium Sand, little to some Silt, trace Gravel (glacial till)
15		S-4	15-17	12	11 24 29 29	50+			Very dense, olive brown, fine to medium Sand, some Silt, trace Gravel (glacial till) Auger refusal 18 feet
20									

Water Level Data

Date	Time	Bott. of Casing	Bott. of Hole	Water
4/28	E.O.D	-	18'	None

Sample Identification
O = Open Ended Rod
U = Undisturbed Sampl
S = Split Spoon
C = Rock Core
G = Geoprobe

Cohesive Soils N-Value
0 to 2: Very Soft
2 to 4: Soft
4 to 8: Medium Stiff
8 to 15: Stiff
15 to 30 Very Stiff
Over 30: Hard

Granular Soils N- Value
0 to 4: Very Loose
4 to 10: Loose
11 to 30: Medium Dense
31 to 50: Dense
Over 50: Very Dense

Trace (0 to 10%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

Notes:
Start Time: 8:15am
Finish Time: 9:30am

GSI-6

Geotechnical Services, Inc. 55 North Stark Highway, Weare, NH 03281 Phone 603/529-7766 Fax 603/5297080 - 30 Newbury St. 3rd Floor, Boston, MA 02116 Phone 617/455-4248 Fax 617/745-4308

TEST BORING LOG

Boring No. GSI-7

Project	Pie Hill Industrial Development	GSI Project No.	222138	Elevation	E.G.
Location	Methuen, MA	Project Mgr.	HKW	Datum	-
Client	CMGC Building Corp.	Inspector	ASH	Date Started	4/28/2022
Contractor	TDS	Checked By	HKW	Date Finished	4/28/2022
Driller	Brett Balyk	Rig Make & Model	Diedrich	Rig Model	D-50

Item:	Auger	Casing	Sampler	Core Barrel
Type	HSA		SS	
Inside Diameter (in.)	4"		1-3/8"	
Hammer Weight (lb)			140	
Hammer Fall (in.)			30"	

☐ Truck ☑ Track ☐ Bomb. ☐ Tripod ☐ Skid ☐ ATV ☐ Geoprobe ☐ Other ☑ Winch ☐ Cat Head ☑ Roller Bit ☐ Cutting Head

Hammer Type: ☐ Safety Hammer ☐ Doughnut ☑ Automatic

Depth (ft)	Casing (Blows/ft)	No.	Depth (ft)	Rec (in.)	SPT (Bl./6-in.)	"N" Value	PID Rdg. (ppm)	Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
0		S-1	0-2	18	1 1 3 3	4			5" top soil overlaying very loose, brown, fine to medium Sand, little Silt, trace Gravel
5		S-2	5-7	16	25 27 30 30	50+			Very dense, olive, fine to medium Sand, little to some Silt, trace Gravel (glacial till)
10		S-3	10-12	22	10 16 21 26	37			Dense, olive, fine to medium Sand, little to some Silt, trace Gravel (glacial till)
15		S-4	15-17	24	14 16 16 14	32			Dense, olive, fine to medium Sand, little to some Silt, trace Gravel (glacial till) Auger refusal 19 feet
20									

Water Level Data

Date	Time	Depth (ft) to: Bott. of Casing	Bott. of Hole	Water
4/28	E.O.D	-	18'	None

Sample Identification
O = Open Ended Rod
U = Undisturbed Sampl
S = Split Spoon
C = Rock Core
G = Geoprobe

Cohesive Soils N-Value
0 to 2: Very Soft
2 to 4: Soft
4 to 8: Medium Stiff
8 to 15: Stiff
15 to 30 Very Stiff
Over 30: Hard

Granular Soils N- Value
0 to 4: Very Loose
4 to 10: Loose
11 to 30: Medium Dense
31 to 50: Dense
Over 50: Very Dense

Trace (0 to 10%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

Notes:
Start Time: 8:50am
Finish Time: 11:30am

GSI-7

Geotechnical Services, Inc. 55 North Stark Highway, Weare, NH 03281 Phone 603/529-7766 Fax 603/5297080 - 30 Newbury St. 3rd Floor, Boston, MA 02116 Phone 617/455-4248 Fax 617/745-4308

TEST BORING LOG

Boring No. **GSI-8**

Project	Pie Hill Industrial Development	GSI Project No.	222138	Elevation	E.G.
Location	Methuen, MA	Project Mgr.	HKW	Datum	-
Client	CMGC Building Corp.	Inspector	ASH	Date Started	4/28/2022
Contractor	TDS	Checked By	HKW	Date Finished	4/28/2022
Driller	Brett Balyk	Rig Make & Model	Diedrich	Rig Model	D-50

Item:	Auger	Casing	Sampler	Core Barrel
Type	HSA		SS	
Inside Diameter (in.)	4"		1-3/8"	
Hammer Weight (lb)			140	
Hammer Fall (in.)			30"	

☐ Truck ☐ Skid
☑ Track ☐ ATV
☐ Bomb. ☐ Geoprobe
☐ Tripod ☐ Other
☑ Winch ☐ Cat Head ☑ Roller Bit ☐ Cutting Head

Hammer Type:
☐ Safety Hammer
☐ Doughnut
☑ Automatic

Depth (ft)	Casing (Blows/ft)	No.	Depth (ft)	Rec (in.)	SPT (Bl./6-in.)	"N" Value	PID Rdg. (ppm)	Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
0		S-1	0-2	18	2 3 28 11	31			5" top soil overlaying very loose, brown, fine to medium Sand, little Silt, trace Gravel
5		S-2A S-2B	5-7	13 3	9 18 23 14	41			Dense, olive brown, fine to medium Sand, little to some Silt, little Gravel (glacial till) Tan, fine to medium Sand, trace Silt
10		S-3	10-12	15	10 20 22 25	42			Dense, olive brown, fine to coarse Sand, little Silt, little Gravel (glacial till)
15		S-4	15-17	14	7 11 25 50/2	36			Moist, Dense, olive brown, fine to medium Sand, little Silt, trace Gravel (glacial till) Auger refusal 17 feet
20									

Water Level Data

Date	Time	Depth (ft) to: Bott. of Casing	Bott. of Hole	Water
4/28	E.O.D	-	18'	None

Sample Identification
O = Open Ended Rod
U = Undisturbed Sampl
S = Split Spoon
C = Rock Core
G = Geoprobe

Cohesive Soils N-Value
0 to 2: Very Soft
2 to 4: Soft
4 to 8: Medium Stiff
8 to 15: Stiff
15 to 30 Very Stiff
Over 30: Hard

Granular Soils N- Value
0 to 4: Very Loose
4 to 10: Loose
11 to 30: Medium Dense
31 to 50: Dense
Over 50: Very Dense

Trace (0 to 10%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

Notes:
Start Time: 11:55am
Finish Time: 12:45am

GSI-8

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GSI

TEST BORING LOG

Boring No. **GSI-9**

Project	Pie Hill Industrial Development	GSI Project No.	222138	Elevation	E.G.
Location	Methuen, MA	Project Mgr.	HKW	Datum	-
Client	CMGC Building Corp.	Inspector	ASH	Date Started	4/28/2022
Contractor	TDS	Checked By	HKW	Date Finished	4/28/2022
Driller	Brett Balyk	Rig Make & Model	Diedrich	Rig Model	D-50

Item:	Auger	Casing	Sampler	Core Barrel
Type	HSA		SS	
Inside Diameter (in.)	4"		1-3/8"	
Hammer Weight (lb)			140	
Hammer Fall (in.)			30"	

☐ Truck ☐ Skid
☑ Track ☐ ATV
☐ Bomb. ☐ Geoprobe
☐ Tripod ☐ Other
☑ Winch ☐ Cat Head ☑ Roller Bit ☐ Cutting Head

Hammer Type:
☐ Safety Hammer
☐ Doughnut
☑ Automatic

Depth (ft)	Casing (Blows/ft)	No.	Depth (ft)	Rec (in.)	SPT (Bl./6-in.)	"N" Value	PID Rdg. (ppm)	Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
0		S-1	0-2	6	6 7 5 5	12			Medium dense, olive brown, fine to medium Sand, little Silt, trace Gravel
5		S-2	5-7	24	7 9 13 17	22			Medium dense, olive brown, fine to medium Sand, little Silt, little Gravel (glacial till)
10		S-3	10-12	12	17 25 38 29	50+			Very dense, olive, fine to medium Sand, little Silt, little Gravel (glacial till)
15		S-4	15-17	24	16 30 33 52	50+			Very dense, olive brown, fine to medium Sand, little Silt, little Gravel (glacial till)
20		S-5	20-22	12	22 27 50/3"	50+			Very dense, olive brown, fine to medium Sand, little Silt, little Gravel (glacial till) Boring Terminated at 20 feet

Water Level Data

Date	Time	Depth (ft) to: Bott. of Casing	Bott. of Hole	Water
4/28	E.O.D	-	20'	None

Sample Identification	Cohesive Soils N-Value	Granular Soils N- Value
O = Open Ended Rod	0 to 2: Very Soft	0 to 4: Very Loose
U = Undisturbed Sampl	2 to 4: Soft	4 to 10: Loose
S = Split Spoon	4 to 8: Medium Stiff	11 to 30: Medium Dense
C = Rock Core	8 to 15: Stiff	31 to 50: Dense
G = Geoprobe	15 to 30 Very Stiff	Over 50: Very Dense
	Over 30: Hard	

Trace (0 to 10%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

Notes:
Start Time: 1:40pm
Finish Time: 3:15pm

GSI-9

APPENDIX C

SUBSURFACE EXPLORATION KEY

FIELD DESCRIPTION AND CLASSIFICATION OF SOIL - Burmister System

Soil descriptions indicated on the test boring logs are based on Standard Penetration Test (SPT) results and observation of the soil samples obtained. Soil samples generally described and classified as illustrated in the following example:

Density or consistently → Dense; Color → brown; Major Component → f-m SAND; Minor Components → some Gravel, trace Silt; Moisture Content → moist.

Dense, brown, f-m SAND, some Gravel, trace Silt, moist.

1.0 DENSITY OR CONSISTENCY – The density or consistency is determined from the Standard Penetration Test (ASTM 1586), which corresponds to the number of blows required to drive a standard 2-inch outside diameter split-spoon sampler from the 6 to 18-inch depth of a 24-inch sample using a 140-pound weight falling freely for 30 inches.

Density of Granular Soil	Penetration Resistance (N-blows/ft)		Consistency of Composite Clay Soil
Very Loose	0 - 4	< 2	Very soft
Loose	4 - 10	2 - 4	Soft
Medium Dense	10 - 30	4 - 8	Medium soft
Dense	30 - 50	8 - 15	Stiff
Very Dense	> 50	15 - 30	Very stiff
		> 30	Hard

2.0 COLOR – Visual

3.0 SOIL COMPONENTS – The description and classification is based on the following criteria.

3.1 DESCRIPTION – The components of a soil sample are described by visually estimating the percentage of each component by weight of the total sample.

Major Component – The major component (>50%) is written with upper case letters for granular soil (SAND, GRAVEL), and a combination of upper and lower case letters for composite soil (Silty CLAY, Clayey SILT).

Minor Component – The minor soil components (≤50%) are written with the first letter of each material in upper case, and the remaining letters in lower case (Gravel, Silt). The minor components are identified and prefaced in the description based on the following percentages:

Description	Percentage
and	35 - 50%
some	20 - 35%
little	10 - 20%
trace	0 - 10%

Other Components – The other components within the soil which may be encountered include glass, bricks, trash, etc. The other components are identified and follow the major and minor soil components.

3.2 CLASSIFICATION

Granular Soil by Sieve Size – A granular soil sample is classified by visually estimating the particle size as referenced to a Standard Sieve.

Material*		Standard Sieve Limit Upper	Standard Sieve Limit Lower
GRAVEL	- coarse	3-inch	3/4-inch
	- fine	3/4-inch	No. 4
SAND	- coarse	No. 4	No. 10
	- medium	No. 10	No. 40
	- fine	No. 40	No. 200
SILT		No. 200	

Granular Soil by Visual Identification

Material	Visual ID
Silts and Clays	Too small to see.
Fine Sand	Finest visible grain.
Medium Sand	1/64" to 1/16"
Coarse Sand	1/16" to 1/4"
Fine Gravel	1/4" to 3/4"
Coarse Gravel	3/4" to 3"
Cobbles	3" to 6"
Boulders	Greater than 6"

*The Gravel/Sand portions of a granular soil are further divided based on the following proportions:

Gravel/Sand	Proportion
fine to coarse	> 10% all factions
coarse	< 10% fine and medium
medium to coarse	< 10% fine
medium	< 10% fine and coarse
fine to medium	< 10% coarse
fine	< 10% medium and coarse

Composite Clay Soil – A composite clay soil sample is classified by determining the smallest diameter thread that can be rolled manually.

Material	Smallest Thread Diameter	Degree of Plasticity
SILT	None	Nonplastic
Clayey SILT	1/4-inch	Slight
SILT & CLAY	1/8-inch	Low
CLAY & SILT	1/16-inch	Medium
Silty CLAY	1/32-inch	High
CLAY	1/64-inch	Very High

Organic Soil – An organic soil sample is classified by observation of the sample structure.

Material		
Topsoil	-	surficial soils that support plant life and which contain a high percentage of organic matter.
Fibrous Peat	-	deposits of plant remains in which the original plant fibers are still visible.
Amorphous Peat	-	deposits of plant remains in which the original plant fibers have been destroyed. Usually found underlying fibrous peat.
Organic Silt	-	fine grained marine soils which have been transported due to erosion and deposited in still water below the zone of wave action. May contain shell fragments, organic odor, high sand content, nonplastic.
Clayey Organic Silt	-	similar to Organic Silt, low sand content, plastic.

4.0 ADDITIONAL DETAILS AND DISCRIPTIVE TERMS

SOIL STRUCTURE – produced by deposition of sediments.

Stratified	-	random soil deposits of varying components or color.
Varved	-	alternating soil deposits of varying thickness (i.e. clays or silts).
Stratum	-	soil deposit greater than 12 inches thick.
Layer	-	soil deposit 3 inches to 12 inches thick.
Seam	-	soil deposit 1/8 inch to 3 inches thick.
Parting/lens	-	soil deposit less than 1/8 inch thick.

MOISTURE CONTENT

Dry	-	moisture not apparent, dusty, dry to the touch.
Moist	-	damp, but no visible water.
Wet	-	visible free water.

5.0 UNIFIED SOIL CLASSIFICATION SYMBOL AND DISCRIPTION

CL	Lean Clay	GW	Well Graded Gravel
ML	Silt	GP	Poorly Graded Gravel
OL	Organic Silt/ Clay Low Plasticity	GM	Silty Gravel
CH	Fat Clay	GC	Clayey Gravel
MH	Plastic Silt	SW	Well Graded Sand
OH	Organic Silt/Clay High Plasticity	SP	Poorly Graded Sand
PT	Peat	SM	Silty Sand
		SC	Clayey Sand

GUIDELINES TO CLASSIFICATION AND IDENTIFICATION OF ROCK

A. WEATHERING

Fresh	Fresh rock, crystals bright, few joints, may show slight staining. Rock rings under hammer if crystalline.
Slightly Weathered	Rock generally fresh, joints stained and discoloration extends into rock up to 1 inch. Joints may contain clay or gouge. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderately Weathered	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some look clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Highly Weathered	All rock is discolored or stained. In granitoid rocks all feldspars are dull and discolored and majority shows kaolinization. Rock shows severe loss of strength and can be excavated with a geologists pick. A clunking sound when struck with a hammer.
Disintegrate Rock	Rock texture clear and evident, but reduced in strength to strong soil. Some fragments of strong rock usually left.

B. FRACTURING AND BEDDING

Spacing	Fracturing	Bedding and Foliation
More than 3 feet	Massive	Thick
1 foot – 3 feet	Slightly Fractured	Medium
2 inches – 1 foot	Moderately Fractured	Thin
Less than 2 inches	Highly fractured	Very Thin

C. GRAIN SIZE

Fine	Visible to naked eye to 1/16-inch diameter.
Medium	1/16-inch to 1/4-inch diameter.
Coarse	Greater than 1/4-inch diameter.

D. HARDNESS

Very Hard	Cannot be scratched with a knife or sharp pick. Breaking of hand specimens requires several hard blows with a geologists pick.
Hard	Can be scratched with a knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately Hard	Can be scratched with a knife or pick. Gouges or grooves to ¼ inch deep can be excavated with hard blows of a geologists pick. Hand specimens can be detached by a moderate blow.
Medium	Can be grooved to a 1/16-inch deep by firm pressure on a knife or pick point. Can be excavated in small chips to pieces approximately 1-inch maximum size by hard blows of the point of a geologists pick.
Soft	Can be gouged or grooved easily with a knife or pick point. Can be excavated in chips to pieces several inches in size. Small thin pieces can be broken by finger pressure.
Very Soft	Can be carved with a knife. Can be excavated easily with the point of a pick. Pieces 1 inch or more in thickness can be broken with finger pressure.

E. ROCK QUALITY DESIGNATION (RQD)

RQD (Percent)	Diagnostic Description
Exceeding 90	Excellent
75 – 90	Good
50 – 75	Fair
25 – 50	Poor
0 – 25	Very Poor

Comments: RQD is applicable to NX core only. The diameter of an NX core is 2.16 inches. RQD is expressed as a percentage and is determined by dividing the length of the run by the total length of the recovered cores pieces measuring 4-inches or greater. Core recovery is reported as a percentage and is determined by dividing the length of the core recovered (all pieces) by the length of the run.

APPENDIX D

USGS SEISMIC DESIGN MAPS

Pie Hill Industrial Development

46 Old Ferry Rd, Methuen, MA 01844, USA

Latitude, Longitude: 42.750157, -71.14269

Date	5/3/2022, 11:35:31 AM
Design Code Reference Document	IBC-2015
Risk Category	II
Site Class	C - Very Dense Soil and Soft Rock

Type	Value	Description
S_S	0.255	MCE_R ground motion. (for 0.2 second period)
S_1	0.077	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.306	Site-modified spectral acceleration value
S_{M1}	0.131	Site-modified spectral acceleration value
S_{DS}	0.204	Numeric seismic design value at 0.2 second SA
S_{D1}	0.087	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	B	Seismic design category
F_a	1.2	Site amplification factor at 0.2 second
F_v	1.7	Site amplification factor at 1.0 second
PGA	0.144	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.173	Site modified peak ground acceleration
T_L	6	Long-period transition period in seconds
SsRT	0.255	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.289	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.077	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.085	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)

Type	Value	Description
PGAd	0.6	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.884	Mapped value of the risk coefficient at short periods
C_{R1}	0.9	Mapped value of the risk coefficient at a period of 1 s

APPENDIX E

DRAFT EARTHWORK SPECIFICATIONS

SECTION 02200
EARTHWORK

PART I- GENERAL

1.01 GENERAL REQUIREMENTS

1. Include GENERAL CONDITIONS and SUPPLEMENTARY CONDITIONS as part of this Section.

2. Examine all other Sections of the Specifications for requirements, which affect work of this Section whether or not such work is specifically mentioned in this Section.

3. Coordinate work with trades affecting, or affected by, work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 WORK INCLUDED

1. Perform all work required to complete the work of the Section, as indicated. Such work includes, but is not limited to, the following:

    1. Excavation, filling, grading and compaction
    2. Supplying of fill materials
    3. Construction Dewatering
    4. Sheeting, shoring and bracing
    5. Rock excavation/blasting

1.03 RELATED WORK UNDER OTHER SECTIONS

1. Erosion and Sediment Control
2. Site Preparation
3. Bituminous Concrete Paving
4. Site Water Lines
5. Storm Drainage System
6. Sanitary Sewer System
7. Site Furnishings
8. Site Irrigation
9. Lawns
10. Planting

1.04 SUBMITTALS

1. Issue submittals in accordance with Division 1. Submittals under this Section shall include manufacturer's specifications and installation instructions.

1.05 SAMPLES AND TESTING

1. A 50 lb. sample of each off-site material proposed for use, and of any on-site material when so requested by the Architect or Geotechnical Engineer, shall be submitted for approval.

    1. Samples shall be delivered to office of the Geotechnical Engineer, as directed.
    2. Samples required in connection with compaction tests will be taken and transported by the Geotechnical Engineer.

3. Product Data: Submit location of pits for all borrow material.

1.06 COORDINATION

1. The work of this Section shall be coordinated with that of other trades affecting, or affected by, this work, as necessary to assure the steady progress of all work of the Contract.

2. Prior to the start of earthwork, the Contractor shall arrange an on-site meeting with the Architect and Geotechnical Engineer for the purpose of establishing Contractor's schedule of operations and scheduling inspection procedures and requirements.

3. As construction proceeds, the Contractor shall be responsible for notifying the Architect prior to start of earthwork operations requiring inspection and/or testing.

1.09 INFORMATION

1. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.

2. Plans, surveys, measurements and dimensions, under which the work is to be performed, are believed to be correct to the best of the Architect's knowledge, but the Contractor shall have examined them for himself during the bidding period, as no allowance will be made for any errors or inaccuracies that may be found herein.

3. Information on the Drawings, Reference Drawings, and in the Specifications relating to subsurface conditions, natural phenomena, and existing utilities and structures is from the best sources presently available. Such information is furnished only for the information and convenience of the Contractor, and the accuracy or completeness of this information is not guaranteed.

1.10 EXISTING CONDITIONS

1. The Contractor shall become thoroughly familiar with the site, consult records and drawings of adjacent structures and of existing utilities, and note all conditions, which may influence the work of this Section.

2. By submitting a bid, the Contractor affirms that he has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.

3. The Contractor may, at his own expense, conduct additional subsurface testing as required for his own information after approval by the Owner.

1.11 SUBSURFACE CONDITIONS AND SPECIAL SITE CONSIDERATIONS

1. Soil borings have been made by a qualified Contractor prior to this Contract. This information shall be made available to bidders as specified under other Sections. The final results of these subsurface explorations were prepared by Geotechnical Services, Inc., consulting geotechnical engineers, and are hereby attached to this specification for information only. Procedures for dewatering, areas to receive special fill and other methods and procedures specified herein shall be supplemented by this information. For purposes of this specification, this information will be referred to as the report. Where procedures within the report vary from procedures as specified herein, this specification shall override. The results and recommendations are available in the geotechnical report prepared by Geotechnical Services. Copies of this report are available from the Architect. Soil samples may be examined at the office of the Geotechnical Engineer.

2. It is the responsibility of the Contractor under this Contract to do the excavation, filling, grading

and rough grading to bring the existing grades to subgrade and parallel to finished grades as specified herein and as shown on the Drawings for this Work. The Contractor shall visit the site prior to submitting a bid to become familiar with the extent of the work to be done under this Contract. The Contractor shall be responsible for determining the quantities of earth materials necessary to complete the work under this Section. All earth materials shall be included in the Contractor's base bid.

3. Site Information - data on indicated subsurface conditions are not representations or warrants of continuity of such conditions between subsurface explorations. It is expressly understood that the Owner will not be responsible for interpretations or conclusions drawn there from by the Contractor. Data are made available for the convenience of the Contractor. Neither the Owner nor the Geotechnical Engineer assumes responsibility for accuracy of the data other than at the particular locations and at the time the explorations were made.

4. The subsurface data was gathered and report prepared by Geotechnical Services, Inc. The elevations indicated on the drill holes, borings and test pits refer to existing conditions. A copy of this report may be seen at the office of the Architect during normal working hours.

1.12 QUALITY ASSURANCE

1. The Owner will retain a Geotechnical Engineer to perform on-site observations and testing during the following phases of the construction operations. The services of the Geotechnical Engineer may include, but not be limited to the following:

    1. Observation during excavation and dewatering of building areas, parking areas and controlled fill areas.
    2. Observation and testing during placement and compaction of fills within the building area, parking area, and controlled fill areas.
    3. Laboratory testing and analysis of fill and bedding materials specified, as required.
    4. Observation, construction and performance of water content, gradation, and compaction tests at a frequency and at locations to assure conformance of this Specification. The results of these tests will be submitted to the Architect; copy to the Contractor, on a timely basis so that the Contractor can take such action as is required to remedy indicated deficiencies. During the course of construction, the Geotechnical Engineer will advise the Architect, in writing, with copy to Contractor if, at any time, in his opinion, the work is not in substantial conformity with the Contract Documents.

2. The Geotechnical Engineer's presence does not include supervision or direction of the actual work by the Contractor, his employees or agents. Neither the presence of the Geotechnical Engineer, nor any observations and testing performed by him, nor any notice or failure to give notice shall excuse the Contractor from defects discovered in his work.

3. The Owner reserves the right to modify or waive Geotechnical Engineer services.

1.13 PERMITS, CODES AND SAFETY REQUIREMENTS

1. All work shall conform to the Drawings and Specifications and shall comply with applicable codes and regulations.

2. Comply with the rules, regulations, laws and ordinances of the City of Methuenp, Massachusetts appropriate agencies of the Commonwealth of Massachusetts and all other authorities having jurisdiction. Coordinate all work done within town and State rights of way with the appropriate agencies. Provide all required traffic control and safety measures, including uniformed police officers per town and State requirements. All labor, materials, equipment and services necessary to make the work comply with such requirements shall be provided without additional cost to the Owner.

3. Comply with the provisions of the Manual of Accident Prevention in Construction of the Associated General Contractors of America, Inc. and the requirements of the Occupational

Safety and Health Administration (OSHA), United States Department of Labor.

4. The Contractor shall procure and pay for all permits and licenses required for the complete work specified herein and shown on the Drawings.

5. The Contractor shall not close or obstruct any street, sidewalk, or passageway unless authorized in writing by the Architect. The Contractor shall so conduct his operations as to interfere as little as possible with the use ordinarily made of roads, driveways, sidewalks or other facilities near enough to the work to be affected hereby. The Contractor shall comply with the time limits established by the terms for trucking onto and off of the site.

6. Any apparent conflict between the Drawings and Specifications and the applicable codes and regulations shall be referred to the Architect in writing, for resolution before the work is started.

1.14 LAYOUTS AND GRADES

1. All line and grade work not presently established at the site shall be laid out by a survey team under the supervision of a Registered Land Surveyor or Professional Engineer employed by the Contractor in accordance with Drawings and Specifications. The Contractor shall establish permanent benchmarks and replace as directed any which are destroyed or disturbed.

2. The words "finished grades" as used herein shall mean final grade elevations indicated on the Drawings. Spot elevations shall govern over proposed contours. Where not otherwise indicated, project site areas outside of the building shall be given uniform slopes between points for which finished grades are indicated or between such points and existing grades.

3. The word "subgrade" as used herein, means the required surface of excavated area, subsoil, borrow fill or compacted fill. This surface is immediately beneath the site improvements; fill materials as dimensioned on the Drawings, or other proposed surface material.

1.15 DISPOSITION OF EXISTING UTILITIES

1. Active utilities existing on the site and work areas shall be carefully protected from damage and relocated or removed as required by the work. When an active utility line is exposed during construction, its location and elevation shall be plotted on the record drawings as described in this Section and both Architect and Utility Owner notified in writing.

2. Inactive or abandoned utilities encountered during construction shall be removed if within the building area or grouted, plugged or capped. The location of such utilities shall be noted on the record drawings and reported in writing to the Architect.

3. The Contractor shall notify "Dig Safe" and local utility companies prior to the start of construction. The "Dig Safe" number shall be submitted by the Contractor in writing to the Architect prior to construction.

1.16 SHORING, SHEETING, AND BRACING

1. Provide shoring, sheeting, and/or bracing at excavations, as required, to ensure complete safety against collapse of earth at sides of excavations.

2. If, at any place, sufficient or proper supports have not been provided, additional supports shall be placed at the expense of the Contractor. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and compacted.

3. All sheeting and bracing not ordered left in place shall be carefully removed in such a manner as not to endanger the construction of other structures, utilities or property whether public or private. All voids left after withdrawal of sheeting shall be immediately refilled with sand and rammed with tools especially adapted to that purpose or otherwise compacted as directed to achieve the

required density.

4. Shoring or sheeting shall not constitute a condition for which an increase may be made in the contract price with the exception that if the Architect directs in writing that certain shoring or sheeting shall be left in place, the contract price will be adjusted in accordance with General Conditions.

5. Excavation support systems shall be designed to support the earth pressures, hydrostatic pressures, surcharge loads and other forces from existing site conditions, stored material and construction equipment.

6. Shoring and bracing of trenches and other excavations shall, at a minimum, be in accordance with the latest requirements of the Department of Labor and Industries Bulletin No. 12, Section 10, and all subsequent amendments.

7. Shoring and sheeting shall be designed by a Registered Professional Engineer in the Commonwealth of Massachusetts and paid for by the Contractor. The contractor shall submit an earth shoring and bracing plan to the Architect for review by the Geotechnical Engineer at least 2 weeks prior to installation. The submittal shall include calculations and plans drawn to scale.

1.17 DRAINAGE

1. The Contractor shall control the grading in areas under construction on the site so that the surface of the ground will properly slope to prevent accumulation of water in excavated areas and adjacent properties.

2. The Contractor shall excavate interceptor swales and ditches where shown on the Drawings and as otherwise necessary prior to the start of major earthmoving operations to ensure minimal erosion and to keep areas as free from surface water as possible.

3. Should surface, rain or ground water be encountered during the operations, the Contractor shall furnish and operate pumps or other equipment, and provide all necessary piping to keep all excavations clear of water at all times and shall be responsible for any damage to work or adjacent properties for such water. All piping exposed above surface for this use, shall be properly covered to allow foot traffic and vehicles to pass without obstruction.

4. Presence of ground water in soil will not constitute a condition for which an increase in the contract price may be made. Under no circumstances place concrete fill, soil fill, lay piping or install appurtenances in excavation containing free water. Keep utility trenches free of water until pipe joint material has hardened and backfilled to prevent flotation.

1.18 FROST PROTECTION

1. Do not excavate to full-indicated depth when freezing temperatures may be expected, unless work can be completed to subgrade or piping can be installed and backfilled the same day. Protect the excavation from frost if placing of concrete or piping is delayed.

2. The Contractor shall keep the operations under this Contract clear and free of accumulation of snow within the limits of Contract Lines as required to carry out the work.

3. No work shall be installed on frozen ground.

4. Provide heat and/or insulation to slab, footings, foundation walls, and other elements during freezing conditions to prevent damage from frost heaving.

1.19 DISTURBANCE OF EXCAVATED AND FILLED AREAS DURING CONSTRUCTION

1. The Contractor shall take the necessary steps to avoid disturbance of subgrade and underlying natural soils/compacted fill during excavation and filling operations. Methods of excavation and filling operations shall be revised as necessary to avoid disturbance of the subgrade and underlying natural soils/compacted fill, including restricting the use of certain types of construction equipment and their movement over sensitive or unstable materials. The Contractor shall coordinate with the Architect or Geotechnical Engineer to modify his operations as necessary to minimize disturbance and protect bearing soils.

2. All excavated or filled areas disturbed during construction, all loose or saturated soil, and other areas that will not meet compaction requirements as specified herein shall be removed and replaced with compacted structural fill or crushed stone. Fill that cannot be compacted within 48 hours because of excess moisture shall be removed and replaced with compacted structural fill or crushed stone. Costs of removal of disturbed material and replacement with gravel fill or crushed stone shall be borne by the Contractor.

3. If requested by the Architect, the Contractor shall place a six-inch layer of crushed stone or 4-inch concrete mudmat over natural underlying soil to stabilize areas disturbed during construction. The placement of crushed stone layer or mudmat as well as material costs shall be borne by the Contractor.

4. Material that is not within +\- 3% optimum moisture for compaction as determined by the Modified Proctor Test of the particular material in place as determined by the Architect or the Geotechnical Engineer, and is disturbed by the Contractor during construction operations so that proper compaction cannot be reached, shall be construed as unsuitable bearing materials. This material shall be removed and replaced with crushed stone or structural fill as directed by the Architect or Geotechnical Engineer at no additional cost to the Owner.

1.20 PROTECTION OF BEARING SUBGRADES

1. The Contractor shall be required to maintain stable, dewatered, and frost fee subgrades for foundations, pavement areas, utility trenches, and other areas as directed by the Architect or Geotechnical Engineer.

2. The Contractor shall take precautions to reduce subgrade disturbance. Such precautions may include diverting storm water runoff away from construction areas, reducing traffic in sensitive areas, thermal protection during cold weather periods, and maintaining an effective dewatering operation.

3. Soils exhibiting weaving/instability or which become frozen, as determined by the Geotechnical Engineer, shall be over-excavated (removed) to competent bearing material and replaced with compacted gravel fill or lean concrete at no additional cost to the Owner.

1.21 DEWATERING

1. Based on subsurface investigations conducted prior to this Contract, it is anticipated that excavation will be carried out below existing groundwater levels. The Contractor shall be required to implement ground water control measures to maintain the ground water level a minimum of one foot below all final excavation levels or to propose alternative methods for placement of fill over existing undisturbed material with ground water at or near the surface in such a manner that the existing materials will not be disturbed. The Contractor will be required to implement ground water control measures adequate to maintain the excavation sufficiently dry to allow efficient use of normal excavation equipment and to provide a borrow material suitable for placement and compaction as specified or as directed by the Geotechnical Engineer. The moisture content shall not exceed 3% above the optimum moisture content as determined by modified Proctor test (ASTM DI557). The Contractor shall furnish all labor, equipment and materials in connection with handling ground water and surface water encountered during construction and placement of compacted granular fill or other material as specified.

2. Not less than 14 days prior to the scheduled start of work, the Contractor shall submit his proposed method of dewatering and maintaining dry conditions, to the Geotechnical Engineer for review. The submittal shall include calculations, plans, sketches, pump curves, method of sediment control, and disposal. The dewatering plan shall be prepared by a licensed Civil Engineer registered in the Commonwealth of Massachusetts. Review by the Architect of the Contractor's proposed method of dewatering shall not relieve the Contractor of responsibility for the satisfactory performance of the dewatering system. The Contractor is responsible for correcting any disturbance of natural bearing soils or damage to structures caused by an inadequate dewatering system or by interruption of the continuous operation of the system as specified.

3. The Contractor shall make the entire excavation for this work in the dry. The water level is to be maintained continuously one foot below bottom of excavation for the length of time to complete the work. The Contractor shall place all fill materials and proposed improvements in the dry.

4. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of properly, all water entering excavations and keep such excavations dry so as to obtain a satisfactory undisturbed bottom of excavation or subgrade condition. Dewatering shall be in operation until the fill or the proposed surface condition has been completed to such extent that it will not be floated or otherwise damaged by allowing water levels to return to natural elevations.

5. In excavations below the ground water level, it is expected that dewatering trenches or deep sumps will be required for predrainage of the soils prior to final excavation, and for maintaining the lowered groundwater level until construction has been completed to such an extent that floating, slumping or damage to excavations or materials placed does not occur. Monitoring of adjacent ground water levels by observation wells or other satisfactory means may be required.

6. The Contractor shall discharge all pumped water away from the work area, and in accordance with all applicable local codes and laws. Requirements specified herein for Erosion and Siltation Control shall be met during this process.

7. All fill material shall be placed and compacted in the dry. The Contractor shall dewater excavated areas as required to perform the work and in such a manner as to preserve the undisturbed Commonwealth of the natural inorganic or other subgrade soils.

8. The Contractor shall verify that the construction and/or operation of his dewatering system will not adversely affect any well, pond, stream structure, utility, etc., on or adjacent to the area being dewatered.

1.22 RESTORATION OF DRAINAGE SWALES, DETENTION BASINS AND WATER BODIES

1. In addition to other work specified and prior to substantial completion, the Contractor shall repair all erosion in all areas and excavate and remove accumulations of silt, debris or other material occurring from work under this Contract in the water bodies, detention areas and in all drainage swales to remain and as shown on Drawings. Water bodies and detention areas will be drained or pumped, if necessary, to properly remove all accumulations of silt and debris and to achieve a smooth bottom. If it is necessary to drain or pump water bodies and detention areas, the Contractor shall be required to implement ground water control measures to maintain the ground water level at a level to eliminate floating or slumping materials. The water level is to be maintained continuously at or below this level for the length of time that the pond water level is lowered. During filling of the water bodies to achieve previous or proposed water levels, the water level should be at or above the water level in the adjacent ground. Water bodies shall be filled with fresh water prior to securing the dewatering system. For further- information on dewatering, refer to DEWATERING as specified herein.

PART 2 - PRODUCTS

2.01 MATERIALS

1. Fill material shall be obtained from required on-site cut to the extent suitable material is available and off-site to the extent suitable material is not available from on-site cuts.

2. On-site material for use in compacted fill shall be natural inorganic granular soil taken from areas of cut after removal of pavement, topsoil, or other unsuitable materials.

3. Fill materials shall be well-graded within specified gradation limits. Gradation of backfill materials shall be determined in accordance with ASTM D-422.

4. Crushed Stone: Crushed stone processed from a stone quarry, washed, graded, free of organic materials. Gradation is as follows:

   1. 1/2" Crushed Stone

U. S. SIEVE NO.	% PASSING BY WEIGHT
2"	100
1/2"	85-100
3/8"	15-45
#4	0-15
#8	0-5

   2. 3/4" Crushed Stone

U.S. SIEVE NO.	% PASSING BY WEIGHT
1"	100
3/4"	90-100
1/2"	10-50
3/8"	0-20
# 4	0-5

   3. 1-1/2" Crushed Stone

U.S. SIEVE NO.	% PASSING BY WEIGHT
2"	100
1-1/2"	95-100
l"	35-70
3/4"	0-25

   4. Modified Rockfill

U.S. SIEVE NO.	% PASSING BY WEIGHT
8"	100
4"	0-25
2-1/2"	0-5

5. Structural Fill: Well-graded, hard, durable, natural sand and gravel, free from ice and snow, roots, sod, rubbish, and other deleterious or organic matter. Material shall conform to the following gradation requirements:

U.S. SIEVE NO.	% PASSING BY WEIGHT
4"*	100
#4	40-70
#200	0-12

- Four inches where placed as base below concrete floor slab and pavement or within 12 inches of walls; elsewhere 2/3 the lift thickness.

6. Ordinary Fill: Well-graded, natural, inorganic soil approved by the Architect and meeting the following requirements:

1. It shall have less than 3% organic matter, free from weak, compressible, or frozen materials, and of stones larger than eight inches in dimension. It shall not contain granite block, concrete, masonry rubble, roots, stumps or other similar materials.

2. It shall be of such nature and character that it can be compacted to the specified densities.

3. Topsoil and the zone directly below the topsoil indicated on the borings as "subsoil" shall not be considered Ordinary Fill nor shall topsoil or subsoil stockpiled on the site. Where subsoil is encountered, it shall be stripped separately from the topsoil and the granular material directly beneath the subsoil. This excavated material shall only be utilized in lawn areas, playfield areas or other non-structural areas, and shall be placed in these areas at distances away from adjacent site improvements as specified herein or as directed by the Architect.

4. It shall have a minimum dry density of not less than 100 pounds per cubic foot.

5. Material from excavations on the site may be used as Ordinary Fill if it is deemed acceptable by the Geotechnical Engineer.

7. Unsuitable material which is classified as "unsuitable" shall be material having at least one of the following properties:

   1. Material with a maximum unit dry weight per cubic foot less than 90 lbs., as determined by ASTM D1557.
   2. Material containing greater than 5% organic matter by weight, organic silt, peat, construction debris, roots and stumps.
   3. Material deemed unsuitable by the Geotechnical Engineer based on its inherent inability to perform satisfactorily as a bearing stratum.
   4. Soil, which is allowed to become frozen, saturated, or unstable because of the contractor's failure to employ appropriate dewatering, excavation methods, or weather protection is not deemed unsuitable soil but rather represents a condition in which the subgrade was not adequately prepared and/or protected.

8. Blast Rock Fill: Shall be broadly graded blasted rock with a maximum size of 12 inches, 25% smaller than six inches and 10% finer than 3/4 inch. Occasional boulders up to 18 inches will be permitted near the base of the fill.

   1. General site rock fill (outside the building area) may be placed up to within 42 inches of finish grade in pavement areas and to within 18 inches of inverts of utility lines. First lift over the top of rock fill shall be a choke stone layer 18 inches thick. Compaction shall be by minimum of four coverages of a self-propelled vibratory drum roller in each direction (i.e. north-south and east-west). The minimum weight of the drum shall be 10,000 lbs. Compaction may also be by four coverages of heavy track equipment such as a CAT D8 Bulldozer or other heavy track equipment approved by the Geotechnical Engineer.
   2. Rock shall not be placed within a five-foot horizontal distance on either side of any proposed utility line. The intent is to leave a zone of granular fill that can later be excavated for installation of utilities. Also, large rock fragments shall be kept away from utility pipes.

9. Choke Stone: Shall have a maximum rock size of nine inches and shall have 50% finer than 1-1/2 inch and 25% finer than 3/4 inch.

10. Sand Fill: Shall consist of well-graded natural sand, free from organic, other weak or compressible materials, or frozen materials, Conforming to the following gradation:

U.S. SIEVE NO.	% PASSING BY WEIGHT
#8	100
#50	15-40
#100	2-10
#200	0-5

11. Slab Base Course: Shall be hard, durable, natural sand and gravel, free from ice and snow, roots, sod, rubbish, or organic matter. Material shall conform to the following gradation requirements:

U.S. SIEVE NO.	% PASSING BY WEIGHT
2"	100
3/4"	20-90
#4	15-70
#40	10-50
#200	0-8

PART 3 - EXECUTION

3.01 GENERAL EXCAVATION

1. Excavate all materials encountered to allow construction of the proposed building and structures, utilities and site work as shown on the Drawings and as hereinafter specified.

2. Excavate to levels shown for footings and structures, as required to provide working clearance and to allow adequate inspection and to subgrades outside of buildings and structures as specified herein and as shown on Drawings.

3. In planted areas, remove ledge, boulders and other obstructions to a depth of at least two feet below finished grade.

4. Remove from the site and legally dispose of all debris and other excavated material not needed for, or suitable for, fill except as otherwise specified herein. Remove all materials subject to rot or attack by termites.

5. In general, the Contractor will be permitted to use machine excavation to the bottom of fill under concrete slabs on grade. The final three inches under footings and foundations shall be excavated using a straight blade bucket. If the final three inches cannot be satisfactorily excavated using a straight blade bucket without disturbing subgrades, the Contractor shall use alternative methods, including hand excavations. Alternative methods shall be subject to approval by the Architect or Geotechnical Engineer.

6. Unsuitable Soil Conditions:

   a. If unsuitable bearing materials are encountered at the specified subgrade depths, the Contractor shall notify the Architect. The Contractor shall carry excavation deeper and replace the excavated material with compacted fill or concrete as directed by the Architect or Geotechnical Engineer. Soil subgrades, which are unstable due to inadequate construction dewatering or excessive subgrade disturbance, are not deemed unsuitable soils.
   b. Removal of such material and its replacement as directed will be paid for as extra compensation in quantity approved by the Architect. Only changes in the work authorized in

advance by the Architect in writing shall constitute an adjustment in the Contract Price.

c. Material that is not within +\- 3% optimum moisture for compaction of the particular material in place as determined by the Architect or the Geotechnical Engineer and is disturbed by the Contractor during construction operations so that proper compaction cannot be reached shall not be construed as unsuitable bearing materials. This material shall be removed and replaced with lean concrete or structural fill as directed by the Architect or Geotechnical Engineer at no additional cost to the Owner.

d. The Contractor shall follow a construction procedure, which permits visual identification of firm natural ground.

e. The volume of unsuitable material shall be measured by profiling the in-place topography and calculation by the average-end-area method or other method deemed acceptable by the Geotechnical Engineer. The contractor's Licensed Surveyor or Professional Engineer shall prepare the calculations. Payment limits shall be as for rock excavation.

7. Excessive Excavation: If any part of the general or trench excavation is carried, through error, beyond the depth and the dimensions indicated on the Drawings or called for in the Specifications, the Contractor at his own expense, shall furnish and install compacted gravel fill, concrete, or take other remedial measures as directed by the Architect to bring fill material up to the required level.

3.02 TRENCH EXCAVATION

1. Excavate as necessary for all footings, structures, pipes, storm and sanitary drainage, electrical, gas, water, related structures and appurtenances, and for any other trenching necessary to complete the work. Unless otherwise indicated, provide separate trench for each utility.

2. Definitions:

   1. "Trench excavation" shall be defined as an excavation in which the bottom width does not exceed seven feet and the top width does not exceed twice the depth or where footings are excavated by backhoe. Refer to Drawings for any special trenching conditions for utilities, structures, etc.

   2. The words "invert" or "invert elevation" as used herein mean the elevation at the inside bottom of pipe or channel.
   3. The words "bottom of the pipe" as used herein means the elevation at the base of the pipe at its outer surface.

3. In general, machine excavation of trenches will be permitted with the exception of preparation of pipe beds, which will be handwork. Excavate by hand or machine methods at least six inches below the bottom of all utilities.

4. Trench excavation shall include the removal of all materials encountered. During excavation, materials determined to be suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or unsuitable for backfill shall be removed and legally disposed off the site. The banks of trenches shall be cut as near vertical as practicable to the extent allowed by OSHA.

5. The Contractor shall provide, at his own expense, suitable bridges over trenches where required for accommodation and safety of the traveling public and as necessary to satisfy the required permits and codes.

6. Trenches shall be excavated to the necessary width and depth for proper laying of pipe or other utility and shall have vertical sides or slopes as required by codes. Minimum width of trenches shall provide clearance between the sides of the trench and the outside face of the utility. Maximum trench sizes are as shown on the Drawings or as specified herein. The depth of the

trench shall be six inches below the bottom of the pipe barrel or respective utility. If the existing soil is found not suitable, the Architect or Geotechnical Engineer may approve removal and replacement of material. Costs for removal and replacement materials will be based on Unit Prices.

7. Coordinate all utility and trench backfilling with the trades involved.

3.03 ROCK EXCAVATION

1. Definitions and Classifications: The following classifications of excavation will be made only when rock excavation is required.

   1. "Earth Excavation" consists of removal and disposal of pavement and other obstructions visible on ground surface; underground structures and utilities indicated to be demolished and removed; material of any classification indicated in data on subsurface conditions; and other materials encountered that are not classified as rock excavation.
   2. "Rock Excavation" consists of removal and disposal of materials encountered that cannot be excavated without continuous and systematic drilling and blasting or continuous use of a ripper or other special equipment, except such materials that are classed as earth excavation. Typical of materials classified as rock excavation are as follows:

      1. Consolidated Bedrock.
      2. Boulders on site, outside trench limits, exceeding two cubic yards in volume.
      3. Boulders within trench limits, exceeding one cubic yard in volume.

   3. Should highly fractured or weathered bedrock be encountered during excavation, the following shall apply:

      1. When the material is encountered in trenching operations or under footings, it shall be excavated or ripped with a hydraulic backhoe equal to or larger than a Caterpillar 235 excavator, and will be classified as Earth Excavation. When it is demonstrated to the satisfaction of the Architect and the Geotechnical Engineer that this material can no longer be removed with a hydraulic backhoe and requires drilling and blasting, this material shall be classified as Rock Excavation. - For excavation procedures when this material is encountered under footings, refer to paragraph below.

   4. Intermittent drilling and ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as Earth Excavation.

   5. Allowance for Rock Excavation: The Contractor shall carry in the Base Bid an allowance for xxx cubic yards of rock encountered in trench excavation removed from the site. The Contractor shall also carry in the Base Bid an allowance of xxx cubic yards of open rock excavation removed from the site. The Base Bid shall cover all costs relating to such rock excavation, including blasting, removal and placement of the excavated material, overhead and profit. The Owner for excavation herein defined will pay no amount other than that herein specified.

      1. If the total quantity of Rock Excavation, open and/or trench, exceeds the amount of Rock Excavation included in the Contract as listed above, the Owner shall pay the excess excavation at the unit prices as indicated in the contract.
      2. If the total quantity of Rock Excavation, open and/or trench, is less than the amount of Rock Excavation included in the Contract as listed above, the Contract sum will be decreased by the difference in Rock Excavation multiplied by the unit prices as listed in the contract.

2. Measurements:

   1. When, during the process of excavation, rock is encountered, such material shall be

uncovered and exposed in such a manner that the unbroken ledge surface is clearly visible, and the Contractor shall notify the Architect, before proceeding further. The areas in question shall then be cross-sectioned as hereinafter specified.

2. Failure on the part of the Contractor to uncover such material and to notify the Architect and proceeding by the Contractor with the rock excavation before cross-sections are taken, will forfeit the Contractor's right of claim towards the stated allowance or additional payment over and above the stated allowance at the quoted unit price.
3. The Contractor shall employ and pay for a licensed Registered Civil Engineer or Land Surveyor to take cross-sections of rock before removal and to make computations of volume of rock encountered within the Payment Lines. Cross-sections shall be taken in the presence of the Geotechnical Engineer and the computations approved by the Architect. The volume calculations shall be by the average end area method. The Owner has the option to perform independent cross-sections and computations of rock quantities.
4. Where removal of boulder or ledge is required outside the established payment lines, the Architect shall determine the extent of this removal and basis of payment.

3. Blasting: Obtain written permission and approval of method from local authorities before proceeding with rock excavation. Explosives shall be stored, handled, and employed in accordance with state and local regulations or, in the absence of such, in accordance with the provisions of the "Manual of Accident Prevention of Construction" of the Associated General Contractors of America, Inc.

   1. Notify the Architect at least 48 hours before any intended blasting and do no blasting without his specific approval of each blasting operation.
   2. Contractor shall present evidence that his insurance includes coverage for blasting operations before doing any blasting work. A preblast survey shall be performed for all buildings and utilities within a radius of 150 feet from the blasting zone or conforming to the ordinance governing blasting and the Fire Department regulations.
   3. All rock blasting shall be well covered with heavy mats or timbers chained together and the Contractor shall take great care to do no damage to existing structures, utility lines and trees to remain.
   4. Any damage caused by the work of this Contractor shall be repaired to the full satisfaction of the Architect at no additional cost to the Owner.
   5. Any rock fragments or loose material from blasting operations shall be removed. All voids shall be filled with a leveling mat of structural fill or lean concrete as directed by the Geotechnical Engineer.
   6. At least 2 weeks prior to blasting the contractor shall submit a blasting plan indicating blasting agent to be used, drill hole depths and spacing, powder factors, personnel, vibration limits and method of measurement, for review by the Geotechnical Engineer.

4. Complaints:

   1. Report all blasting complaints to the Architect within 24 hours of receipt thereof. Include the name, address, date, time received, date and time of blast complained about, and a brief description of the alleged damages or other circumstances upon which the complaint is predicated. Assign each complaint a number, and number all complaints consecutively in order of receipt.
   2. Submit a summary report to the Architect each month which indicates the date, time and name of person investigating the complaint, and the amount of settlement, if any.
   3. When settlement of a claim is made, furnish the Architect with a copy of the release of claim by the claimant.
   4. Immediately notify the Architect, throughout the statutory period of liability, of any formal claim or demands made by attorneys on behalf of claimants, or of serving of any notice, summons, subpoena, or other legal documents incidental to litigation, and of any out-of-court settlement or court verdict resulting from litigation.
   5. Immediately notify the Architect of any investigations, hearings, or orders received from any governmental agency, board or body claiming to have authority to regulate blasting operations.

5. If ledge is encountered within the limits of the Proposed Building Area, the Contractor shall excavate this material 18 inches below subgrade of footings and 12 inches below subgrade of slabs unless otherwise directed by the Architect or Geotechnical Engineer. All loose or shaken rock shall be removed and replaced with compacted gravel fill or lean concrete as specified herein.

6. Rock excavation for foundations outside of the Building Area: Remove rock to foundation or footing subgrade. All rock bottoms for foundations shall be carefully examined. Loose or shaken rock shall be removed to solid bearing, and the rock surface leveled, or shelved to a slope not exceeding one inch per two feet, or as directed.

7. Excavate rock encountered in grading under paved areas, lawns and plant beds to subgrade as specified herein and shown on the Drawings. All boulders or protruding rock outcrops shall remain undisturbed at lawns and plant beds when so directed by the Architect. Rock shall be fractured six inches below subgrade of paved areas but this six-inch layer shall remain in place.

8. If any part of the rock excavation at footings be carried beyond the depth and the dimensions indicated on the Drawings or called for in the Specifications, the Contractor shall, at his own expense, furnish and install concrete of same strength as footings to the required subgrade level of the footings as shown on the Drawings. Doweling or other corrective structural measures as directed by the Architect may also be required to properly anchor or reinforce the concrete. If rock excavation is carried beyond the depth and dimensions to subgrade in other areas, the Contractor shall, at his own expense, furnish and install compacted gravel fill to subgrade as directed by the Architect.

9. Basis of Payment: The total amount of rock excavation will be based upon the volume of rock excavated within and/or above the lines referred to in the next paragraph as "Payment Lines". The payment lines are only to be used as a basis of payment, and are not to be used as limits of excavation. Limits of excavation area as shown on the Drawings and as specified herein.

10. Payment Lines for Rock Excavation:

    1. Payment lines for columns and footings within the building shall be a vertical line one foot from the toe of the footings; the depth shall be measured at 24 inches below the bottom elevations shown on the Drawings. If rock is to remain directly below the bottom of the footings within the Building Area, payment lines shall be six inches below the bottom elevation of the footing as shown on the Drawings. Payment lines for walls to be damp-proofed shall be a vertical line two feet outside the walls. Payment lines for footings outside of the building shall be six inches below the bottom of footings. Vertical payment lines shall be as specified hereinafter.
    2. Payment lines for manholes and catch basins shall be one foot outside of the outer wall and six inches below subgrade beneath the structure.
    3. Payment lines for rock excavation under slabs on grade shall be six inches below the bottom elevation of the specified gravel base course outside of the building and 12 inches below subgrade for slabs within the building.
    4. Payment lines for rock excavation at paved areas and lawns shall be six inches below respective subgrades.
    5. Payment lines for rock excavation under pipes within the building and for utility trenches outside the building lines shall in no case be calculated as greater in width than the outside diameter of the pipe plus two feet for pipes up to 18 inches. For pipes 18 inches and larger payment lines shall in no case be calculated as greater in width than the outside diameter of the pipe plus three feet. Payment lines at bottom of all pipe and utility trenches shall be six inches below subgrade.

3.04 PROOF-ROLLING

1. Contractor shall be required to proofroll foundation and pavement subgrades prior to foundation construction or the placement and compaction of fill materials.

2. Proofrolling of foundation subgrades shall include at least ten passes of a small vibratory plate compactor for trench excavations or six passes of a heavy vibratory roller for open areas.

3. Proofrolling of pavement subgrades shall include four passes of a heavy vibratory roller.

4. If groundwater is located within one foot of foundation or pavement subgrade, proofrolling may be eliminated. However, the Contractor shall demonstrate care during excavation so as to minimize subgrade disturbance.

5. The Geotechnical Engineer shall visually observe Proofrolling. Foundation construction or replacement of fill materials shall not commence until the Geotechnical Engineer has witnessed subgrade conditions and proofrolling operations.

6. Soils which exhibit weaving or instability during the proofrolling operations as determined by the Geotechnical Engineer shall be removed and replaced with compacted Structural Fill or Crushed Stone at no additional cost to the Owner.

3.05 FILLING AND GRADING

1. Samples and Testing:

    1. All fill materials, and their placement shall be subject to quality control testing. The Owner shall pay for all testing except that the Contractor will bear cost of testing materials, which fail to conform to Specifications. Test results and laboratory recommendations will be available to Contractor. All sieve analyses for conformance of on-site and off-site fill materials to be used in the work shall be done by means of a mechanical wet sieve analysis and in accordance with ASTM D-422.
    2. The Owner will retain a Geotechnical Engineer to provide personnel, qualified by training and experience, to be at the site to observe preparation for the placement of compacted fills, to observe excavation and dewatering required for the work, and to observe earthwork operations and report on the conformity of operations with these Specifications. All service and approvals given by the Geotechnical Engineer shall not relieve the Contractor of his responsibility for performing the work in accordance with these Specifications. The Contractor agrees to accept as final the results of field and laboratory tests performed by the above representatives. As stated hereinbefore, the Owner reserves the right to modify or waive Geotechnical Engineer's services.
    3. Excavated material taken directly from on-site cuts that will meet these Specifications may be used as Ordinary Fill or Structural Fill provided the Contractor obtains written approval from the Architect. No such fill material shall be put in place until approved for use by the Architect in writing.
    4. Field density tests will be made by the Geotechnical Engineer in accordance with the Method of Test for ASTM Designation D1556 or D2944, to determine the adequacy of compaction; the location and frequency of such field tests shall be at the Geotechnical Engineer's discretion.
    5. The Contractor shall notify the Architect or the Geotechnical Engineer when an area is ready for compaction testing. This notification shall be 48 hours in advance of placing or final compaction so that the Geotechnical Engineer has adequate time to take compaction tests.
    6. The Architect or his designated representative shall have the right to observe the installation of all controlled compacted fills.
    7. Testing of materials as delivered may be made from time to time. Materials in question may not be used, pending test results. Tests of compacted materials will be made regularly. Remove rejected materials and replace with new, whether in stockpiles or in place.
    8. Cooperate with the Geotechnical Engineer in obtaining field samples of in-place materials after compaction. Furnish incidental field labor in connection with these tests. The Contractor will be informed by the Geotechnical Engineer of areas of unsatisfactory density which may require improvement by removal and replacement, or by scarifying,

aerating, sprinkling (as needed), and re-compaction prior to the placement of the new lift. No additional compensation shall be paid for work required to achieve proper compaction.

9. The Geotechnical Engineer's presence does not include supervision or direction of the actual work by the Contractor, his employees, or agents. Neither the presence of the Geotechnical Engineer nor any observations and testing performed by him shall excuse the Contractor from defects discovered in his work.
10. In no case will frozen material be allowed for use in fill, backfill, or rough grading material.
11. Stones or rock fragments larger than four inches in their greatest dimension shall not be permitted within the top six inches of subgrade of any fills or embankments.

2. Placing, Spreading and Compacting Fill Material:

1. Fill materials are to be placed as designated herein and as indicated on the Contract Drawings.

1. Crushed Stone shall be placed as follows and compacted as specified herein:

1.) Under and around utility structures and around foundation drains and underdrains, (use 1/2" stone).
2.) Behind retaining walls, and under rip rap.
3.) Where otherwise shown on Drawings or as directed by the Architect.

2. Structural Fill shall be placed as follows and compacted in lifts to a minimum of 95% maximum dry density per the Modified Proctor Test (ASTM D 1557) as specified herein: (Refer to table specified herein for compaction methods and lift requirements.)

1.) Within building pad areas.
2.) As a subgrade fill for all material to be placed in controlled compacted fills under exterior concrete slabs, foundations, on grade stairs, and other soil bearing situations.
3.) Wherever a structural fill is called for or shown on the Drawings.

3. Ordinary Fill shall be placed as follows and compacted as specified herein:

1.) In general fill areas such as lawn or in parking islands except where Structural Fill is shown.
2.) Wherever Ordinary Fill is called for and as specified hereinbefore.
3.) Wherever Structural Fill, Crushed Stone, Sand Fill or Topsoil is not required herein or on the Drawings.

4. Blast Rock Fill may be placed up to within three feet of finish grade in pavement areas and within two feet of finish grade in lawns, and to within 30 inches of inverts of utility lines and proposed utility routes. First lift over the top of rock fill shall be choked stone layer 18 inches thick which shall be a well-graded mixture of sand, gravel, and blasted rock with maximum stone size less than nine inches. Compaction shall be by minimum of six coverages of a self-propelled vibratory drum roller in each direction (i.e. north-south and east-west). The minimum weight of the drum shall be 1 0,000 lbs. Compaction may also be by four coverages of heavy track machinery such as a Caterpillar D8 or other track machinery approved by the Geotechnical Engineer.

1.) Blast Rock Fill shall not be placed within 30 inches vertically of exterior concrete slabs (i.e. sidewalks, loading docks, etc.
2.) Rock shall not be placed within a five-foot horizontal distance on either side of any proposed utility line. The intent is to leave a zone of granular fill that can later be excavated for installation of utilities. Also keep large rock

fragments away from any utility lines.

3.) Place woven filter fabric (Mirafi 500X or equivalent) over Blast Rock Fill.

5. Sand Fill shall be placed as follows and compacted as specified for the particular item:

1.) As a bedding material for PVC electrical conduit where concrete is not required, telephone-cable, primary electric service and gas pipe.
2.) Where otherwise specified or shown on the Drawings.

6. Slab Base Fill shall be placed in minimum 6-inch lift under concrete floor slabs.

7. Subsoil shall be used only under lawn areas and athletic fields. This material shall not be placed closer to areas being otherwise prepared than a 1:1 angle of repose x depth of fill for the particular area. For instance, if a fill is four feet deep, subsoil may not be placed closer than four feet to the area being otherwise prepared.

1.) Unsuitable Earth Materials shall be removed from the site.
2.) The fill material shall be placed in uniform horizontal layers and compacted as specified herein.

8. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to obtain uniformity of material in each layer. So far as practicable, each layer of material shall extend the entire length and width of the area being filled plus two additional feet horizontally along each side for every one foot of fill required.

3. All fill material shall be placed and compacted in the dry. The Contractor shall dewater excavated areas as required to perform the work, and in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils. In freezing weather, a layer of fill shall not be left in an uncompacted state at the close of a day's operation. Prior to terminating operations for the day, the final layer of fill, after compaction, shall be rolled with a smooth-wheeled roller to eliminate ridges of soil left by tractors, trucks and compaction equipment.

4. The Contractor shall not place a layer of compacted fill on soil that was permitted to freeze prior to compaction or on snow or ice. Removal of these unsatisfactory materials will be required as directed by the Owner.

5. When the moisture content of the fill material is below optimal moisture necessary for compaction as specified herein, water shall be added until the moisture content is as specified.

6. When the moisture content of the fill material is above the optimal moisture necessary for compaction as specified herein, the fill material shall be aerated by blending, mixing, or other satisfactory methods until the moisture content is as specified.

7. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to the specified density. Compaction shall be continuous over the entire area and the equipment shall make sufficient passes to ensure that the desired density is obtained. A minimum of four coverages with acceptable compaction equipment described hereinafter is a requirement. These coverages are to be provided as systematic compactive effort; incidental coverages due to construction vehicle traffic through the area will not be included.

3. Structural Fill: All fills within the building area shall be made with Structural Fill as defined herein and shown on the Footing Zone of Influence detail included herein. No excavated on-site material will be acceptable as Structural Fill unless specifically approved by testing as specified herein.

4. Allowance for Unsuitable Materials and replacement with Structural Fill: The Contractor shall account for in his base bid for the removal of Unsuitable Materials and Structural Fill in place and graded as specified herein to be used as directed by the Architect or the Geotechnical Engineer. This quantity of Structural Fill is in addition to the requirements for Structural Fill in areas as specified herein, and as shown on the Contract Documents and is to be used at the discretion of the Architect or the Geotechnical Engineer.

5. Backfilling of Trenches, Structures and Foundations:

   1. Areas to be backfilled shall be free of construction debris, refuse, compressible or decayable materials and standing water. Do not place fill when temperature is below 30 degrees F and when fill materials or layers below it is frozen unless specifically approved by the Geotechnical Engineer.
   2. Requirement of description, placement, compaction and spreading of fill materials as specified herein shall be applicable to backfilling operations.
   3. Structural Fill shall be used as Backfill around manholes and other structures. Excavated material may be used if approved by the Architect or Geotechnical Engineer.
   4. Backfilling of foundations, structures and retaining walls shall not commence until construction finish grade has been approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall not be placed against walls until they are braced or have cured sufficiently to develop the strength necessary to withstand, without damage, the pressure that will result from backfilling and compacting operations. If fill is required on both sides of a wall, it shall be brought up simultaneously and evenly on both sides. Avoid damage to the walls and to damp-proofing and waterproofing and other work in place. Allow seven days from the date of application of waterproofing before backfilling. Stones larger than four inches maximum dimension shall not be permitted in the upper six inches of fill or horizontally within 12 inches of walls.
   5. Do not commence backfilling operations of utility trenches until all piping, conduits, etc. have been installed, tested and approved and the locations of all pipe and appurtenances have been recorded. Backfill carefully by hand around pipe to depth of one foot above top of pipe using material specified herein, and tamping firmly in layers not exceeding six-inch layers, compacting by hand rammers or mechanical tampers. When a manufacturer of utility line materials suggests backfill materials and methods other than those specified herein, such requirements shall govern providing the finished work equals or exceeds the result obtained by the materials and methods specified herein. Water mains shall be hand backfilled to a minimum cover of 18 inches before mechanical equipment can be used to backfill trench.
   6. Sand Bedding will be required below all pipe unless otherwise shown on the Drawings or specified herein. Crushed Stone is required under utility structures where shown on the Drawings. Gravel Bedding, Sand Bedding or Crushed Stone shall be placed to the full width of the trench and under utility structure foundations as indicated on the Drawings. After a pipe is bedded, the trench shall be filled to the centerline of the pipe with Gravel Fill or Sand Bedding except at the joint. After the joint is inspected, that portion shall be filled in with Sand Bedding. Material under and around the pipe shall be carefully and thoroughly tamped.
   7. From the centerline of the pipe to a point 12 inches above the top of the pipe the backfill shall be Structural Fill or Sand Fill placed by hand and hand tamped. Above this point, backfill shall be placed in layers six inches deep and each layer shall be compacted with mechanical tampers to not less than 95% of maximum density at optimum moisture of the material. This backfill shall be carried up to the bottom of materials specified to be placed for surfacing requirements.
   8. Utilities shall not be laid directly on ledge, boulders or other hard material. This material shall be removed as specified herein within trench limits, and within vertical planes one foot outside of structure walls. Backfill will be placed in eight-inch lifts and thoroughly compacted. If hand guided compaction equipment is used, fill shall be placed in six-inch lifts. All rock excavation shall be considered unsuitable for backfill around utilities. Ordinary fill may be used as backfill in areas as specified herein.
   9. Coordinate all utility and trench backfilling with the trades involved.

6. Compaction Equipment:

1. Compaction shall be accomplished by vibratory rollers, multiple wheel pneumatic tired rollers or other types of approved compacting equipment. Loaded trucks, low beds, water wagons and the like shall not be considered as acceptable compaction equipment unless specifically approved by the Architect or Geotechnical Engineer for a particular location. Equipment shall be of any such design that it will be able to compact the fill to the specified density in a reasonable length of time. All compaction equipment shall be subject to the approval of the Geotechnical Engineer.

7. Compaction Requirements:

1. The following table lists minimum compactive efforts and lift weights which are required for all fill materials. Compaction of each lift shall be completed before compaction of the next lift is started. The compaction equipment shall make an equal number of transverse and longitudinal coverages of each lift. Allow the Geotechnical Engineer sufficient time to make necessary observations and tests. The degree of compaction for fill placed in various areas shall be as follows:

Relative Compaction

1.	Within buildings and structures:	
	-Under footings	95%
	-under slab	95%
2.	Outside building areas:	
	-within paved areas	95%
	-within lawn areas and playing fields	85%

- Percent of maximum dry density of the material at optimum moisture content as determined by methods or tests for ASTM designation D 1557.

8. Methods: The compaction alternatives given below are stated to provide minimum compaction standards only and in no way relieves the Contractor of his obligation to achieve the specified degree of compaction by whatever additional effort is necessary.

1. All fill to be placed "in-the-dry" with the exception specified hereinafter. If, in the opinion of the Architect or the Geotechnical Engineer, the Contractor has followed a logical sequence of construction procedures, has employed the proper and necessary equipment, and has otherwise conducted himself in a workmanlike manner, but still cannot effectively dewater the excavation, the Architect or the Geotechnical Engineer may permit the Contractor to place a first lift of Gravel or Crushed Stone fill "in-the-wet". Fill placed in-the-wet must meet the gradation and placement requirements specified herein. The quantity of fill placed in-the-wet must be no greater than deemed necessary by the Architect and must be limited to the lowermost lift.

9. Moisture Control:

1. Variation of moisture content in fill and backfill materials shall be limited to Optimum Moisture (-l% to +2%). Moisture content shall be as uniformly distributed as practicable within each lift, and shall be adjusted as necessary to obtain the specified compaction.
2. Material which does not contain sufficient moisture to be compacted to the specified densities shall be moisture conditioned by sprinkling, discing, windrowing, or other method approved by the Geotechnical Engineer.

1. Material conditioned by sprinkling shall have water added before compaction. Uniformly apply water to surface of subgrade or layer of soil material to obtain sufficient moisture content. The Contractor shall maintain sufficient hoses and/or water distributing equipment at the site for this purpose.

3. Material containing excess moisture shall be dried to required Optimum Moisture before it is placed and compacted. Excessively moist soils shall be removed and replaced and shall be scarified by use of plows, discs, or other approved methods, and air-dried to meet the above requirements.
4. Materials, which are within the moisture requirements specified above, but which display pronounced elasticity or deformation under the action of earthmoving and compaction equipment, shall be reduced to Optimum Moisture Content, or below, to secure stability.
5. In the event of sudden downpours or other inclement weather, exposed subgrades and fills which, in the opinion of the Geotechnical Engineer become inundated or excessively moistened shall have excess water removed and soil dried as specified above.

3.06 ROUGH GRADING

1. Rough grading shall include the shaping, trimming, rolling and finishing the surface of the sub-base, shoulders, and earth slopes, and the preparation of the sub-base for loam, seeding and paved surfaces. The grading of shoulders and sloped areas may be done by machine methods. Up to two inches in 100" tolerance will be permitted on slopes and one inch in 100" on lawn areas provided the slopes are uniform in appearance and without abrupt changes. All ruts shall be eliminated. Grading of subgrades for paved areas shall be finished at the required depth below and parallel to the proposed surface within 3/8 inch in 100" tolerance.

2. If, during the progress of rough grading work, water pipe, sewer conduit, drain, or other construction is damaged due to operations under this Contract, the Contractor shall repair all such damage at no additional cost to the Owner and restore damaged areas to their original condition.

3. Do all other cutting, filling and rough grading to the lines and grades indicated on the Drawings. Grade evenly to within the dimensions required for finished grades shown on the Drawings. No stone larger than three inches in largest dimension shall be placed in upper 12 inches of fill.

4. Grades shall be brought below finished grades in accordance with the various depths specified below:

    1. Under slabs-on-grade, as specified herein and as shown on the Drawings.
    2. Under paved areas, bottom of base course as shown on Drawings.
    3. Under seeded areas, six inches.
    4. Under cattail marsh area and pond bottom, 12 inches.

5. No rubbish of any description shall be allowed to enter fill material. Such material shall be removed from the site.

6. Complete the grading operations after the building has been finished, the utilities installed, site improvements constructed, and all materials, rubbish and debris removed from the site. Leave subgrade for lawns clean at required grades. There must be sufficient grade staking to provide correct lines and grades.

3.07 DEFICIENCY OF FILL MATERIAL

1. Provide required additional fill material from offsite sources to complete the work if a sufficient quantity of suitable material is not available from the required excavation on the project site.

3.08 SURPLUS OF FILL MATERIAL

1. Surplus fill which is not required to fulfill the requirements of the Contract shall be removed from

the site and legally disposed of.

3.09 DUST AND EROSION CONTROL

1. The Contractor shall take all necessary measures and provide equipment and/or materials to minimize dust from rising and blowing across the site and also to control surface water throughout the operation so that it does not run onto paved ways without being filtered. In addition, the Contractor shall control all dust created by construction operations and movement of construction vehicles, both on the site and on paved ways. Provide additional crushed stone where necessary to provide traps or pads for construction vehicles carrying sediment. Provide temporary swales and interceptor ditches to control surface runoff water where necessary.

2. If dust control is required off-site due to work under this Contract, in addition to watering, sweeping and other methods, the Contractor shall apply calcium chloride in the required amounts to properly control dust. These amounts shall be approved by the Town Engineer prior to application.

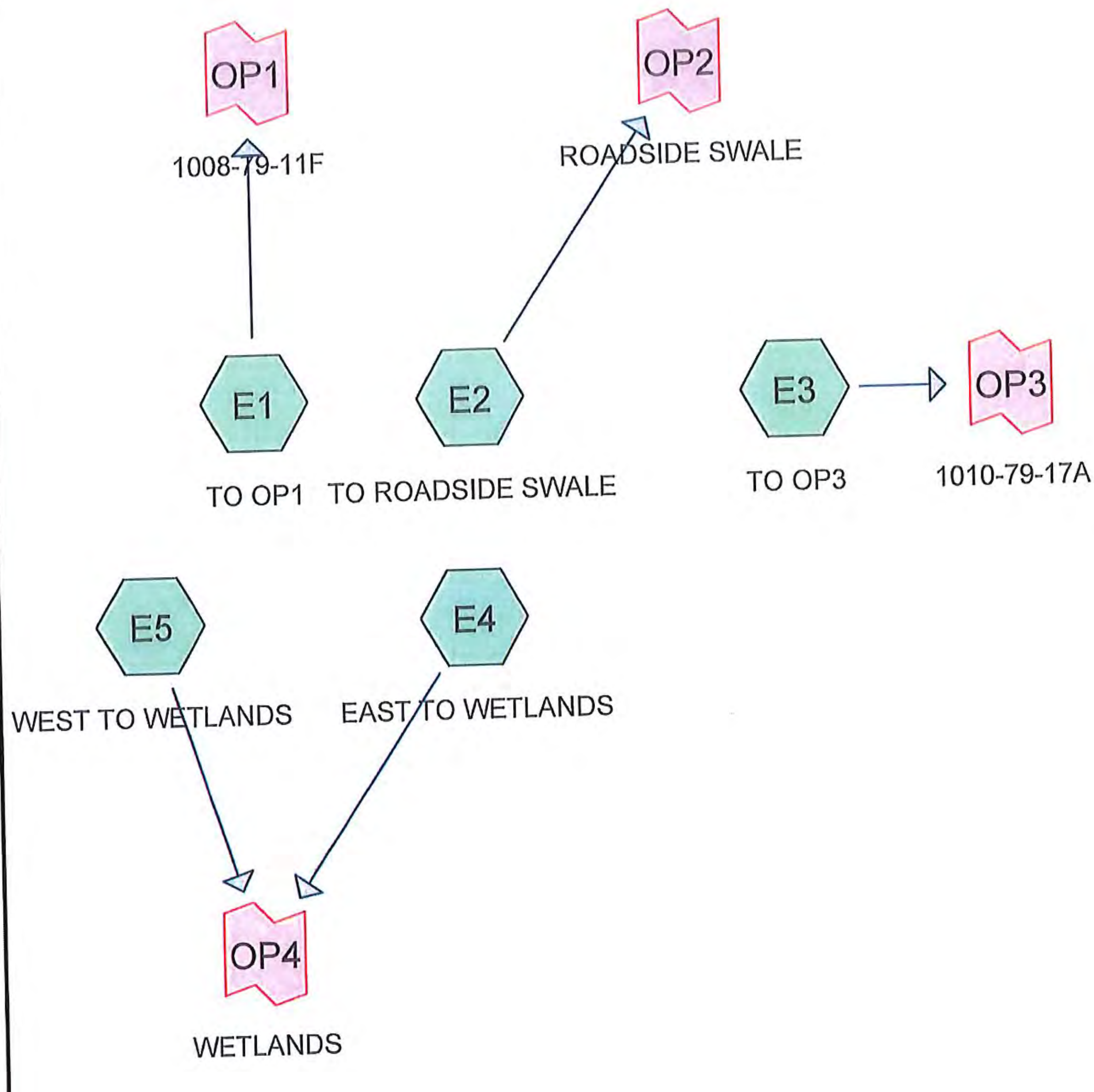
3.10 RESTORATION OF SITE ITEMS

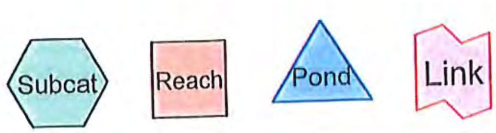
1. Wherever streets, lawns or other items within the Contract Limit Lines have been excavated in fulfilling the work required under the Contract, the Contractor shall furnish and install all material at no cost to the Owner to bring finish surface level with the existing adjacent conditions. All work shall be installed to match the existing conditions.

END OF SECTION 02200

Section 1.1

Existing Conditions
2, 10, & 100 Year Storm Full Summary





Routing Diagram for 2295.01_PRE_DEVELOPMENT_A
Prepared by {enter your company name here}, Printed 6/29/2022
HydroCAD® 10.10-7b s/n 06037 © 2022 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.129	39	>75% Grass cover, Good, HSG A (E3)
10.147	74	>75% Grass cover, Good, HSG C (E1, E2, E3, E4, E5)
1.096	96	Gravel surface, HSG C (E1, E2, E3, E5)
0.010	98	Paved parking, HSG C (E2)
1.392	30	Woods, Good, HSG A (E3)
7.569	70	Woods, Good, HSG C (E1, E2, E3, E4, E5)
20.343	**70**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.521	HSG A	E3
0.000	HSG B	
18.822	HSG C	E1, E2, E3, E4, E5
0.000	HSG D	
0.000	Other	
20.343		**TOTAL AREA**

Summary for Subcatchment E1: TO OP1

Runoff = 3.33 cfs @ 12.12 hrs, Volume= 0.244 af, Depth> 0.94"
Routed to Link OP1 : 1008-79-11F

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
16,581	96	Gravel surface, HSG C
35,269	74	>75% Grass cover, Good, HSG C
66,934	70	Woods, Good, HSG C
16,581	74	>75% Grass cover, Good, HSG C
135,365	75	Weighted Average
135,365		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.0320	0.42		**Sheet Flow, A-B** Cultivated: Residue<=20% n= 0.060 P2= 3.11"
2.9	375	0.0960	2.17		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	235	0.1500	5.16	17.19	**Parabolic Channel,** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.080 Earth, long dense weeds
7.7	710	Total			

Summary for Subcatchment E2: TO ROADSIDE SWALE

Runoff = 8.06 cfs @ 12.10 hrs, Volume= 0.560 af, Depth> 0.94"
Routed to Link OP2 : ROADSIDE SWALE

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
425	98	Paved parking, HSG C
22,730	96	Gravel surface, HSG C
229,356	74	>75% Grass cover, Good, HSG C
34,883	70	Woods, Good, HSG C
22,730	74	>75% Grass cover, Good, HSG C
310,124	75	Weighted Average
309,699		99.86% Pervious Area
425		0.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	100	0.0270	0.39		**Sheet Flow, A-B** Cultivated: Residue<=20% n= 0.060 P2= 3.11"
0.9	265	0.0850	4.69		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.5	380	0.1250	12.56	41.85	**Parabolic Channel, C-D** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.030 Earth, grassed & winding
0.0	32	0.1200	28.95	142.09	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Cast iron, coated
0.5	330	0.1050	11.51	38.36	**Parabolic Channel,** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.030 Earth, grassed & winding
6.1	1,107	Total			

Summary for Subcatchment E3: TO OP3

Runoff = 0.04 cfs @ 13.71 hrs, Volume= 0.020 af, Depth> 0.09"
Routed to Link OP3 : 1010-79-17A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
5,121	96	Gravel surface, HSG C
5,616	39	>75% Grass cover, Good, HSG A
21,424	74	>75% Grass cover, Good, HSG C
60,647	30	Woods, Good, HSG A
27,820	70	Woods, Good, HSG C
120,628	50	Weighted Average
120,628		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	100	0.0200	0.15		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.11"
0.7	192	0.1000	4.74		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
0.2	240	0.3900	18.46	49.22	**Parabolic Channel, C-D** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.035 Earth, dense weeds
11.9	532	Total			

Summary for Subcatchment E4: EAST TO WETLANDS

Runoff = 4.06 cfs @ 12.12 hrs, Volume= 0.306 af, Depth> 0.79"
Routed to Link OP4 : WETLANDS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
84,051	74	>75% Grass cover, Good, HSG C
118,105	70	Woods, Good, HSG C
202,156	72	Weighted Average
202,156		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0100	0.26		**Sheet Flow, A-B** Cultivated: Residue<=20% n= 0.060 P2= 3.11"
0.8	200	0.0750	4.41		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.5	425	0.1900	13.27	44.23	**Parabolic Channel, C-D** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.035 Earth, dense weeds
7.6	725	Total			

Summary for Subcatchment E5: WEST TO WETLANDS

Runoff = 2.39 cfs @ 12.12 hrs, Volume= 0.179 af, Depth> 0.79"
Routed to Link OP4 : WETLANDS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
3,306	96	Gravel surface, HSG C
32,579	74	>75% Grass cover, Good, HSG C
81,979	70	Woods, Good, HSG C
117,864	72	Weighted Average
117,864		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0100	0.26		**Sheet Flow, A-B** Cultivated: Residue<=20% n= 0.060 P2= 3.11"
0.9	255	0.0850	4.69		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.1	60	0.2500	14.78	39.41	**Parabolic Channel, C-D** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.035 Earth, dense weeds
7.3	415	Total			

Summary for Link OP1: 1008-79-11F

Inflow Area = 3.108 ac, 0.00% Impervious, Inflow Depth > 0.94" for 2 Year Storm event
Inflow = 3.33 cfs @ 12.12 hrs, Volume= 0.244 af
Primary = 3.33 cfs @ 12.12 hrs, Volume= 0.244 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Link OP2: ROADSIDE SWALE

Inflow Area = 7.119 ac, 0.14% Impervious, Inflow Depth > 0.94" for 2 Year Storm event
Inflow = 8.06 cfs @ 12.10 hrs, Volume= 0.560 af
Primary = 8.06 cfs @ 12.10 hrs, Volume= 0.560 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Link OP3: 1010-79-17A

Inflow Area = 2.769 ac, 0.00% Impervious, Inflow Depth > 0.09" for 2 Year Storm event
Inflow = 0.04 cfs @ 13.71 hrs, Volume= 0.020 af
Primary = 0.04 cfs @ 13.71 hrs, Volume= 0.020 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Link OP4: WETLANDS

Inflow Area = 7.347 ac, 0.00% Impervious, Inflow Depth > 0.79" for 2 Year Storm event
Inflow = 6.45 cfs @ 12.12 hrs, Volume= 0.485 af
Primary = 6.45 cfs @ 12.12 hrs, Volume= 0.485 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Subcatchment E1: TO OP1

Runoff = 7.59 cfs @ 12.11 hrs, Volume= 0.539 af, Depth> 2.08"
Routed to Link OP1 : 1008-79-11F

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
16,581	96	Gravel surface, HSG C
35,269	74	>75% Grass cover, Good, HSG C
66,934	70	Woods, Good, HSG C
16,581	74	>75% Grass cover, Good, HSG C
135,365	75	Weighted Average
135,365		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.0320	0.42		**Sheet Flow, A-B** Cultivated: Residue<=20% n= 0.060 P2= 3.11"
2.9	375	0.0960	2.17		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	235	0.1500	5.16	17.19	**Parabolic Channel,** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.080 Earth, long dense weeds
7.7	710	Total			

Summary for Subcatchment E2: TO ROADSIDE SWALE

Runoff = 18.29 cfs @ 12.10 hrs, Volume= 1.236 af, Depth> 2.08"
Routed to Link OP2 : ROADSIDE SWALE

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
425	98	Paved parking, HSG C
22,730	96	Gravel surface, HSG C
229,356	74	>75% Grass cover, Good, HSG C
34,883	70	Woods, Good, HSG C
22,730	74	>75% Grass cover, Good, HSG C
310,124	75	Weighted Average
309,699		99.86% Pervious Area
425		0.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	100	0.0270	0.39		**Sheet Flow, A-B** Cultivated: Residue<=20% n= 0.060 P2= 3.11"
0.9	265	0.0850	4.69		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.5	380	0.1250	12.56	41.85	**Parabolic Channel, C-D** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.030 Earth, grassed & winding
0.0	32	0.1200	28.95	142.09	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Cast iron, coated
0.5	330	0.1050	11.51	38.36	**Parabolic Channel,** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.030 Earth, grassed & winding
6.1	1,107	Total			

Summary for Subcatchment E3: TO OP3

Runoff = 0.90 cfs @ 12.27 hrs, Volume= 0.118 af, Depth> 0.51"
Routed to Link OP3 : 1010-79-17A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
5,121	96	Gravel surface, HSG C
5,616	39	>75% Grass cover, Good, HSG A
21,424	74	>75% Grass cover, Good, HSG C
60,647	30	Woods, Good, HSG A
27,820	70	Woods, Good, HSG C
120,628	50	Weighted Average
120,628		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	100	0.0200	0.15		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.11"
0.7	192	0.1000	4.74		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
0.2	240	0.3900	18.46	49.22	**Parabolic Channel, C-D** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.035 Earth, dense weeds
11.9	532	Total			

Summary for Subcatchment E4: EAST TO WETLANDS

Runoff = 10.05 cfs @ 12.11 hrs, Volume= 0.715 af, Depth> 1.85"
Routed to Link OP4 : WETLANDS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
84,051	74	>75% Grass cover, Good, HSG C
118,105	70	Woods, Good, HSG C
202,156	72	Weighted Average
202,156		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0100	0.26		**Sheet Flow, A-B** Cultivated: Residue<=20% n= 0.060 P2= 3.11"
0.8	200	0.0750	4.41		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.5	425	0.1900	13.27	44.23	**Parabolic Channel, C-D** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.035 Earth, dense weeds
7.6	725	Total			

Summary for Subcatchment E5: WEST TO WETLANDS

Runoff = 5.92 cfs @ 12.11 hrs, Volume= 0.417 af, Depth> 1.85"
Routed to Link OP4 : WETLANDS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
3,306	96	Gravel surface, HSG C
32,579	74	>75% Grass cover, Good, HSG C
81,979	70	Woods, Good, HSG C
117,864	72	Weighted Average
117,864		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0100	0.26		**Sheet Flow, A-B** Cultivated: Residue<=20% n= 0.060 P2= 3.11"
0.9	255	0.0850	4.69		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.1	60	0.2500	14.78	39.41	**Parabolic Channel, C-D** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.035 Earth, dense weeds
7.3	415	Total			

Summary for Link OP1: 1008-79-11F

Inflow Area =	3.108 ac,	0.00% Impervious, Inflow Depth > 2.08"	for 10 Year Storm event
Inflow =	7.59 cfs @	12.11 hrs, Volume=	0.539 af
Primary =	7.59 cfs @	12.11 hrs, Volume=	0.539 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Link OP2: ROADSIDE SWALE

Inflow Area =	7.119 ac,	0.14% Impervious, Inflow Depth > 2.08"	for 10 Year Storm event
Inflow =	18.29 cfs @	12.10 hrs, Volume=	1.236 af
Primary =	18.29 cfs @	12.10 hrs, Volume=	1.236 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Link OP3: 1010-79-17A

Inflow Area =	2.769 ac,	0.00% Impervious, Inflow Depth > 0.51"	for 10 Year Storm event
Inflow =	0.90 cfs @	12.27 hrs, Volume=	0.118 af
Primary =	0.90 cfs @	12.27 hrs, Volume=	0.118 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Link OP4: WETLANDS

Inflow Area =	7.347 ac,	0.00% Impervious, Inflow Depth > 1.85"	for 10 Year Storm event
Inflow =	15.97 cfs @	12.11 hrs, Volume=	1.133 af
Primary =	15.97 cfs @	12.11 hrs, Volume=	1.133 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Subcatchment E1: TO OP1

Runoff = 19.29 cfs @ 12.11 hrs, Volume= 1.391 af, Depth> 5.37"
Routed to Link OP1 : 1008-79-11F

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
16,581	96	Gravel surface, HSG C
35,269	74	>75% Grass cover, Good, HSG C
66,934	70	Woods, Good, HSG C
16,581	74	>75% Grass cover, Good, HSG C
135,365	75	Weighted Average
135,365		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.0320	0.42		**Sheet Flow, A-B** Cultivated: Residue<=20% n= 0.060 P2= 3.11"
2.9	375	0.0960	2.17		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	235	0.1500	5.16	17.19	**Parabolic Channel,** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.080 Earth, long dense weeds
7.7	710	Total			

Summary for Subcatchment E2: TO ROADSIDE SWALE

Runoff = 46.33 cfs @ 12.09 hrs, Volume= 3.188 af, Depth> 5.37"
Routed to Link OP2 : ROADSIDE SWALE

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
425	98	Paved parking, HSG C
22,730	96	Gravel surface, HSG C
229,356	74	>75% Grass cover, Good, HSG C
34,883	70	Woods, Good, HSG C
22,730	74	>75% Grass cover, Good, HSG C
310,124	75	Weighted Average
309,699		99.86% Pervious Area
425		0.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	100	0.0270	0.39		**Sheet Flow, A-B** Cultivated: Residue<=20% n= 0.060 P2= 3.11"
0.9	265	0.0850	4.69		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.5	380	0.1250	12.56	41.85	**Parabolic Channel, C-D** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.030 Earth, grassed & winding
0.0	32	0.1200	28.95	142.09	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Cast iron, coated
0.5	330	0.1050	11.51	38.36	**Parabolic Channel,** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.030 Earth, grassed & winding
6.1	1,107	Total			

Summary for Subcatchment E3: TO OP3

Runoff = 6.69 cfs @ 12.18 hrs, Volume= 0.570 af, Depth> 2.47"
Routed to Link OP3 : 1010-79-17A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
5,121	96	Gravel surface, HSG C
5,616	39	>75% Grass cover, Good, HSG A
21,424	74	>75% Grass cover, Good, HSG C
60,647	30	Woods, Good, HSG A
27,820	70	Woods, Good, HSG C
120,628	50	Weighted Average
120,628		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	100	0.0200	0.15		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.11"
0.7	192	0.1000	4.74		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
0.2	240	0.3900	18.46	49.22	**Parabolic Channel, C-D** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.035 Earth, dense weeds
11.9	532	Total			

Summary for Subcatchment E4: EAST TO WETLANDS

Runoff = 27.19 cfs @ 12.11 hrs, Volume= 1.939 af, Depth> 5.01"
Routed to Link OP4 : WETLANDS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
84,051	74	>75% Grass cover, Good, HSG C
118,105	70	Woods, Good, HSG C
202,156	72	Weighted Average
202,156		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0100	0.26		**Sheet Flow, A-B** Cultivated: Residue<=20% n= 0.060 P2= 3.11"
0.8	200	0.0750	4.41		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.5	425	0.1900	13.27	44.23	**Parabolic Channel, C-D** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.035 Earth, dense weeds
7.6	725	Total			

Summary for Subcatchment E5: WEST TO WETLANDS

Runoff = 16.02 cfs @ 12.11 hrs, Volume= 1.131 af, Depth> 5.01"
Routed to Link OP4 : WETLANDS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
3,306	96	Gravel surface, HSG C
32,579	74	>75% Grass cover, Good, HSG C
81,979	70	Woods, Good, HSG C
117,864	72	Weighted Average
117,864		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0100	0.26		**Sheet Flow, A-B** Cultivated: Residue<=20% n= 0.060 P2= 3.11"
0.9	255	0.0850	4.69		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.1	60	0.2500	14.78	39.41	**Parabolic Channel, C-D** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.035 Earth, dense weeds
7.3	415	Total			

Summary for Link OP1: 1008-79-11F

Inflow Area = 3.108 ac, 0.00% Impervious, Inflow Depth > 5.37" for 100 Year Storm event
Inflow = 19.29 cfs @ 12.11 hrs, Volume= 1.391 af
Primary = 19.29 cfs @ 12.11 hrs, Volume= 1.391 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Link OP2: ROADSIDE SWALE

Inflow Area = 7.119 ac, 0.14% Impervious, Inflow Depth > 5.37" for 100 Year Storm event
Inflow = 46.33 cfs @ 12.09 hrs, Volume= 3.188 af
Primary = 46.33 cfs @ 12.09 hrs, Volume= 3.188 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Link OP3: 1010-79-17A

Inflow Area = 2.769 ac, 0.00% Impervious, Inflow Depth > 2.47" for 100 Year Storm event
Inflow = 6.69 cfs @ 12.18 hrs, Volume= 0.570 af
Primary = 6.69 cfs @ 12.18 hrs, Volume= 0.570 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

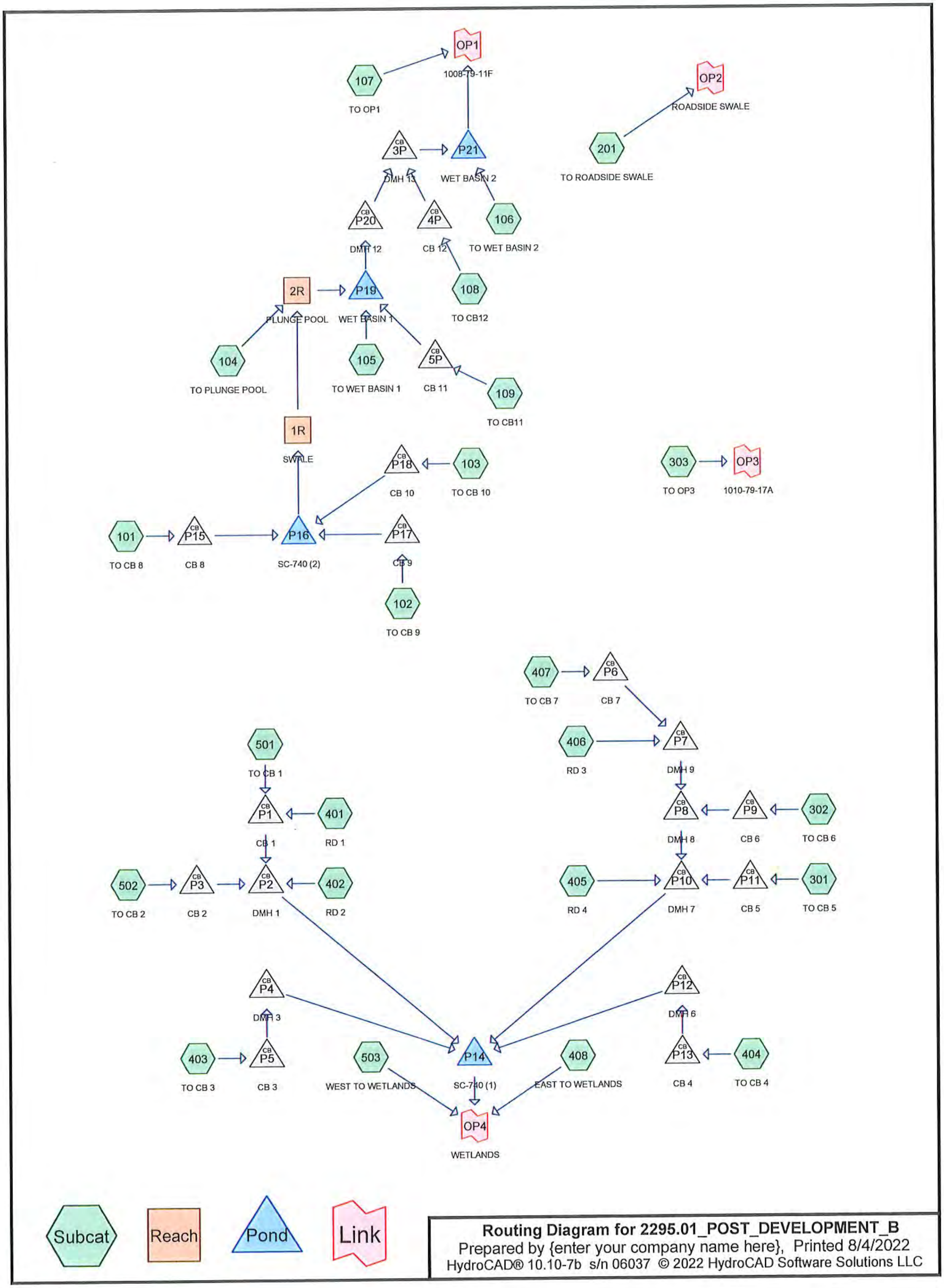
Summary for Link OP4: WETLANDS

Inflow Area = 7.347 ac, 0.00% Impervious, Inflow Depth > 5.01" for 100 Year Storm event
Inflow = 43.20 cfs @ 12.11 hrs, Volume= 3.070 af
Primary = 43.20 cfs @ 12.11 hrs, Volume= 3.070 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Section 2.1

Proposed Conditions
2, 10, & 100 Year Storm Full Summary



Routing Diagram for 2295.01_POST_DEVELOPMENT_B

Prepared by {enter your company name here}, Printed 8/4/2022

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.742	39	>75% Grass cover, Good, HSG A (303)
6.980	74	>75% Grass cover, Good, HSG C (103, 104, 105, 106, 107, 201, 303, 407, 408, 503)
0.234	98	Paved parking, HSG A (301, 302)
3.974	98	Paved parking, HSG C (101, 102, 103, 105, 106, 107, 108, 109, 201, 302, 403, 404, 407, 501, 502)
3.466	98	Roofs, HSG C (401, 402, 405, 406)
0.545	30	Woods, Good, HSG A (303)
4.402	70	Woods, Good, HSG C (106, 107, 201, 303, 408, 503)
20.343	**80**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.521	HSG A	301, 302, 303
0.000	HSG B	
18.822	HSG C	101, 102, 103, 104, 105, 106, 107, 108, 109, 201, 302, 303, 401, 402, 403, 404, 405, 406, 407, 408, 501, 502, 503
0.000	HSG D	
0.000	Other	
20.343		**TOTAL AREA**

Summary for Subcatchment 101: TO CB 8

Runoff = 0.99 cfs @ 12.09 hrs, Volume= 0.077 af, Depth> 2.74"
Routed to Pond P15 : CB 8

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
14,656	98	Paved parking, HSG C
14,656		100.00% Impervious Area

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

Summary for Subcatchment 102: TO CB 9

Runoff = 1.04 cfs @ 12.09 hrs, Volume= 0.081 af, Depth> 2.74"
Routed to Pond P17 : CB 9

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
15,445	98	Paved parking, HSG C
15,445		100.00% Impervious Area

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

Summary for Subcatchment 103: TO CB 10

Runoff = 0.98 cfs @ 12.09 hrs, Volume= 0.068 af, Depth> 1.96"
Routed to Pond P18 : CB 10

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
12,010	98	Paved parking, HSG C
6,006	74	>75% Grass cover, Good, HSG C
18,016	90	Weighted Average
6,006		33.34% Pervious Area
12,010		66.66% Impervious Area

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

Summary for Subcatchment 104: TO PLUNGE POOL

Runoff = 0.78 cfs @ 12.10 hrs, Volume= 0.055 af, Depth> 0.89"
Routed to Reach 2R : PLUNGE POOL

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
32,083	74	>75% Grass cover, Good, HSG C
32,083		100.00% Pervious Area

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

Summary for Subcatchment 105: TO WET BASIN 1

Runoff = 0.82 cfs @ 12.10 hrs, Volume= 0.056 af, Depth> 1.17"
Routed to Pond P19 : WET BASIN 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
5,225	98	Paved parking, HSG C
19,605	74	>75% Grass cover, Good, HSG C
24,830	79	Weighted Average
19,605		78.96% Pervious Area
5,225		21.04% Impervious Area

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

Summary for Subcatchment 106: TO WET BASIN 2

Runoff = 1.47 cfs @ 12.10 hrs, Volume= 0.103 af, Depth> 0.94"
Routed to Pond P21 : WET BASIN 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
7,260	98	Paved parking, HSG C
14,068	74	>75% Grass cover, Good, HSG C
35,523	70	Woods, Good, HSG C
56,851	75	Weighted Average
49,591		87.23% Pervious Area
7,260		12.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	75	0.1500	0.24		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.11"
1.1	160	0.1200	2.42		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.1	85	0.2500	24.21	80.71	**Parabolic Channel, C-D** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.022 Earth, clean & straight
6.3	320	Total			

Summary for Subcatchment 107: TO OP1

Runoff = 0.96 cfs @ 12.17 hrs, Volume= 0.080 af, Depth> 0.79"
Routed to Link OP1 : 1008-79-11F

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
600	98	Paved parking, HSG C
25,268	74	>75% Grass cover, Good, HSG C
26,940	70	Woods, Good, HSG C
52,808	72	Weighted Average
52,208		98.86% Pervious Area
600		1.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	70	0.0320	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.11"
0.8	100	0.0960	2.17		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.0	300	0.1500	5.16	17.19	**Parabolic Channel, C-D** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.080 Earth, long dense weeds
10.8	470	Total			

Summary for Subcatchment 108: TO CB12

Runoff = 0.57 cfs @ 12.09 hrs, Volume= 0.044 af, Depth> 2.74"
Routed to Pond 4P : CB 12

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
8,400	98	Paved parking, HSG C
8,400		100.00% Impervious Area

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

Summary for Subcatchment 109: TO CB11

Runoff = 0.54 cfs @ 12.09 hrs, Volume= 0.042 af, Depth> 2.74"
Routed to Pond 5P : CB 11

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
7,950	98	Paved parking, HSG C
7,950		100.00% Impervious Area

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

Summary for Subcatchment 201: TO ROADSIDE SWALE

Runoff = 2.96 cfs @ 12.20 hrs, Volume= 0.259 af, Depth> 0.84"
Routed to Link OP2 : ROADSIDE SWALE

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
424	98	Paved parking, HSG C
134,797	74	>75% Grass cover, Good, HSG C
26,290	70	Woods, Good, HSG C
161,511	73	Weighted Average
161,087		99.74% Pervious Area
424		0.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	90	0.0270	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.11"
0.4	100	0.3000	3.83		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.5	380	0.1250	12.56	41.85	**Parabolic Channel, C-D** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.030 Earth, grassed & winding
12.7	570	Total			

Summary for Subcatchment 301: TO CB 5

Runoff = 0.61 cfs @ 12.09 hrs, Volume= 0.047 af, Depth> 2.74"
Routed to Pond P11 : CB 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
8,952	98	Paved parking, HSG A
8,952		100.00% Impervious Area

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

Summary for Subcatchment 302: TO CB 6

Runoff = 0.20 cfs @ 12.09 hrs, Volume= 0.015 af, Depth> 2.74"
Routed to Pond P9 : CB 6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
1,250	98	Paved parking, HSG A
1,655	98	Paved parking, HSG C
2,905	98	Weighted Average
2,905		100.00% Impervious Area

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

Summary for Subcatchment 303: TO OP3

Runoff = 0.02 cfs @ 14.72 hrs, Volume= 0.009 af, Depth> 0.06"
Routed to Link OP3 : 1010-79-17A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
32,328	39	>75% Grass cover, Good, HSG A
18,412	74	>75% Grass cover, Good, HSG C
23,735	30	Woods, Good, HSG A
10,524	70	Woods, Good, HSG C
84,999	48	Weighted Average
84,999		100.00% Pervious Area

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

Summary for Subcatchment 401: RD 1

Runoff = 1.84 cfs @ 12.09 hrs, Volume= 0.142 af, Depth> 2.74"
Routed to Pond P1 : CB 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
27,136	98	Roofs, HSG C
27,136		100.00% Impervious Area

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

Summary for Subcatchment 402: RD 2

Runoff = 2.79 cfs @ 12.09 hrs, Volume= 0.217 af, Depth> 2.74"
Routed to Pond P2 : DMH 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
41,280	98	Roofs, HSG C
41,280		100.00% Impervious Area

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

Summary for Subcatchment 403: TO CB 3

Runoff = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af, Depth> 2.74"
Routed to Pond P5 : CB 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
34,409	98	Paved parking, HSG C
34,409		100.00% Impervious Area

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

Summary for Subcatchment 404: TO CB 4

Runoff = 2.41 cfs @ 12.09 hrs, Volume= 0.187 af, Depth> 2.74"
Routed to Pond P13 : CB 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
35,576	98	Paved parking, HSG C
35,576		100.00% Impervious Area

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

Summary for Subcatchment 405: RD 4

Runoff = 2.79 cfs @ 12.09 hrs, Volume= 0.217 af, Depth> 2.74"
Routed to Pond P10 : DMH 7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
41,280	98	Roofs, HSG C
41,280		100.00% Impervious Area

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

Summary for Subcatchment 406: RD 3

Runoff = 2.79 cfs @ 12.09 hrs, Volume= 0.217 af, Depth> 2.74"
Routed to Pond P7 : DMH 9

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
41,280	98	Roofs, HSG C
41,280		100.00% Impervious Area

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

Summary for Subcatchment 407: TO CB 7

Runoff = 1.24 cfs @ 12.09 hrs, Volume= 0.087 af, Depth> 2.14"
Routed to Pond P6 : CB 7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
15,597	98	Paved parking, HSG C
5,745	74	>75% Grass cover, Good, HSG C
21,342	92	Weighted Average
5,745		26.92% Pervious Area
15,597		73.08% Impervious Area

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

Summary for Subcatchment 408: EAST TO WETLANDS

Runoff = 1.33 cfs @ 12.13 hrs, Volume= 0.103 af, Depth> 0.79"
Routed to Link OP4 : WETLANDS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
27,878	74	>75% Grass cover, Good, HSG C
40,375	70	Woods, Good, HSG C
68,253	72	Weighted Average
68,253		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	40	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.11"
0.9	100	0.0750	1.92		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.1	95	0.1900	13.27	44.23	**Parabolic Channel, C-D** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.035 Earth, dense weeds
8.0	235	Total			

Summary for Subcatchment 501: TO CB 1

Runoff = 0.42 cfs @ 12.09 hrs, Volume= 0.033 af, Depth> 2.74"
Routed to Pond P1 : CB 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
6,277	98	Paved parking, HSG C
6,277		100.00% Impervious Area

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

Summary for Subcatchment 502: TO CB 2

Runoff = 0.51 cfs @ 12.09 hrs, Volume= 0.040 af, Depth> 2.74"
Routed to Pond P3 : CB 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
7,604	98	Paved parking, HSG C
7,604		100.00% Impervious Area

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

Summary for Subcatchment 503: WEST TO WETLANDS

Runoff = 1.30 cfs @ 12.14 hrs, Volume= 0.103 af, Depth> 0.74"
Routed to Link OP4 : WETLANDS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Storm Rainfall=3.11"

Area (sf)	CN	Description
20,196	74	>75% Grass cover, Good, HSG C
52,094	70	Woods, Good, HSG C
72,290	71	Weighted Average
72,290		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	40	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.11"
1.3	160	0.0850	2.04		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
8.3	200	Total			

Summary for Reach 1R: SWALE

Inflow Area = 1.105 ac, 87.52% Impervious, Inflow Depth = 0.87" for 2 Year Storm event
Inflow = 1.09 cfs @ 12.33 hrs, Volume= 0.080 af
Outflow = 1.09 cfs @ 12.35 hrs, Volume= 0.080 af, Atten= 0%, Lag= 1.3 min
Routed to Reach 2R : PLUNGE POOL

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.16 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 1.01 fps, Avg. Travel Time= 3.0 min

Peak Storage= 91 cf @ 12.35 hrs
Average Depth at Peak Storage= 0.41' , Surface Width= 2.46'
Bank-Full Depth= 1.50' Flow Area= 6.8 sf, Capacity= 34.54 cfs

0.00' x 1.50' deep channel, n= 0.069 Riprap, 6-inch
Side Slope Z-value= 3.0 '/' Top Width= 9.00'
Length= 180.0' Slope= 0.0889 '/'
Inlet Invert= 230.00', Outlet Invert= 214.00'

Summary for Reach 2R: PLUNGE POOL

Inflow Area = 1.841 ac, 52.51% Impervious, Inflow Depth > 0.88" for 2 Year Storm event
Inflow = 1.47 cfs @ 12.32 hrs, Volume= 0.135 af
Outflow = 1.47 cfs @ 12.32 hrs, Volume= 0.135 af, Atten= 0%, Lag= 0.3 min
Routed to Pond P19 : WET BASIN 1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.05 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.78 fps, Avg. Travel Time= 0.6 min

Peak Storage= 22 cf @ 12.32 hrs
Average Depth at Peak Storage= 0.35' , Surface Width= 1.51'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 22.62 cfs

24.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 60.0' Slope= 0.0100 '/'
Inlet Invert= 210.00', Outlet Invert= 209.40'

Summary for Pond 3P: DMH 13

Inflow Area = 2.787 ac, 52.47% Impervious, Inflow Depth > 1.17" for 2 Year Storm event
Inflow = 1.52 cfs @ 12.44 hrs, Volume= 0.271 af
Outflow = 1.52 cfs @ 12.44 hrs, Volume= 0.271 af, Atten= 0%, Lag= 0.0 min
Primary = 1.52 cfs @ 12.44 hrs, Volume= 0.271 af
Routed to Pond P21 : WET BASIN 2

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 168.33' @ 12.44 hrs
Flood Elev= 174.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	167.70'	**18.0" Round Culvert** L= 90.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 167.70' / 165.00' S= 0.0300 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=1.52 cfs @ 12.44 hrs HW=168.33' TW=153.83' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 1.52 cfs @ 2.14 fps)

Summary for Pond 4P: CB 12

Inflow Area = 0.193 ac,100.00% Impervious, Inflow Depth > 2.74" for 2 Year Storm event
Inflow = 0.57 cfs @ 12.09 hrs, Volume= 0.044 af
Outflow = 0.57 cfs @ 12.09 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.0 min
Primary = 0.57 cfs @ 12.09 hrs, Volume= 0.044 af
Routed to Pond 3P : DMH 13

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 171.43' @ 12.09 hrs
Flood Elev= 174.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	171.00'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 171.00' / 170.80' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.55 cfs @ 12.09 hrs HW=171.42' TW=168.28' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.55 cfs @ 1.75 fps)

Summary for Pond 5P: CB 11

Inflow Area = 0.183 ac,100.00% Impervious, Inflow Depth > 2.74" for 2 Year Storm event
Inflow = 0.54 cfs @ 12.09 hrs, Volume= 0.042 af
Outflow = 0.54 cfs @ 12.09 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min
Primary = 0.54 cfs @ 12.09 hrs, Volume= 0.042 af
Routed to Pond P19 : WET BASIN 1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 214.42' @ 12.09 hrs
Flood Elev= 220.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	214.00'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 214.00' / 212.00' S= 0.1000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.52 cfs @ 12.09 hrs HW=214.41' TW=193.73' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.52 cfs @ 1.72 fps)

Summary for Pond P1: CB 1

Inflow Area = 0.767 ac,100.00% Impervious, Inflow Depth > 2.74" for 2 Year Storm event
Inflow = 2.26 cfs @ 12.09 hrs, Volume= 0.175 af
Outflow = 2.26 cfs @ 12.09 hrs, Volume= 0.175 af, Atten= 0%, Lag= 0.0 min
Primary = 2.26 cfs @ 12.09 hrs, Volume= 0.175 af
Routed to Pond P2 : DMH 1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 241.06' @ 12.09 hrs
Flood Elev= 243.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	240.20'	**15.0" Round Culvert** L= 210.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.20' / 238.30' S= 0.0090 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=2.20 cfs @ 12.09 hrs HW=241.05' TW=239.59' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 2.20 cfs @ 2.48 fps)

Summary for Pond P10: DMH 7

Inflow Area = 2.657 ac, 95.04% Impervious, Inflow Depth > 2.63" for 2 Year Storm event
Inflow = 7.63 cfs @ 12.09 hrs, Volume= 0.582 af
Outflow = 7.63 cfs @ 12.09 hrs, Volume= 0.582 af, Atten= 0%, Lag= 0.0 min
Primary = 7.63 cfs @ 12.09 hrs, Volume= 0.582 af
Routed to Pond P14 : SC-740 (1)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 238.97' @ 12.09 hrs
Flood Elev= 241.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	237.55'	**24.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 237.55' / 235.70' S= 0.0185 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=7.43 cfs @ 12.09 hrs HW=238.95' TW=235.83' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 7.43 cfs @ 3.17 fps)

Summary for Pond P11: CB 5

Inflow Area = 0.206 ac,100.00% Impervious, Inflow Depth > 2.74" for 2 Year Storm event
Inflow = 0.61 cfs @ 12.09 hrs, Volume= 0.047 af
Outflow = 0.61 cfs @ 12.09 hrs, Volume= 0.047 af, Atten= 0%, Lag= 0.0 min
Primary = 0.61 cfs @ 12.09 hrs, Volume= 0.047 af
Routed to Pond P10 : DMH 7

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 239.00' @ 12.13 hrs
Flood Elev= 241.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	237.75'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 237.75' / 237.65' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=238.87' TW=238.94' (Dynamic Tailwater)
↑—**1=Culvert** (Controls 0.00 cfs)

Summary for Pond P12: DMH 6

Inflow Area = 0.817 ac,100.00% Impervious, Inflow Depth > 2.74" for 2 Year Storm event
Inflow = 2.41 cfs @ 12.09 hrs, Volume= 0.187 af
Outflow = 2.41 cfs @ 12.09 hrs, Volume= 0.187 af, Atten= 0%, Lag= 0.0 min
Primary = 2.41 cfs @ 12.09 hrs, Volume= 0.187 af
Routed to Pond P14 : SC-740 (1)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 236.77' @ 12.09 hrs
Flood Elev= 240.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.80'	**15.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.80' / 235.70' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=2.34 cfs @ 12.09 hrs HW=236.76' TW=235.82' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 2.34 cfs @ 3.22 fps)

Summary for Pond P13: CB 4

Inflow Area = 0.817 ac,100.00% Impervious, Inflow Depth > 2.74" for 2 Year Storm event
Inflow = 2.41 cfs @ 12.09 hrs, Volume= 0.187 af
Outflow = 2.41 cfs @ 12.09 hrs, Volume= 0.187 af, Atten= 0%, Lag= 0.0 min
Primary = 2.41 cfs @ 12.09 hrs, Volume= 0.187 af
Routed to Pond P12 : DMH 6

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 237.60' @ 12.09 hrs
Flood Elev= 239.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	236.70'	**15.0" Round Culvert** L= 80.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.70' / 235.90' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=2.34 cfs @ 12.09 hrs HW=237.58' TW=236.76' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 2.34 cfs @ 2.53 fps)

Summary for Pond P14: SC-740 (1)

Inflow Area = 6.153 ac, 97.86% Impervious, Inflow Depth > 2.69" for 2 Year Storm event
Inflow = 17.93 cfs @ 12.09 hrs, Volume= 1.381 af
Outflow = 3.11 cfs @ 12.55 hrs, Volume= 1.140 af, Atten= 83%, Lag= 27.7 min
Discarded = 0.93 cfs @ 12.55 hrs, Volume= 0.866 af
Primary = 2.18 cfs @ 12.55 hrs, Volume= 0.274 af
Routed to Link OP4 : WETLANDS

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 236.41' @ 12.55 hrs Surf.Area= 40,388 sf Storage= 27,284 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 93.7 min (825.5 - 731.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	235.00'	17,614 cf	**49.00'W x 409.46'L x 3.50'H Field A** 70,222 cf Overall - 26,186 cf Embedded = 44,036 cf x 40.0% Voids
#2A	235.50'	26,186 cf	**ADS_StormTech SC-740 +Cap** x 570 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 570 Chambers in 10 Rows
#3	236.00'	43,656 cf	**Custom Stage Data (Conic)**Listed below (Recalc)
#4	234.00'	8,036 cf	**49.00'W x 410.00'L x 1.00'H Prismatoid** 20,090 cf Overall x 40.0% Voids
		95,492 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
236.00	100	0	0	100
238.70	2,000	2,292	2,292	2,018
240.00	12,000	8,190	10,482	12,024
240.80	22,000	13,399	23,882	22,031
241.50	35,000	19,775	43,656	35,038

Device	Routing	Invert	Outlet Devices
#1	Discarded	234.00'	**1.000 in/hr Exfiltration over Surface area**
#2	Primary	235.80'	**24.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.80' / 234.70' S= 0.0275 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Discarded OutFlow Max=0.93 cfs @ 12.55 hrs HW=236.41' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.93 cfs)

Primary OutFlow Max=2.18 cfs @ 12.55 hrs HW=236.41' TW=0.00' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 2.18 cfs @ 2.67 fps)

Summary for Pond P15: CB 8

Inflow Area = 0.336 ac,100.00% Impervious, Inflow Depth > 2.74" for 2 Year Storm event
Inflow = 0.99 cfs @ 12.09 hrs, Volume= 0.077 af
Outflow = 0.99 cfs @ 12.09 hrs, Volume= 0.077 af, Atten= 0%, Lag= 0.0 min
Primary = 0.99 cfs @ 12.09 hrs, Volume= 0.077 af
Routed to Pond P16 : SC-740 (2)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 240.59' @ 12.09 hrs
Flood Elev= 243.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	240.00'	**12.0" Round Culvert** L= 120.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.00' / 233.10' S= 0.0575 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.96 cfs @ 12.09 hrs HW=240.58' TW=233.91' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.96 cfs @ 2.05 fps)

Summary for Pond P16: SC-740 (2)

Inflow Area = 1.105 ac, 87.52% Impervious, Inflow Depth > 2.45" for 2 Year Storm event
Inflow = 3.02 cfs @ 12.09 hrs, Volume= 0.225 af
Outflow = 1.16 cfs @ 12.33 hrs, Volume= 0.162 af, Atten= 61%, Lag= 14.4 min
Discarded = 0.07 cfs @ 9.50 hrs, Volume= 0.082 af
Primary = 1.09 cfs @ 12.33 hrs, Volume= 0.080 af
Routed to Reach 1R : SWALE

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 234.33' @ 12.33 hrs Surf.Area= 3,095 sf Storage= 3,868 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 41.9 min (785.1 - 743.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	232.50'	2,789 cf	**34.75'W x 89.06'L x 3.50'H Field A** 10,832 cf Overall - 3,859 cf Embedded = 6,973 cf x 40.0% Voids
#2A	233.00'	3,859 cf	**ADS_StormTech SC-740 +Cap** x 84 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 84 Chambers in 7 Rows
		6,648 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	232.50'	**1.000 in/hr Exfiltration over Surface area**
#2	Primary	233.90'	**24.0" Round Culvert** L= 80.0' CPP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 233.90' / 233.10' S= 0.0100 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Discarded OutFlow Max=0.07 cfs @ 9.50 hrs HW=232.54' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=1.09 cfs @ 12.33 hrs HW=234.33' TW=230.41' (Dynamic Tailwater)
2=Culvert (Inlet Controls 1.09 cfs @ 2.22 fps)

Summary for Pond P17: CB 9

Inflow Area = 0.355 ac,100.00% Impervious, Inflow Depth > 2.74" for 2 Year Storm event
Inflow = 1.04 cfs @ 12.09 hrs, Volume= 0.081 af
Outflow = 1.04 cfs @ 12.09 hrs, Volume= 0.081 af, Atten= 0%, Lag= 0.0 min
Primary = 1.04 cfs @ 12.09 hrs, Volume= 0.081 af
Routed to Pond P16 : SC-740 (2)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 234.71' @ 12.09 hrs
Flood Elev= 241.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	234.10'	**12.0" Round Culvert** L= 35.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 234.10' / 233.10' S= 0.0286 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.02 cfs @ 12.09 hrs HW=234.70' TW=233.91' (Dynamic Tailwater)
1=Culvert (Inlet Controls 1.02 cfs @ 2.08 fps)

Summary for Pond P18: CB 10

Inflow Area = 0.414 ac, 66.66% Impervious, Inflow Depth > 1.96" for 2 Year Storm event
Inflow = 0.98 cfs @ 12.09 hrs, Volume= 0.068 af
Outflow = 0.98 cfs @ 12.09 hrs, Volume= 0.068 af, Atten= 0%, Lag= 0.0 min
Primary = 0.98 cfs @ 12.09 hrs, Volume= 0.068 af
Routed to Pond P16 : SC-740 (2)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 234.35' @ 12.36 hrs
Flood Elev= 236.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	233.40'	**12.0" Round Culvert** L= 60.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 233.40' / 233.10' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.63 cfs @ 12.09 hrs HW=234.07' TW=233.92' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.63 cfs @ 1.59 fps)

Summary for Pond P19: WET BASIN 1

Inflow Area = 2.594 ac, 48.93% Impervious, Inflow Depth > 1.07" for 2 Year Storm event
Inflow = 2.14 cfs @ 12.10 hrs, Volume= 0.232 af
Outflow = 1.39 cfs @ 12.52 hrs, Volume= 0.227 af, Atten= 35%, Lag= 25.0 min
Primary = 1.39 cfs @ 12.52 hrs, Volume= 0.227 af
Routed to Pond P20 : DMH 12

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 193.20' Surf.Area= 2,028 sf Storage= 4,687 cf
Peak Elev= 194.21' @ 12.52 hrs Surf.Area= 2,424 sf Storage= 6,937 cf (2,251 cf above start)

Plug-Flow detention time= 177.2 min calculated for 0.119 af (51% of inflow)
Center-of-Mass det. time= 27.4 min (819.4 - 791.9)

Volume	Invert	Avail.Storage	Storage Description
#1	190.00'	29,445 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
190.00	950	0	0
192.00	1,575	2,525	2,525
194.00	2,330	3,905	6,430
196.00	3,215	5,545	11,975
198.00	4,220	7,435	19,410
200.00	5,815	10,035	29,445

Device	Routing	Invert	Outlet Devices
#1	Primary	186.00'	**15.0" Round Culvert** L= 180.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 186.00' / 175.20' S= 0.0600 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	199.00'	**29.0" x 20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	197.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	193.20'	**8.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.38 cfs @ 12.52 hrs HW=194.21' TW=174.75' (Dynamic Tailwater)
1=Culvert (Passes 1.38 cfs of 16.28 cfs potential flow)
2=Orifice/Grate (Controls 0.00 cfs)
3=Orifice/Grate (Controls 0.00 cfs)
4=Orifice/Grate (Orifice Controls 1.38 cfs @ 3.97 fps)

Summary for Pond P2: DMH 1

Inflow Area = 1.889 ac,100.00% Impervious, Inflow Depth > 2.74" for 2 Year Storm event
Inflow = 5.57 cfs @ 12.09 hrs, Volume= 0.432 af
Outflow = 5.57 cfs @ 12.09 hrs, Volume= 0.432 af, Atten= 0%, Lag= 0.0 min
Primary = 5.57 cfs @ 12.09 hrs, Volume= 0.432 af
Routed to Pond P14 : SC-740 (1)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 239.62' @ 12.09 hrs
Flood Elev= 241.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	238.20'	**18.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 238.20' / 235.60' S= 0.0260 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=5.42 cfs @ 12.09 hrs HW=239.59' TW=235.82' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 5.42 cfs @ 3.17 fps)

Summary for Pond P20: DMH 12

Inflow Area = 2.594 ac, 48.93% Impervious, Inflow Depth > 1.05" for 2 Year Storm event
Inflow = 1.39 cfs @ 12.52 hrs, Volume= 0.227 af
Outflow = 1.39 cfs @ 12.52 hrs, Volume= 0.227 af, Atten= 0%, Lag= 0.0 min
Primary = 1.39 cfs @ 12.52 hrs, Volume= 0.227 af
Routed to Pond 3P : DMH 13

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 174.75' @ 12.52 hrs
Flood Elev= 181.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	174.10'	**15.0" Round Culvert** L= 65.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 174.10' / 170.85' S= 0.0500 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=1.38 cfs @ 12.52 hrs HW=174.75' TW=168.33' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 1.38 cfs @ 2.16 fps)

Summary for Pond P21: WET BASIN 2

Inflow Area = 4.092 ac, 39.81% Impervious, Inflow Depth > 1.09" for 2 Year Storm event
Inflow = 2.85 cfs @ 12.11 hrs, Volume= 0.373 af
Outflow = 2.40 cfs @ 12.21 hrs, Volume= 0.370 af, Atten= 16%, Lag= 5.9 min
Primary = 2.40 cfs @ 12.21 hrs, Volume= 0.370 af
Routed to Link OP1 : 1008-79-11F

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 153.00' Surf.Area= 950 sf Storage= 1,825 cf
Peak Elev= 153.90' @ 12.21 hrs Surf.Area= 1,175 sf Storage= 2,779 cf (954 cf above start)

Plug-Flow detention time= 63.0 min calculated for 0.328 af (88% of inflow)
Center-of-Mass det. time= 8.5 min (816.7 - 808.2)

Volume	Invert	Avail.Storage	Storage Description
#1	150.00'	17,020 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
150.00	300	0	0
152.00	700	1,000	1,000
154.00	1,200	1,900	2,900
156.00	1,900	3,100	6,000
158.00	2,720	4,620	10,620
160.00	3,680	6,400	17,020

Device	Routing	Invert	Outlet Devices
#1	Primary	151.80'	**12.0" Round Culvert** L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 151.80' / 150.00' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	153.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	158.60'	**29.0" x 20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.39 cfs @ 12.21 hrs HW=153.89' TW=0.00' (Dynamic Tailwater)
└1=**Culvert** (Passes 2.39 cfs of 4.78 cfs potential flow)
  ├2=**Orifice/Grate** (Orifice Controls 2.39 cfs @ 3.22 fps)
  └3=**Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond P3: CB 2

Inflow Area = 0.175 ac,100.00% Impervious, Inflow Depth > 2.74" for 2 Year Storm event
Inflow = 0.51 cfs @ 12.09 hrs, Volume= 0.040 af
Outflow = 0.51 cfs @ 12.09 hrs, Volume= 0.040 af, Atten= 0%, Lag= 0.0 min
Primary = 0.51 cfs @ 12.09 hrs, Volume= 0.040 af
Routed to Pond P2 : DMH 1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 239.64' @ 12.14 hrs
Flood Elev= 241.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	238.40'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 238.40' / 238.30' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=239.49' TW=239.59' (Dynamic Tailwater)
└1=**Culvert** (Controls 0.00 cfs)

Summary for Pond P4: DMH 3

Inflow Area = 0.790 ac,100.00% Impervious, Inflow Depth > 2.74" for 2 Year Storm event
Inflow = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af
Outflow = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af, Atten= 0%, Lag= 0.0 min
Primary = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af
Routed to Pond P14 : SC-740 (1)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 236.65' @ 12.09 hrs
Flood Elev= 240.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.70'	**15.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.70' / 235.60' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=2.26 cfs @ 12.09 hrs HW=236.64' TW=235.82' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 2.26 cfs @ 3.19 fps)

Summary for Pond P5: CB 3

Inflow Area = 0.790 ac,100.00% Impervious, Inflow Depth > 2.74" for 2 Year Storm event
Inflow = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af
Outflow = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af, Atten= 0%, Lag= 0.0 min
Primary = 2.33 cfs @ 12.09 hrs, Volume= 0.180 af
Routed to Pond P4 : DMH 3

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 237.58' @ 12.09 hrs
Flood Elev= 239.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	236.70'	**15.0" Round Culvert** L= 70.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.70' / 236.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=2.26 cfs @ 12.09 hrs HW=237.56' TW=236.64' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 2.26 cfs @ 2.50 fps)

Summary for Pond P6: CB 7

Inflow Area = 0.490 ac, 73.08% Impervious, Inflow Depth > 2.14" for 2 Year Storm event
Inflow = 1.24 cfs @ 12.09 hrs, Volume= 0.087 af
Outflow = 1.24 cfs @ 12.09 hrs, Volume= 0.087 af, Atten= 0%, Lag= 0.0 min
Primary = 1.24 cfs @ 12.09 hrs, Volume= 0.087 af
Routed to Pond P7 : DMH 9

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 241.15' @ 12.12 hrs
Flood Elev= 243.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	240.40'	**15.0" Round Culvert** L= 130.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.40' / 239.70' S= 0.0054 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=1.03 cfs @ 12.09 hrs HW=241.12' TW=240.78' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 1.03 cfs @ 2.03 fps)

Summary for Pond P7: DMH 9

Inflow Area = 1.438 ac, 90.83% Impervious, Inflow Depth > 2.54" for 2 Year Storm event
Inflow = 4.04 cfs @ 12.09 hrs, Volume= 0.304 af
Outflow = 4.04 cfs @ 12.09 hrs, Volume= 0.304 af, Atten= 0%, Lag= 0.0 min
Primary = 4.04 cfs @ 12.09 hrs, Volume= 0.304 af
Routed to Pond P8 : DMH 8

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 240.80' @ 12.11 hrs
Flood Elev= 245.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	239.60'	**18.0" Round Culvert** L= 65.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 239.60' / 239.20' S= 0.0062 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=3.52 cfs @ 12.09 hrs HW=240.77' TW=240.28' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 3.52 cfs @ 3.27 fps)

Summary for Pond P8: DMH 8

Inflow Area = 1.504 ac, 91.23% Impervious, Inflow Depth > 2.54" for 2 Year Storm event
Inflow = 4.23 cfs @ 12.09 hrs, Volume= 0.319 af
Outflow = 4.23 cfs @ 12.09 hrs, Volume= 0.319 af, Atten= 0%, Lag= 0.0 min
Primary = 4.23 cfs @ 12.09 hrs, Volume= 0.319 af
Routed to Pond P10 : DMH 7

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 240.31' @ 12.10 hrs
Flood Elev= 244.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	239.10'	**18.0" Round Culvert** L= 285.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 239.10' / 237.65' S= 0.0051 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=3.97 cfs @ 12.09 hrs HW=240.28' TW=238.95' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 3.97 cfs @ 3.65 fps)

Summary for Pond P9: CB 6

Inflow Area = 0.067 ac,100.00% Impervious, Inflow Depth > 2.74" for 2 Year Storm event
Inflow = 0.20 cfs @ 12.09 hrs, Volume= 0.015 af
Outflow = 0.20 cfs @ 12.09 hrs, Volume= 0.015 af, Atten= 0%, Lag= 0.0 min
Primary = 0.20 cfs @ 12.09 hrs, Volume= 0.015 af
Routed to Pond P8 : DMH 8

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 240.31' @ 12.15 hrs
Flood Elev= 244.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	239.40'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 239.40' / 239.20' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=240.16' TW=240.28' (Dynamic Tailwater)
↑—**1=Culvert** (Controls 0.00 cfs)

Summary for Link OP1: 1008-79-11F

Inflow Area = 5.304 ac, 30.97% Impervious, Inflow Depth > 1.02" for 2 Year Storm event
Inflow = 3.32 cfs @ 12.19 hrs, Volume= 0.450 af
Primary = 3.32 cfs @ 12.19 hrs, Volume= 0.450 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Link OP2: ROADSIDE SWALE

Inflow Area = 3.708 ac, 0.26% Impervious, Inflow Depth > 0.84" for 2 Year Storm event
Inflow = 2.96 cfs @ 12.20 hrs, Volume= 0.259 af
Primary = 2.96 cfs @ 12.20 hrs, Volume= 0.259 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Link OP3: 1010-79-17A

Inflow Area = 1.951 ac, 0.00% Impervious, Inflow Depth > 0.06" for 2 Year Storm event
Inflow = 0.02 cfs @ 14.72 hrs, Volume= 0.009 af
Primary = 0.02 cfs @ 14.72 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Link OP4: WETLANDS

Inflow Area =	9.380 ac,	64.20% Impervious,	Inflow Depth > 0.61"	for 2 Year Storm event	
Inflow =	3.26 cfs @	12.42 hrs,	Volume=	0.480 af	
Primary =	3.26 cfs @	12.42 hrs,	Volume=	0.480 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Subcatchment 101: TO CB 8

Runoff = 1.53 cfs @ 12.09 hrs, Volume= 0.121 af, Depth> 4.31"
Routed to Pond P15 : CB 8

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
14,656	98	Paved parking, HSG C
14,656		100.00% Impervious Area

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

Summary for Subcatchment 102: TO CB 9

Runoff = 1.61 cfs @ 12.09 hrs, Volume= 0.127 af, Depth> 4.31"
Routed to Pond P17 : CB 9

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
15,445	98	Paved parking, HSG C
15,445		100.00% Impervious Area

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

Summary for Subcatchment 103: TO CB 10

Runoff = 1.67 cfs @ 12.09 hrs, Volume= 0.118 af, Depth> 3.44"
Routed to Pond P18 : CB 10

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
12,010	98	Paved parking, HSG C
6,006	74	>75% Grass cover, Good, HSG C
18,016	90	Weighted Average
6,006		33.34% Pervious Area
12,010		66.66% Impervious Area

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

Summary for Subcatchment 104: TO PLUNGE POOL

Runoff = 1.82 cfs @ 12.10 hrs, Volume= 0.123 af, Depth> 2.00"
Routed to Reach 2R : PLUNGE POOL

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
32,083	74	>75% Grass cover, Good, HSG C
32,083		100.00% Pervious Area

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

Summary for Subcatchment 105: TO WET BASIN 1

Runoff = 1.70 cfs @ 12.09 hrs, Volume= 0.115 af, Depth> 2.41"
Routed to Pond P19 : WET BASIN 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
5,225	98	Paved parking, HSG C
19,605	74	>75% Grass cover, Good, HSG C
24,830	79	Weighted Average
19,605		78.96% Pervious Area
5,225		21.04% Impervious Area

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

Summary for Subcatchment 106: TO WET BASIN 2

Runoff = 3.33 cfs @ 12.10 hrs, Volume= 0.227 af, Depth> 2.08"
Routed to Pond P21 : WET BASIN 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
7,260	98	Paved parking, HSG C
14,068	74	>75% Grass cover, Good, HSG C
35,523	70	Woods, Good, HSG C
56,851	75	Weighted Average
49,591		87.23% Pervious Area
7,260		12.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	75	0.1500	0.24		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.11"
1.1	160	0.1200	2.42		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.1	85	0.2500	24.21	80.71	**Parabolic Channel, C-D** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.022 Earth, clean & straight
6.3	320	Total			

Summary for Subcatchment 107: TO OP1

Runoff = 2.37 cfs @ 12.16 hrs, Volume= 0.187 af, Depth> 1.85"
Routed to Link OP1 : 1008-79-11F

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
600	98	Paved parking, HSG C
25,268	74	>75% Grass cover, Good, HSG C
26,940	70	Woods, Good, HSG C
52,808	72	Weighted Average
52,208		98.86% Pervious Area
600		1.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	70	0.0320	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.11"
0.8	100	0.0960	2.17		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.0	300	0.1500	5.16	17.19	**Parabolic Channel, C-D** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.080 Earth, long dense weeds
10.8	470	Total			

Summary for Subcatchment 108: TO CB12

Runoff = 0.87 cfs @ 12.09 hrs, Volume= 0.069 af, Depth> 4.31"
Routed to Pond 4P : CB 12

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
8,400	98	Paved parking, HSG C
8,400		100.00% Impervious Area

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

Summary for Subcatchment 109: TO CB11

Runoff = 0.83 cfs @ 12.09 hrs, Volume= 0.065 af, Depth> 4.31"
Routed to Pond 5P : CB 11

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
7,950	98	Paved parking, HSG C
7,950		100.00% Impervious Area

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

Summary for Subcatchment 201: TO ROADSIDE SWALE

Runoff = 7.12 cfs @ 12.18 hrs, Volume= 0.594 af, Depth> 1.92"
Routed to Link OP2 : ROADSIDE SWALE

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
424	98	Paved parking, HSG C
134,797	74	>75% Grass cover, Good, HSG C
26,290	70	Woods, Good, HSG C
161,511	73	Weighted Average
161,087		99.74% Pervious Area
424		0.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	90	0.0270	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.11"
0.4	100	0.3000	3.83		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.5	380	0.1250	12.56	41.85	**Parabolic Channel, C-D** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.030 Earth, grassed & winding
12.7	570	Total			

Summary for Subcatchment 301: TO CB 5

Runoff = 0.93 cfs @ 12.09 hrs, Volume= 0.074 af, Depth> 4.31"
Routed to Pond P11 : CB 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
8,952	98	Paved parking, HSG A
8,952		100.00% Impervious Area

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

Summary for Subcatchment 302: TO CB 6

Runoff = 0.30 cfs @ 12.09 hrs, Volume= 0.024 af, Depth> 4.31"
Routed to Pond P9 : CB 6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
1,250	98	Paved parking, HSG A
1,655	98	Paved parking, HSG C
2,905	98	Weighted Average
2,905		100.00% Impervious Area

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

Summary for Subcatchment 303: TO OP3

Runoff = 0.51 cfs @ 12.17 hrs, Volume= 0.069 af, Depth> 0.43"
Routed to Link OP3 : 1010-79-17A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
32,328	39	>75% Grass cover, Good, HSG A
18,412	74	>75% Grass cover, Good, HSG C
23,735	30	Woods, Good, HSG A
10,524	70	Woods, Good, HSG C
84,999	48	Weighted Average
84,999		100.00% Pervious Area

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

Summary for Subcatchment 401: RD 1

Runoff = 2.83 cfs @ 12.09 hrs, Volume= 0.224 af, Depth> 4.31"
Routed to Pond P1 : CB 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
27,136	98	Roofs, HSG C
27,136		100.00% Impervious Area

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

Summary for Subcatchment 402: RD 2

Runoff = 4.30 cfs @ 12.09 hrs, Volume= 0.340 af, Depth> 4.31"
Routed to Pond P2 : DMH 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
41,280	98	Roofs, HSG C
41,280		100.00% Impervious Area

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

Summary for Subcatchment 403: TO CB 3

Runoff = 3.58 cfs @ 12.09 hrs, Volume= 0.283 af, Depth> 4.31"
Routed to Pond P5 : CB 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
34,409	98	Paved parking, HSG C
34,409		100.00% Impervious Area

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

Summary for Subcatchment 404: TO CB 4

Runoff = 3.70 cfs @ 12.09 hrs, Volume= 0.293 af, Depth> 4.31"
Routed to Pond P13 : CB 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
35,576	98	Paved parking, HSG C
35,576		100.00% Impervious Area

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

Summary for Subcatchment 405: RD 4

Runoff = 4.30 cfs @ 12.09 hrs, Volume= 0.340 af, Depth> 4.31"
Routed to Pond P10 : DMH 7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
41,280	98	Roofs, HSG C
41,280		100.00% Impervious Area

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

Summary for Subcatchment 406: RD 3

Runoff = 4.30 cfs @ 12.09 hrs, Volume= 0.340 af, Depth> 4.31"
Routed to Pond P7 : DMH 9

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
41,280	98	Roofs, HSG C
41,280		100.00% Impervious Area

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

Summary for Subcatchment 407: TO CB 7

Runoff = 2.06 cfs @ 12.09 hrs, Volume= 0.149 af, Depth> 3.64"
Routed to Pond P6 : CB 7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
15,597	98	Paved parking, HSG C
5,745	74	>75% Grass cover, Good, HSG C
21,342	92	Weighted Average
5,745		26.92% Pervious Area
15,597		73.08% Impervious Area

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

Summary for Subcatchment 408: EAST TO WETLANDS

Runoff = 3.34 cfs @ 12.12 hrs, Volume= 0.242 af, Depth> 1.85"
Routed to Link OP4 : WETLANDS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
27,878	74	>75% Grass cover, Good, HSG C
40,375	70	Woods, Good, HSG C
68,253	72	Weighted Average
68,253		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	40	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.11"
0.9	100	0.0750	1.92		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.1	95	0.1900	13.27	44.23	**Parabolic Channel, C-D** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.035 Earth, dense weeds
8.0	235	Total			

Summary for Subcatchment 501: TO CB 1

Runoff = 0.65 cfs @ 12.09 hrs, Volume= 0.052 af, Depth> 4.31"
Routed to Pond P1 : CB 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
6,277	98	Paved parking, HSG C
6,277		100.00% Impervious Area

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

Summary for Subcatchment 502: TO CB 2

Runoff = 0.79 cfs @ 12.09 hrs, Volume= 0.063 af, Depth> 4.31"
Routed to Pond P3 : CB 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
7,604	98	Paved parking, HSG C
7,604		100.00% Impervious Area

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

Summary for Subcatchment 503: WEST TO WETLANDS

Runoff = 3.35 cfs @ 12.12 hrs, Volume= 0.245 af, Depth> 1.77"
Routed to Link OP4 : WETLANDS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Storm Rainfall=4.75"

Area (sf)	CN	Description
20,196	74	>75% Grass cover, Good, HSG C
52,094	70	Woods, Good, HSG C
72,290	71	Weighted Average
72,290		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	40	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.11"
1.3	160	0.0850	2.04		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
8.3	200	Total			

Summary for Reach 1R: SWALE

Inflow Area = 1.105 ac, 87.52% Impervious, Inflow Depth > 2.24" for 10 Year Storm event
Inflow = 3.77 cfs @ 12.16 hrs, Volume= 0.206 af
Outflow = 3.76 cfs @ 12.17 hrs, Volume= 0.206 af, Atten= 0%, Lag= 0.8 min
Routed to Reach 2R : PLUNGE POOL

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.93 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.26 fps, Avg. Travel Time= 2.4 min

Peak Storage= 230 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.65' , Surface Width= 3.92'
Bank-Full Depth= 1.50' Flow Area= 6.8 sf, Capacity= 34.54 cfs

0.00' x 1.50' deep channel, n= 0.069 Riprap, 6-inch
Side Slope Z-value= 3.0 '/' Top Width= 9.00'
Length= 180.0' Slope= 0.0889 '/'
Inlet Invert= 230.00', Outlet Invert= 214.00'

Summary for Reach 2R: PLUNGE POOL

Inflow Area = 1.841 ac, 52.51% Impervious, Inflow Depth > 2.14" for 10 Year Storm event
Inflow = 5.21 cfs @ 12.15 hrs, Volume= 0.329 af
Outflow = 5.21 cfs @ 12.15 hrs, Volume= 0.329 af, Atten= 0%, Lag= 0.1 min
Routed to Pond P19 : WET BASIN 1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.85 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.12 fps, Avg. Travel Time= 0.5 min

Peak Storage= 53 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.65' , Surface Width= 1.88'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 22.62 cfs

24.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 60.0' Slope= 0.0100 '/'
Inlet Invert= 210.00', Outlet Invert= 209.40'

Summary for Pond 3P: DMH 13

Inflow Area = 2.787 ac, 52.47% Impervious, Inflow Depth > 2.46" for 10 Year Storm event
Inflow = 2.79 cfs @ 12.37 hrs, Volume= 0.570 af
Outflow = 2.79 cfs @ 12.37 hrs, Volume= 0.570 af, Atten= 0%, Lag= 0.0 min
Primary = 2.79 cfs @ 12.37 hrs, Volume= 0.570 af
Routed to Pond P21 : WET BASIN 2

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 168.59' @ 12.37 hrs
Flood Elev= 174.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	167.70'	**18.0" Round Culvert** L= 90.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 167.70' / 165.00' S= 0.0300 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=2.79 cfs @ 12.37 hrs HW=168.59' TW=154.82' (Dynamic Tailwater)
1=Culvert (Inlet Controls 2.79 cfs @ 2.54 fps)

Summary for Pond 4P: CB 12

Inflow Area = 0.193 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 0.87 cfs @ 12.09 hrs, Volume= 0.069 af
Outflow = 0.87 cfs @ 12.09 hrs, Volume= 0.069 af, Atten= 0%, Lag= 0.0 min
Primary = 0.87 cfs @ 12.09 hrs, Volume= 0.069 af
Routed to Pond 3P : DMH 13

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 171.55' @ 12.09 hrs
Flood Elev= 174.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	171.00'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 171.00' / 170.80' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.85 cfs @ 12.09 hrs HW=171.54' TW=168.53' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.85 cfs @ 2.85 fps)

Summary for Pond 5P: CB 11

Inflow Area = 0.183 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 0.83 cfs @ 12.09 hrs, Volume= 0.065 af
Outflow = 0.83 cfs @ 12.09 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min
Primary = 0.83 cfs @ 12.09 hrs, Volume= 0.065 af
Routed to Pond P19 : WET BASIN 1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 214.53' @ 12.09 hrs
Flood Elev= 220.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	214.00'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 214.00' / 212.00' S= 0.1000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.81 cfs @ 12.09 hrs HW=214.52' TW=194.47' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.81 cfs @ 1.94 fps)

Summary for Pond P1: CB 1

Inflow Area = 0.767 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 3.48 cfs @ 12.09 hrs, Volume= 0.275 af
Outflow = 3.48 cfs @ 12.09 hrs, Volume= 0.275 af, Atten= 0%, Lag= 0.0 min
Primary = 3.48 cfs @ 12.09 hrs, Volume= 0.275 af
Routed to Pond P2 : DMH 1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 241.44' @ 12.11 hrs
Flood Elev= 243.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	240.20'	**15.0" Round Culvert** L= 210.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.20' / 238.30' S= 0.0090 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=3.03 cfs @ 12.09 hrs HW=241.40' TW=240.49' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 3.03 cfs @ 3.20 fps)

Summary for Pond P10: DMH 7

Inflow Area = 2.657 ac, 95.04% Impervious, Inflow Depth > 4.18" for 10 Year Storm event
Inflow = 11.89 cfs @ 12.09 hrs, Volume= 0.926 af
Outflow = 11.89 cfs @ 12.09 hrs, Volume= 0.926 af, Atten= 0%, Lag= 0.0 min
Primary = 11.89 cfs @ 12.09 hrs, Volume= 0.926 af
Routed to Pond P14 : SC-740 (1)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 239.52' @ 12.09 hrs
Flood Elev= 241.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	237.55'	**24.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 237.55' / 235.70' S= 0.0185 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=11.59 cfs @ 12.09 hrs HW=239.48' TW=236.59' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 11.59 cfs @ 3.73 fps)

Summary for Pond P11: CB 5

Inflow Area = 0.206 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 0.93 cfs @ 12.09 hrs, Volume= 0.074 af
Outflow = 0.93 cfs @ 12.09 hrs, Volume= 0.074 af, Atten= 0%, Lag= 0.0 min
Primary = 0.93 cfs @ 12.09 hrs, Volume= 0.074 af
Routed to Pond P10 : DMH 7

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 239.59' @ 12.13 hrs
Flood Elev= 241.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	237.75'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 237.75' / 237.65' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=239.37' TW=239.48' (Dynamic Tailwater)
└─**1=Culvert** (Controls 0.00 cfs)

Summary for Pond P12: DMH 6

Inflow Area = 0.817 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 3.70 cfs @ 12.09 hrs, Volume= 0.293 af
Outflow = 3.70 cfs @ 12.09 hrs, Volume= 0.293 af, Atten= 0%, Lag= 0.0 min
Primary = 3.70 cfs @ 12.09 hrs, Volume= 0.293 af
Routed to Pond P14 : SC-740 (1)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 237.19' @ 12.35 hrs
Flood Elev= 240.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.80'	**15.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.80' / 235.70' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=3.24 cfs @ 12.09 hrs HW=237.07' TW=236.59' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 3.24 cfs @ 2.64 fps)

Summary for Pond P13: CB 4

Inflow Area = 0.817 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 3.70 cfs @ 12.09 hrs, Volume= 0.293 af
Outflow = 3.70 cfs @ 12.09 hrs, Volume= 0.293 af, Atten= 0%, Lag= 0.0 min
Primary = 3.70 cfs @ 12.09 hrs, Volume= 0.293 af
Routed to Pond P12 : DMH 6

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 237.94' @ 12.09 hrs
Flood Elev= 239.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	236.70'	**15.0" Round Culvert** L= 80.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.70' / 235.90' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=3.61 cfs @ 12.09 hrs HW=237.92' TW=237.07' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 3.61 cfs @ 2.97 fps)

Summary for Pond P14: SC-740 (1)

Inflow Area = 6.153 ac, 97.86% Impervious, Inflow Depth > 4.25" for 10 Year Storm event
Inflow = 27.74 cfs @ 12.09 hrs, Volume= 2.181 af
Outflow = 9.58 cfs @ 12.36 hrs, Volume= 1.852 af, Atten= 65%, Lag= 16.4 min
Discarded = 0.94 cfs @ 12.36 hrs, Volume= 0.970 af
Primary = 8.63 cfs @ 12.36 hrs, Volume= 0.882 af
Routed to Link OP4 : WETLANDS

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 237.12' @ 12.36 hrs Surf.Area= 40,751 sf Storage= 38,229 cf

Plug-Flow detention time= 113.2 min calculated for 1.847 af (85% of inflow)
Center-of-Mass det. time= 66.4 min (790.2 - 723.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	235.00'	17,614 cf	**49.00'W x 409.46'L x 3.50'H Field A** 70,222 cf Overall - 26,186 cf Embedded = 44,036 cf x 40.0% Voids
#2A	235.50'	26,186 cf	**ADS_StormTech SC-740 +Cap** x 570 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 570 Chambers in 10 Rows
#3	236.00'	43,656 cf	**Custom Stage Data (Conic)**Listed below (Recalc)
#4	234.00'	8,036 cf	**49.00'W x 410.00'L x 1.00'H Prismatoid** 20,090 cf Overall x 40.0% Voids
		95,492 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
236.00	100	0	0	100
238.70	2,000	2,292	2,292	2,018
240.00	12,000	8,190	10,482	12,024
240.80	22,000	13,399	23,882	22,031
241.50	35,000	19,775	43,656	35,038

Device	Routing	Invert	Outlet Devices
#1	Discarded	234.00'	**1.000 in/hr Exfiltration over Surface area**
#2	Primary	235.80'	**24.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.80' / 234.70' S= 0.0275 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Discarded OutFlow Max=0.94 cfs @ 12.36 hrs HW=237.12' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.94 cfs)

Primary OutFlow Max=8.62 cfs @ 12.36 hrs HW=237.12' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Inlet Controls 8.62 cfs @ 3.91 fps)

Summary for Pond P15: CB 8

```
Inflow Area =     0.336 ac,100.00% Impervious,  Inflow Depth >  4.31"   for  10 Year Storm event
Inflow      =     1.53 cfs @  12.09 hrs,  Volume=        0.121 af
Outflow     =     1.53 cfs @  12.09 hrs,  Volume=        0.121 af,  Atten= 0%,  Lag= 0.0 min
Primary     =     1.53 cfs @  12.09 hrs,  Volume=        0.121 af
   Routed to Pond P16 : SC-740 (2)
```

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 240.77' @ 12.09 hrs
Flood Elev= 243.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	240.00'	**12.0" Round Culvert** L= 120.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.00' / 233.10' S= 0.0575 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.48 cfs @ 12.09 hrs HW=240.75' TW=234.63' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 1.48 cfs @ 2.33 fps)

Summary for Pond P16: SC-740 (2)

```
Inflow Area =     1.105 ac, 87.52% Impervious,  Inflow Depth >  3.98"   for  10 Year Storm event
Inflow      =     4.80 cfs @  12.09 hrs,  Volume=        0.366 af
Outflow     =     3.84 cfs @  12.16 hrs,  Volume=        0.298 af,  Atten= 20%,  Lag= 4.1 min
Discarded   =     0.07 cfs @   8.00 hrs,  Volume=        0.092 af
Primary     =     3.77 cfs @  12.16 hrs,  Volume=        0.206 af
   Routed to Reach 1R : SWALE
```

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 234.72' @ 12.16 hrs Surf.Area= 3,095 sf Storage= 4,725 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 31.3 min (765.9 - 734.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	232.50'	2,789 cf	**34.75'W x 89.06'L x 3.50'H Field A** 10,832 cf Overall - 3,859 cf Embedded = 6,973 cf x 40.0% Voids
#2A	233.00'	3,859 cf	**ADS_StormTech SC-740 +Cap** x 84 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 84 Chambers in 7 Rows
		6,648 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	232.50'	**1.000 in/hr Exfiltration over Surface area**
#2	Primary	233.90'	**24.0" Round Culvert** L= 80.0' CPP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 233.90' / 233.10' S= 0.0100 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Discarded OutFlow Max=0.07 cfs @ 8.00 hrs HW=232.54' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=3.73 cfs @ 12.16 hrs HW=234.72' TW=230.65' (Dynamic Tailwater)
↑—**2=Culvert** (Inlet Controls 3.73 cfs @ 3.08 fps)

Summary for Pond P17: CB 9

Inflow Area = 0.355 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 1.61 cfs @ 12.09 hrs, Volume= 0.127 af
Outflow = 1.61 cfs @ 12.09 hrs, Volume= 0.127 af, Atten= 0%, Lag= 0.0 min
Primary = 1.61 cfs @ 12.09 hrs, Volume= 0.127 af
Routed to Pond P16 : SC-740 (2)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 234.94' @ 12.12 hrs
Flood Elev= 241.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	234.10'	**12.0" Round Culvert** L= 35.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 234.10' / 233.10' S= 0.0286 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.28 cfs @ 12.09 hrs HW=234.91' TW=234.63' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 1.28 cfs @ 2.55 fps)

Summary for Pond P18: CB 10

Inflow Area = 0.414 ac, 66.66% Impervious, Inflow Depth > 3.44" for 10 Year Storm event
Inflow = 1.67 cfs @ 12.09 hrs, Volume= 0.118 af
Outflow = 1.67 cfs @ 12.09 hrs, Volume= 0.118 af, Atten= 0%, Lag= 0.0 min
Primary = 1.67 cfs @ 12.09 hrs, Volume= 0.118 af
Routed to Pond P16 : SC-740 (2)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 234.86' @ 12.15 hrs
Flood Elev= 236.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	233.40'	**12.0" Round Culvert** L= 60.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 233.40' / 233.10' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.14 cfs @ 12.09 hrs HW=234.78' TW=234.63' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 1.14 cfs @ 1.45 fps)

Summary for Pond P19: WET BASIN 1

Inflow Area = 2.594 ac, 48.93% Impervious, Inflow Depth > 2.35" for 10 Year Storm event
Inflow = 7.46 cfs @ 12.12 hrs, Volume= 0.509 af
Outflow = 2.56 cfs @ 12.50 hrs, Volume= 0.501 af, Atten= 66%, Lag= 22.8 min
Primary = 2.56 cfs @ 12.50 hrs, Volume= 0.501 af
Routed to Pond P20 : DMH 12

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 193.20' Surf.Area= 2,028 sf Storage= 4,687 cf
Peak Elev= 195.84' @ 12.50 hrs Surf.Area= 3,146 sf Storage= 11,480 cf (6,793 cf above start)

Plug-Flow detention time= 113.3 min calculated for 0.393 af (77% of inflow)
Center-of-Mass det. time= 31.6 min (814.0 - 782.4)

Volume	Invert	Avail.Storage	Storage Description
#1	190.00'	29,445 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
190.00	950	0	0
192.00	1,575	2,525	2,525
194.00	2,330	3,905	6,430
196.00	3,215	5,545	11,975
198.00	4,220	7,435	19,410
200.00	5,815	10,035	29,445

Device	Routing	Invert	Outlet Devices
#1	Primary	186.00'	**15.0" Round Culvert** L= 180.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 186.00' / 175.20' S= 0.0600 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	199.00'	**29.0" x 20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	197.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	193.20'	**8.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.55 cfs @ 12.50 hrs HW=195.84' TW=175.03' (Dynamic Tailwater)
1=Culvert (Passes 2.55 cfs of 17.94 cfs potential flow)
2=Orifice/Grate (Controls 0.00 cfs)
3=Orifice/Grate (Controls 0.00 cfs)
4=Orifice/Grate (Orifice Controls 2.55 cfs @ 7.32 fps)

Summary for Pond P2: DMH 1

Inflow Area = 1.889 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 8.57 cfs @ 12.09 hrs, Volume= 0.678 af
Outflow = 8.57 cfs @ 12.09 hrs, Volume= 0.678 af, Atten= 0%, Lag= 0.0 min
Primary = 8.57 cfs @ 12.09 hrs, Volume= 0.678 af
Routed to Pond P14 : SC-740 (1)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 240.57' @ 12.09 hrs
Flood Elev= 241.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	238.20'	**18.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 238.20' / 235.60' S= 0.0260 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=8.34 cfs @ 12.09 hrs HW=240.49' TW=236.59' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 8.34 cfs @ 4.72 fps)

Summary for Pond P20: DMH 12

Inflow Area = 2.594 ac, 48.93% Impervious, Inflow Depth > 2.32" for 10 Year Storm event
Inflow = 2.56 cfs @ 12.50 hrs, Volume= 0.501 af
Outflow = 2.56 cfs @ 12.50 hrs, Volume= 0.501 af, Atten= 0%, Lag= 0.0 min
Primary = 2.56 cfs @ 12.50 hrs, Volume= 0.501 af
Routed to Pond 3P : DMH 13

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 175.03' @ 12.50 hrs
Flood Elev= 181.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	174.10'	**15.0" Round Culvert** L= 65.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 174.10' / 170.85' S= 0.0500 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=2.55 cfs @ 12.50 hrs HW=175.03' TW=168.58' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 2.55 cfs @ 2.60 fps)

Summary for Pond P21: WET BASIN 2

Inflow Area = 4.092 ac, 39.81% Impervious, Inflow Depth > 2.34" for 10 Year Storm event
Inflow = 5.93 cfs @ 12.11 hrs, Volume= 0.797 af
Outflow = 4.38 cfs @ 12.29 hrs, Volume= 0.792 af, Atten= 26%, Lag= 11.1 min
Primary = 4.38 cfs @ 12.29 hrs, Volume= 0.792 af
Routed to Link OP1 : 1008-79-11F

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 153.00' Surf.Area= 950 sf Storage= 1,825 cf
Peak Elev= 154.84' @ 12.29 hrs Surf.Area= 1,495 sf Storage= 4,037 cf (2,212 cf above start)

Plug-Flow detention time= 39.3 min calculated for 0.750 af (94% of inflow)
Center-of-Mass det. time= 7.4 min (809.3 - 801.9)

Volume	Invert	Avail.Storage	Storage Description
#1	150.00'	17,020 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
150.00	300	0	0
152.00	700	1,000	1,000
154.00	1,200	1,900	2,900
156.00	1,900	3,100	6,000
158.00	2,720	4,620	10,620
160.00	3,680	6,400	17,020

Device	Routing	Invert	Outlet Devices
#1	Primary	151.80'	**12.0" Round Culvert** L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 151.80' / 150.00' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	153.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	158.60'	**29.0" x 20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.38 cfs @ 12.29 hrs HW=154.84' TW=0.00' (Dynamic Tailwater)
└1=**Culvert** (Passes 4.38 cfs of 5.94 cfs potential flow)
  └2=**Orifice/Grate** (Orifice Controls 4.38 cfs @ 5.58 fps)
  └3=**Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond P3: CB 2

Inflow Area = 0.175 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 0.79 cfs @ 12.09 hrs, Volume= 0.063 af
Outflow = 0.79 cfs @ 12.09 hrs, Volume= 0.063 af, Atten= 0%, Lag= 0.0 min
Primary = 0.79 cfs @ 12.09 hrs, Volume= 0.063 af
Routed to Pond P2 : DMH 1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 240.62' @ 12.14 hrs
Flood Elev= 241.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	238.40'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 238.40' / 238.30' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=240.22' TW=240.49' (Dynamic Tailwater)
└1=**Culvert** (Controls 0.00 cfs)

Summary for Pond P4: DMH 3

Inflow Area = 0.790 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 3.58 cfs @ 12.09 hrs, Volume= 0.283 af
Outflow = 3.58 cfs @ 12.09 hrs, Volume= 0.283 af, Atten= 0%, Lag= 0.0 min
Primary = 3.58 cfs @ 12.09 hrs, Volume= 0.283 af
Routed to Pond P14 : SC-740 (1)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 237.18' @ 12.36 hrs
Flood Elev= 240.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.70'	**15.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.70' / 235.60' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=2.84 cfs @ 12.09 hrs HW=236.96' TW=236.59' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 2.84 cfs @ 2.31 fps)

Summary for Pond P5: CB 3

Inflow Area = 0.790 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 3.58 cfs @ 12.09 hrs, Volume= 0.283 af
Outflow = 3.58 cfs @ 12.09 hrs, Volume= 0.283 af, Atten= 0%, Lag= 0.0 min
Primary = 3.58 cfs @ 12.09 hrs, Volume= 0.283 af
Routed to Pond P4 : DMH 3

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 237.90' @ 12.09 hrs
Flood Elev= 239.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	236.70'	**15.0" Round Culvert** L= 70.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.70' / 236.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=3.49 cfs @ 12.09 hrs HW=237.88' TW=236.96' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 3.49 cfs @ 2.91 fps)

Summary for Pond P6: CB 7

Inflow Area = 0.490 ac, 73.08% Impervious, Inflow Depth > 3.64" for 10 Year Storm event
Inflow = 2.06 cfs @ 12.09 hrs, Volume= 0.149 af
Outflow = 2.06 cfs @ 12.09 hrs, Volume= 0.149 af, Atten= 0%, Lag= 0.0 min
Primary = 2.06 cfs @ 12.09 hrs, Volume= 0.149 af
Routed to Pond P7 : DMH 9

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 241.73' @ 12.15 hrs
Flood Elev= 243.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	240.40'	**15.0" Round Culvert** L= 130.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.40' / 239.70' S= 0.0054 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=241.45' TW=241.46' (Dynamic Tailwater)
↑—**1=Culvert** (Controls 0.00 cfs)

Summary for Pond P7: DMH 9

Inflow Area = 1.438 ac, 90.83% Impervious, Inflow Depth > 4.08" for 10 Year Storm event
Inflow = 6.35 cfs @ 12.09 hrs, Volume= 0.489 af
Outflow = 6.35 cfs @ 12.09 hrs, Volume= 0.489 af, Atten= 0%, Lag= 0.0 min
Primary = 6.35 cfs @ 12.09 hrs, Volume= 0.489 af
Routed to Pond P8 : DMH 8

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 241.59' @ 12.11 hrs
Flood Elev= 245.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	239.60'	**18.0" Round Culvert** L= 65.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 239.60' / 239.20' S= 0.0062 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=5.33 cfs @ 12.09 hrs HW=241.45' TW=240.82' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 5.33 cfs @ 3.01 fps)

Summary for Pond P8: DMH 8

Inflow Area = 1.504 ac, 91.23% Impervious, Inflow Depth > 4.09" for 10 Year Storm event
Inflow = 6.66 cfs @ 12.09 hrs, Volume= 0.513 af
Outflow = 6.66 cfs @ 12.09 hrs, Volume= 0.513 af, Atten= 0%, Lag= 0.0 min
Primary = 6.66 cfs @ 12.09 hrs, Volume= 0.513 af
Routed to Pond P10 : DMH 7

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 240.87' @ 12.10 hrs
Flood Elev= 244.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	239.10'	**18.0" Round Culvert** L= 285.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 239.10' / 237.65' S= 0.0051 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=6.17 cfs @ 12.09 hrs HW=240.82' TW=239.48' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 6.17 cfs @ 3.81 fps)

Summary for Pond P9: CB 6

Inflow Area = 0.067 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 0.30 cfs @ 12.09 hrs, Volume= 0.024 af
Outflow = 0.30 cfs @ 12.09 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min
Primary = 0.30 cfs @ 12.09 hrs, Volume= 0.024 af
Routed to Pond P8 : DMH 8

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 240.87' @ 12.15 hrs
Flood Elev= 244.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	239.40'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 239.40' / 239.20' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=240.59' TW=240.82' (Dynamic Tailwater)
↑—**1=Culvert** (Controls 0.00 cfs)

Summary for Link OP1: 1008-79-11F

Inflow Area = 5.304 ac, 30.97% Impervious, Inflow Depth > 2.21" for 10 Year Storm event
Inflow = 6.54 cfs @ 12.18 hrs, Volume= 0.979 af
Primary = 6.54 cfs @ 12.18 hrs, Volume= 0.979 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Link OP2: ROADSIDE SWALE

Inflow Area = 3.708 ac, 0.26% Impervious, Inflow Depth > 1.92" for 10 Year Storm event
Inflow = 7.12 cfs @ 12.18 hrs, Volume= 0.594 af
Primary = 7.12 cfs @ 12.18 hrs, Volume= 0.594 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Link OP3: 1010-79-17A

Inflow Area = 1.951 ac, 0.00% Impervious, Inflow Depth > 0.43" for 10 Year Storm event
Inflow = 0.51 cfs @ 12.17 hrs, Volume= 0.069 af
Primary = 0.51 cfs @ 12.17 hrs, Volume= 0.069 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Link OP4: WETLANDS

Inflow Area = 9.380 ac, 64.20% Impervious, Inflow Depth > 1.75" for 10 Year Storm event
Inflow = 12.70 cfs @ 12.20 hrs, Volume= 1.369 af
Primary = 12.70 cfs @ 12.20 hrs, Volume= 1.369 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Subcatchment 101: TO CB 8

Runoff = 2.82 cfs @ 12.09 hrs, Volume= 0.228 af, Depth> 8.12"
Routed to Pond P15 : CB 8

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
14,656	98	Paved parking, HSG C
14,656		100.00% Impervious Area

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

Summary for Subcatchment 102: TO CB 9

Runoff = 2.98 cfs @ 12.09 hrs, Volume= 0.240 af, Depth> 8.12"
Routed to Pond P17 : CB 9

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
15,445	98	Paved parking, HSG C
15,445		100.00% Impervious Area

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

Summary for Subcatchment 103: TO CB 10

Runoff = 3.32 cfs @ 12.09 hrs, Volume= 0.247 af, Depth> 7.17"
Routed to Pond P18 : CB 10

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
12,010	98	Paved parking, HSG C
6,006	74	>75% Grass cover, Good, HSG C
18,016	90	Weighted Average
6,006		33.34% Pervious Area
12,010		66.66% Impervious Area

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

Summary for Subcatchment 104: TO PLUNGE POOL

Runoff = 4.71 cfs @ 12.09 hrs, Volume= 0.322 af, Depth> 5.25"
Routed to Reach 2R : PLUNGE POOL

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
32,083	74	>75% Grass cover, Good, HSG C
32,083		100.00% Pervious Area

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

Summary for Subcatchment 105: TO WET BASIN 1

Runoff = 3.99 cfs @ 12.09 hrs, Volume= 0.278 af, Depth> 5.85"
Routed to Pond P19 : WET BASIN 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
5,225	98	Paved parking, HSG C
19,605	74	>75% Grass cover, Good, HSG C
24,830	79	Weighted Average
19,605		78.96% Pervious Area
5,225		21.04% Impervious Area

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

Summary for Subcatchment 106: TO WET BASIN 2

Runoff = 8.45 cfs @ 12.09 hrs, Volume= 0.584 af, Depth> 5.37"
Routed to Pond P21 : WET BASIN 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
7,260	98	Paved parking, HSG C
14,068	74	>75% Grass cover, Good, HSG C
35,523	70	Woods, Good, HSG C
56,851	75	Weighted Average
49,591		87.23% Pervious Area
7,260		12.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	75	0.1500	0.24		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.11"
1.1	160	0.1200	2.42		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.1	85	0.2500	24.21	80.71	**Parabolic Channel, C-D** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.022 Earth, clean & straight
6.3	320	Total			

Summary for Subcatchment 107: TO OP1

Runoff = 6.43 cfs @ 12.15 hrs, Volume= 0.506 af, Depth> 5.01"
Routed to Link OP1 : 1008-79-11F

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
600	98	Paved parking, HSG C
25,268	74	>75% Grass cover, Good, HSG C
26,940	70	Woods, Good, HSG C
52,808	72	Weighted Average
52,208		98.86% Pervious Area
600		1.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	70	0.0320	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.11"
0.8	100	0.0960	2.17		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.0	300	0.1500	5.16	17.19	**Parabolic Channel, C-D** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.080 Earth, long dense weeds
10.8	470	Total			

Summary for Subcatchment 108: TO CB12

Runoff = 1.62 cfs @ 12.09 hrs, Volume= 0.130 af, Depth> 8.12"
Routed to Pond 4P : CB 12

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
8,400	98	Paved parking, HSG C
8,400		100.00% Impervious Area

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

Summary for Subcatchment 109: TO CB11

Runoff = 1.53 cfs @ 12.09 hrs, Volume= 0.124 af, Depth> 8.12"
Routed to Pond 5P : CB 11

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
7,950	98	Paved parking, HSG C
7,950		100.00% Impervious Area

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

Summary for Subcatchment 201: TO ROADSIDE SWALE

Runoff = 19.01 cfs @ 12.17 hrs, Volume= 1.583 af, Depth> 5.12"
Routed to Link OP2 : ROADSIDE SWALE

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
424	98	Paved parking, HSG C
134,797	74	>75% Grass cover, Good, HSG C
26,290	70	Woods, Good, HSG C
161,511	73	Weighted Average
161,087		99.74% Pervious Area
424		0.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	90	0.0270	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.11"
0.4	100	0.3000	3.83		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.5	380	0.1250	12.56	41.85	**Parabolic Channel, C-D** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.030 Earth, grassed & winding
12.7	570	Total			

Summary for Subcatchment 301: TO CB 5

Runoff = 1.72 cfs @ 12.09 hrs, Volume= 0.139 af, Depth> 8.12"
Routed to Pond P11 : CB 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
8,952	98	Paved parking, HSG A
8,952		100.00% Impervious Area

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

Summary for Subcatchment 302: TO CB 6

Runoff = 0.56 cfs @ 12.09 hrs, Volume= 0.045 af, Depth> 8.12"
Routed to Pond P9 : CB 6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
1,250	98	Paved parking, HSG A
1,655	98	Paved parking, HSG C
2,905	98	Weighted Average
2,905		100.00% Impervious Area

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

Summary for Subcatchment 303: TO OP3

Runoff = 5.16 cfs @ 12.10 hrs, Volume= 0.367 af, Depth> 2.26"
Routed to Link OP3 : 1010-79-17A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
32,328	39	>75% Grass cover, Good, HSG A
18,412	74	>75% Grass cover, Good, HSG C
23,735	30	Woods, Good, HSG A
10,524	70	Woods, Good, HSG C
84,999	48	Weighted Average
84,999		100.00% Pervious Area

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

Summary for Subcatchment 401: RD 1

Runoff = 5.23 cfs @ 12.09 hrs, Volume= 0.422 af, Depth> 8.12"
Routed to Pond P1 : CB 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
27,136	98	Roofs, HSG C
27,136		100.00% Impervious Area

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

Summary for Subcatchment 402: RD 2

Runoff = 7.95 cfs @ 12.09 hrs, Volume= 0.641 af, Depth> 8.12"
Routed to Pond P2 : DMH 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
41,280	98	Roofs, HSG C
41,280		100.00% Impervious Area

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

Summary for Subcatchment 403: TO CB 3

Runoff = 6.63 cfs @ 12.09 hrs, Volume= 0.535 af, Depth> 8.12"
Routed to Pond P5 : CB 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
34,409	98	Paved parking, HSG C
34,409		100.00% Impervious Area

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

Summary for Subcatchment 404: TO CB 4

Runoff = 6.85 cfs @ 12.09 hrs, Volume= 0.553 af, Depth> 8.12"
Routed to Pond P13 : CB 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
35,576	98	Paved parking, HSG C
35,576		100.00% Impervious Area

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

Summary for Subcatchment 405: RD 4

Runoff = 7.95 cfs @ 12.09 hrs, Volume= 0.641 af, Depth> 8.12"
Routed to Pond P10 : DMH 7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
41,280	98	Roofs, HSG C
41,280		100.00% Impervious Area

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

Summary for Subcatchment 406: RD 3

Runoff = 7.95 cfs @ 12.09 hrs, Volume= 0.641 af, Depth> 8.12"
Routed to Pond P7 : DMH 9

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
41,280	98	Roofs, HSG C
41,280		100.00% Impervious Area

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

Summary for Subcatchment 407: TO CB 7

Runoff = 4.00 cfs @ 12.09 hrs, Volume= 0.302 af, Depth> 7.41"
Routed to Pond P6 : CB 7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
15,597	98	Paved parking, HSG C
5,745	74	>75% Grass cover, Good, HSG C
21,342	92	Weighted Average
5,745		26.92% Pervious Area
15,597		73.08% Impervious Area

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

Summary for Subcatchment 408: EAST TO WETLANDS

Runoff = 9.05 cfs @ 12.11 hrs, Volume= 0.655 af, Depth> 5.01"
Routed to Link OP4 : WETLANDS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
27,878	74	>75% Grass cover, Good, HSG C
40,375	70	Woods, Good, HSG C
68,253	72	Weighted Average
68,253		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	40	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.11"
0.9	100	0.0750	1.92		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.1	95	0.1900	13.27	44.23	**Parabolic Channel, C-D** W=5.00' D=1.00' Area=3.3 sf Perim=5.5' n= 0.035 Earth, dense weeds
8.0	235	Total			

Summary for Subcatchment 501: TO CB 1

Runoff = 1.21 cfs @ 12.09 hrs, Volume= 0.098 af, Depth> 8.12"
Routed to Pond P1 : CB 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
6,277	98	Paved parking, HSG C
6,277		100.00% Impervious Area

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

Summary for Subcatchment 502: TO CB 2

Runoff = 1.46 cfs @ 12.09 hrs, Volume= 0.118 af, Depth> 8.12"
Routed to Pond P3 : CB 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
7,604	98	Paved parking, HSG C
7,604		100.00% Impervious Area

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

Summary for Subcatchment 503: WEST TO WETLANDS

Runoff = 9.28 cfs @ 12.12 hrs, Volume= 0.677 af, Depth> 4.90"
Routed to Link OP4 : WETLANDS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Storm Rainfall=8.75"

Area (sf)	CN	Description
20,196	74	>75% Grass cover, Good, HSG C
52,094	70	Woods, Good, HSG C
72,290	71	Weighted Average
72,290		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	40	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.11"
1.3	160	0.0850	2.04		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
8.3	200	Total			

Summary for Reach 1R: SWALE

Inflow Area = 1.105 ac, 87.52% Impervious, Inflow Depth > 5.83" for 100 Year Storm event
Inflow = 8.01 cfs @ 12.13 hrs, Volume= 0.536 af
Outflow = 8.02 cfs @ 12.15 hrs, Volume= 0.536 af, Atten= 0%, Lag= 0.8 min
Routed to Reach 2R : PLUNGE POOL

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.55 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.62 fps, Avg. Travel Time= 1.9 min

Peak Storage= 406 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.87' , Surface Width= 5.20'
Bank-Full Depth= 1.50' Flow Area= 6.8 sf, Capacity= 34.54 cfs

0.00' x 1.50' deep channel, n= 0.069 Riprap, 6-inch
Side Slope Z-value= 3.0 '/' Top Width= 9.00'
Length= 180.0' Slope= 0.0889 '/'
Inlet Invert= 230.00', Outlet Invert= 214.00'

Summary for Reach 2R: PLUNGE POOL

Inflow Area = 1.841 ac, 52.51% Impervious, Inflow Depth > 5.60" for 100 Year Storm event
Inflow = 12.23 cfs @ 12.12 hrs, Volume= 0.859 af
Outflow = 12.23 cfs @ 12.12 hrs, Volume= 0.859 af, Atten= 0%, Lag= 0.1 min
Routed to Pond P19 : WET BASIN 1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.30 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.63 fps, Avg. Travel Time= 0.4 min

Peak Storage= 100 cf @ 12.12 hrs
Average Depth at Peak Storage= 1.05' , Surface Width= 2.00'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 22.62 cfs

24.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 60.0' Slope= 0.0100 '/'
Inlet Invert= 210.00', Outlet Invert= 209.40'

Summary for Pond 3P: DMH 13

Inflow Area = 2.787 ac, 52.47% Impervious, Inflow Depth > 5.93" for 100 Year Storm event
Inflow = 7.89 cfs @ 12.34 hrs, Volume= 1.378 af
Outflow = 7.89 cfs @ 12.34 hrs, Volume= 1.378 af, Atten= 0%, Lag= 0.0 min
Primary = 7.89 cfs @ 12.34 hrs, Volume= 1.378 af
Routed to Pond P21 : WET BASIN 2

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 169.83' @ 12.34 hrs
Flood Elev= 174.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	167.70'	**18.0" Round Culvert** L= 90.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 167.70' / 165.00' S= 0.0300 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=7.88 cfs @ 12.34 hrs HW=169.83' TW=158.10' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 7.88 cfs @ 4.46 fps)

Summary for Pond 4P: CB 12

Inflow Area = 0.193 ac,100.00% Impervious, Inflow Depth > 8.12" for 100 Year Storm event
Inflow = 1.62 cfs @ 12.09 hrs, Volume= 0.130 af
Outflow = 1.62 cfs @ 12.09 hrs, Volume= 0.130 af, Atten= 0%, Lag= 0.0 min
Primary = 1.62 cfs @ 12.09 hrs, Volume= 0.130 af
Routed to Pond 3P : DMH 13

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 171.81' @ 12.09 hrs
Flood Elev= 174.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	171.00'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 171.00' / 170.80' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.57 cfs @ 12.09 hrs HW=171.79' TW=168.93' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 1.57 cfs @ 3.24 fps)

Summary for Pond 5P: CB 11

Inflow Area = 0.183 ac,100.00% Impervious, Inflow Depth > 8.12" for 100 Year Storm event
Inflow = 1.53 cfs @ 12.09 hrs, Volume= 0.124 af
Outflow = 1.53 cfs @ 12.09 hrs, Volume= 0.124 af, Atten= 0%, Lag= 0.0 min
Primary = 1.53 cfs @ 12.09 hrs, Volume= 0.124 af
Routed to Pond P19 : WET BASIN 1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 214.77' @ 12.09 hrs
Flood Elev= 220.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	214.00'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 214.00' / 212.00' S= 0.1000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.49 cfs @ 12.09 hrs HW=214.76' TW=196.84' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 1.49 cfs @ 2.34 fps)

Summary for Pond P1: CB 1

Inflow Area = 0.767 ac,100.00% Impervious, Inflow Depth > 8.12" for 100 Year Storm event
Inflow = 6.44 cfs @ 12.09 hrs, Volume= 0.519 af
Outflow = 6.44 cfs @ 12.09 hrs, Volume= 0.519 af, Atten= 0%, Lag= 0.0 min
Primary = 6.44 cfs @ 12.09 hrs, Volume= 0.519 af
Routed to Pond P2 : DMH 1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 246.81' @ 12.12 hrs
Flood Elev= 243.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	240.20'	**15.0" Round Culvert** L= 210.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.20' / 238.30' S= 0.0090 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=4.79 cfs @ 12.09 hrs HW=245.83' TW=244.23' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 4.79 cfs @ 3.90 fps)

Summary for Pond P10: DMH 7

Inflow Area = 2.657 ac, 95.04% Impervious, Inflow Depth > 7.99" for 100 Year Storm event
Inflow = 22.19 cfs @ 12.09 hrs, Volume= 1.769 af
Outflow = 22.19 cfs @ 12.09 hrs, Volume= 1.769 af, Atten= 0%, Lag= 0.0 min
Primary = 22.19 cfs @ 12.09 hrs, Volume= 1.769 af
Routed to Pond P14 : SC-740 (1)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 241.99' @ 12.09 hrs
Flood Elev= 241.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	237.55'	**24.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 237.55' / 235.70' S= 0.0185 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=21.60 cfs @ 12.09 hrs HW=241.82' TW=238.24' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 21.60 cfs @ 6.87 fps)

Summary for Pond P11: CB 5

Inflow Area = 0.206 ac,100.00% Impervious, Inflow Depth > 8.12" for 100 Year Storm event
Inflow = 1.72 cfs @ 12.09 hrs, Volume= 0.139 af
Outflow = 1.72 cfs @ 12.09 hrs, Volume= 0.139 af, Atten= 0%, Lag= 0.0 min
Primary = 1.72 cfs @ 12.09 hrs, Volume= 0.139 af
Routed to Pond P10 : DMH 7

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 242.22' @ 12.13 hrs
Flood Elev= 241.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	237.75'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 237.75' / 237.65' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=241.42' TW=241.82' (Dynamic Tailwater)
↑—**1=Culvert** (Controls 0.00 cfs)

Summary for Pond P12: DMH 6

Inflow Area = 0.817 ac,100.00% Impervious, Inflow Depth > 8.12" for 100 Year Storm event
Inflow = 6.85 cfs @ 12.09 hrs, Volume= 0.553 af
Outflow = 6.85 cfs @ 12.09 hrs, Volume= 0.553 af, Atten= 0%, Lag= 0.0 min
Primary = 6.85 cfs @ 12.09 hrs, Volume= 0.553 af
Routed to Pond P14 : SC-740 (1)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 240.15' @ 12.22 hrs
Flood Elev= 240.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.80'	**15.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.80' / 235.70' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=5.73 cfs @ 12.09 hrs HW=239.75' TW=238.24' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 5.73 cfs @ 4.67 fps)

Summary for Pond P13: CB 4

Inflow Area = 0.817 ac,100.00% Impervious, Inflow Depth > 8.12" for 100 Year Storm event
Inflow = 6.85 cfs @ 12.09 hrs, Volume= 0.553 af
Outflow = 6.85 cfs @ 12.09 hrs, Volume= 0.553 af, Atten= 0%, Lag= 0.0 min
Primary = 6.85 cfs @ 12.09 hrs, Volume= 0.553 af
Routed to Pond P12 : DMH 6

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 241.53' @ 12.12 hrs
Flood Elev= 239.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	236.70'	**15.0" Round Culvert** L= 80.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.70' / 235.90' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=5.23 cfs @ 12.09 hrs HW=241.01' TW=239.75' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 5.23 cfs @ 4.26 fps)

Summary for Pond P14: SC-740 (1)

Inflow Area = 6.153 ac, 97.86% Impervious, Inflow Depth > 8.06" for 100 Year Storm event
Inflow = 51.52 cfs @ 12.09 hrs, Volume= 4.135 af
Outflow = 26.59 cfs @ 12.23 hrs, Volume= 3.703 af, Atten= 48%, Lag= 8.5 min
Discarded = 1.12 cfs @ 12.23 hrs, Volume= 1.151 af
Primary = 25.46 cfs @ 12.23 hrs, Volume= 2.552 af
Routed to Link OP4 : WETLANDS

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 239.63' @ 12.23 hrs Surf.Area= 48,485 sf Storage= 58,614 cf

Plug-Flow detention time= 88.9 min calculated for 3.693 af (89% of inflow)
Center-of-Mass det. time= 52.3 min (767.5 - 715.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	235.00'	17,614 cf	**49.00'W x 409.46'L x 3.50'H Field A** 70,222 cf Overall - 26,186 cf Embedded = 44,036 cf x 40.0% Voids
#2A	235.50'	26,186 cf	**ADS_StormTech SC-740 +Cap** x 570 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 570 Chambers in 10 Rows
#3	236.00'	43,656 cf	**Custom Stage Data (Conic)**Listed below (Recalc)
#4	234.00'	8,036 cf	**49.00'W x 410.00'L x 1.00'H Prismatoid** 20,090 cf Overall x 40.0% Voids
		95,492 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
236.00	100	0	0	100
238.70	2,000	2,292	2,292	2,018
240.00	12,000	8,190	10,482	12,024
240.80	22,000	13,399	23,882	22,031
241.50	35,000	19,775	43,656	35,038

Device	Routing	Invert	Outlet Devices
#1	Discarded	234.00'	**1.000 in/hr Exfiltration over Surface area**
#2	Primary	235.80'	**24.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 235.80' / 234.70' S= 0.0275 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Discarded OutFlow Max=1.12 cfs @ 12.23 hrs HW=239.62' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 1.12 cfs)

Primary OutFlow Max=25.41 cfs @ 12.23 hrs HW=239.62' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Inlet Controls 25.41 cfs @ 8.09 fps)

Summary for Pond P15: CB 8

```
Inflow Area =      0.336 ac,100.00% Impervious,  Inflow Depth >  8.12"   for  100 Year Storm event
Inflow      =      2.82 cfs @  12.09 hrs,  Volume=        0.228 af
Outflow     =      2.82 cfs @  12.09 hrs,  Volume=        0.228 af,  Atten= 0%,  Lag= 0.0 min
Primary     =      2.82 cfs @  12.09 hrs,  Volume=        0.228 af
   Routed to Pond P16 : SC-740 (2)
```

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 241.39' @ 12.09 hrs
Flood Elev= 243.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	240.00'	**12.0" Round Culvert** L= 120.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.00' / 233.10' S= 0.0575 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.75 cfs @ 12.09 hrs HW=241.35' TW=235.11' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 2.75 cfs @ 3.50 fps)

Summary for Pond P16: SC-740 (2)

```
Inflow Area =      1.105 ac, 87.52% Impervious,  Inflow Depth >  7.76"   for  100 Year Storm event
Inflow      =      9.12 cfs @  12.09 hrs,  Volume=        0.715 af
Outflow     =      8.08 cfs @  12.13 hrs,  Volume=        0.643 af,  Atten= 11%,  Lag= 2.7 min
Discarded   =      0.07 cfs @   4.85 hrs,  Volume=        0.107 af
Primary     =      8.01 cfs @  12.13 hrs,  Volume=        0.536 af
   Routed to Reach 1R : SWALE
```

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 235.19' @ 12.13 hrs Surf.Area= 3,095 sf Storage= 5,590 cf

Plug-Flow detention time= 66.0 min calculated for 0.643 af (90% of inflow)
Center-of-Mass det. time= 30.6 min (754.8 - 724.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	232.50'	2,789 cf	**34.75'W x 89.06'L x 3.50'H Field A** 10,832 cf Overall - 3,859 cf Embedded = 6,973 cf x 40.0% Voids
#2A	233.00'	3,859 cf	**ADS_StormTech SC-740 +Cap** x 84 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 84 Chambers in 7 Rows
		6,648 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	232.50'	**1.000 in/hr Exfiltration over Surface area**
#2	Primary	233.90'	**24.0" Round Culvert** L= 80.0' CPP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 233.90' / 233.10' S= 0.0100 '/' Cc= 0.900
n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Discarded OutFlow Max=0.07 cfs @ 4.85 hrs HW=232.54' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=7.84 cfs @ 12.13 hrs HW=235.17' TW=230.86' (Dynamic Tailwater)
└─**2=Culvert** (Barrel Controls 7.84 cfs @ 5.32 fps)

Summary for Pond P17: CB 9

Inflow Area = 0.355 ac,100.00% Impervious, Inflow Depth > 8.12" for 100 Year Storm event
Inflow = 2.98 cfs @ 12.09 hrs, Volume= 0.240 af
Outflow = 2.98 cfs @ 12.09 hrs, Volume= 0.240 af, Atten= 0%, Lag= 0.0 min
Primary = 2.98 cfs @ 12.09 hrs, Volume= 0.240 af
Routed to Pond P16 : SC-740 (2)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 235.95' @ 12.11 hrs
Flood Elev= 241.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	234.10'	**12.0" Round Culvert** L= 35.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 234.10' / 233.10' S= 0.0286 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.59 cfs @ 12.09 hrs HW=235.86' TW=235.11' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 2.59 cfs @ 3.30 fps)

Summary for Pond P18: CB 10

Inflow Area = 0.414 ac, 66.66% Impervious, Inflow Depth > 7.17" for 100 Year Storm event
Inflow = 3.32 cfs @ 12.09 hrs, Volume= 0.247 af
Outflow = 3.32 cfs @ 12.09 hrs, Volume= 0.247 af, Atten= 0%, Lag= 0.0 min
Primary = 3.32 cfs @ 12.09 hrs, Volume= 0.247 af
Routed to Pond P16 : SC-740 (2)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 236.19' @ 12.10 hrs
Flood Elev= 236.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	233.40'	**12.0" Round Culvert** L= 60.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 233.40' / 233.10' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.97 cfs @ 12.09 hrs HW=236.10' TW=235.11' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 2.97 cfs @ 3.78 fps)

Summary for Pond P19: WET BASIN 1

```
Inflow Area =      2.594 ac, 48.93% Impervious, Inflow Depth >  5.83"   for 100 Year Storm event
Inflow      =     17.53 cfs @  12.11 hrs, Volume=        1.260 af
Outflow     =      7.33 cfs @  12.38 hrs, Volume=        1.247 af, Atten= 58%, Lag= 16.1 min
Primary     =      7.33 cfs @  12.38 hrs, Volume=        1.247 af
   Routed to Pond P20 : DMH 12
```

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 193.20' Surf.Area= 2,028 sf Storage= 4,687 cf
Peak Elev= 198.42' @ 12.38 hrs Surf.Area= 4,551 sf Storage= 21,231 cf (16,544 cf above start)

Plug-Flow detention time= 84.3 min calculated for 1.139 af (90% of inflow)
Center-of-Mass det. time= 35.6 min (804.7 - 769.1)

Volume	Invert	Avail.Storage	Storage Description
#1	190.00'	29,445 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
190.00	950	0	0
192.00	1,575	2,525	2,525
194.00	2,330	3,905	6,430
196.00	3,215	5,545	11,975
198.00	4,220	7,435	19,410
200.00	5,815	10,035	29,445

Device	Routing	Invert	Outlet Devices
#1	Primary	186.00'	**15.0" Round Culvert** L= 180.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 186.00' / 175.20' S= 0.0600 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	199.00'	**29.0" x 20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	197.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	193.20'	**8.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=7.32 cfs @ 12.38 hrs HW=198.41' TW=177.19' (Dynamic Tailwater)
└─**1=Culvert** (Passes 7.32 cfs of 19.01 cfs potential flow)
  ├─**2=Orifice/Grate** (Controls 0.00 cfs)
  ├─**3=Orifice/Grate** (Orifice Controls 3.61 cfs @ 4.59 fps)
  └─**4=Orifice/Grate** (Orifice Controls 3.71 cfs @ 10.63 fps)

Summary for Pond P2: DMH 1

```
Inflow Area =      1.889 ac,100.00% Impervious, Inflow Depth >  8.12"   for 100 Year Storm event
Inflow      =     15.85 cfs @  12.09 hrs, Volume=        1.278 af
Outflow     =     15.85 cfs @  12.09 hrs, Volume=        1.278 af, Atten= 0%, Lag= 0.0 min
Primary     =     15.85 cfs @  12.09 hrs, Volume=        1.278 af
   Routed to Pond P14 : SC-740 (1)
```

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 244.50' @ 12.09 hrs
Flood Elev= 241.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	238.20'	**18.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 238.20' / 235.60' S= 0.0260 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=15.43 cfs @ 12.09 hrs HW=244.23' TW=238.24' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 15.43 cfs @ 8.73 fps)

Summary for Pond P20: DMH 12

Inflow Area = 2.594 ac, 48.93% Impervious, Inflow Depth > 5.77" for 100 Year Storm event
Inflow = 7.33 cfs @ 12.38 hrs, Volume= 1.247 af
Outflow = 7.33 cfs @ 12.38 hrs, Volume= 1.247 af, Atten= 0%, Lag= 0.0 min
Primary = 7.33 cfs @ 12.38 hrs, Volume= 1.247 af
Routed to Pond 3P : DMH 13

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 177.20' @ 12.38 hrs
Flood Elev= 181.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	174.10'	**15.0" Round Culvert** L= 65.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 174.10' / 170.85' S= 0.0500 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=7.32 cfs @ 12.38 hrs HW=177.19' TW=169.81' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 7.32 cfs @ 5.97 fps)

Summary for Pond P21: WET BASIN 2

Inflow Area = 4.092 ac, 39.81% Impervious, Inflow Depth > 5.75" for 100 Year Storm event
Inflow = 13.29 cfs @ 12.12 hrs, Volume= 1.962 af
Outflow = 8.34 cfs @ 12.58 hrs, Volume= 1.955 af, Atten= 37%, Lag= 27.5 min
Primary = 8.34 cfs @ 12.58 hrs, Volume= 1.955 af
Routed to Link OP1 : 1008-79-11F

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Starting Elev= 153.00' Surf.Area= 950 sf Storage= 1,825 cf
Peak Elev= 158.58' @ 12.58 hrs Surf.Area= 3,000 sf Storage= 12,287 cf (10,462 cf above start)

Plug-Flow detention time= 28.2 min calculated for 1.908 af (97% of inflow)
Center-of-Mass det. time= 11.1 min (801.7 - 790.6)

Volume	Invert	Avail.Storage	Storage Description
#1	150.00'	17,020 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
150.00	300	0	0
152.00	700	1,000	1,000
154.00	1,200	1,900	2,900
156.00	1,900	3,100	6,000
158.00	2,720	4,620	10,620
160.00	3,680	6,400	17,020

Device	Routing	Invert	Outlet Devices
#1	Primary	151.80'	**12.0" Round Culvert** L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 151.80' / 150.00' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	153.00'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	158.60'	**29.0" x 20.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=8.34 cfs @ 12.58 hrs HW=158.58' TW=0.00' (Dynamic Tailwater)
└─1=**Culvert** (Barrel Controls 8.34 cfs @ 10.62 fps)
  ├─2=**Orifice/Grate** (Passes 8.34 cfs of 8.52 cfs potential flow)
  └─3=**Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond P3: CB 2

Inflow Area = 0.175 ac,100.00% Impervious, Inflow Depth > 8.12" for 100 Year Storm event
Inflow = 1.46 cfs @ 12.09 hrs, Volume= 0.118 af
Outflow = 1.46 cfs @ 12.09 hrs, **Volume=** 0.118 af, Atten= 0%, Lag= 0.0 min
Primary = 1.46 cfs @ 12.09 hrs, Volume= 0.118 af
Routed to Pond P2 : DMH 1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 244.67' @ 12.14 hrs
Flood Elev= 241.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	238.40'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 238.40' / 238.30' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=243.31' TW=244.23' (Dynamic Tailwater)
└─1=**Culvert** (Controls 0.00 cfs)

Summary for Pond P4: DMH 3

Inflow Area = 0.790 ac,100.00% Impervious, Inflow Depth > 8.12" for 100 Year Storm event
Inflow = 6.63 cfs @ 12.09 hrs, Volume= 0.535 af
Outflow = 6.63 cfs @ 12.09 hrs, Volume= 0.535 af, Atten= 0%, Lag= 0.0 min
Primary = 6.63 cfs @ 12.09 hrs, Volume= 0.535 af
Routed to Pond P14 : SC-740 (1)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 240.11' @ 12.22 hrs
Flood Elev= 240.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.70'	**15.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.70' / 235.60' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=5.48 cfs @ 12.09 hrs HW=239.62' TW=238.24' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 5.48 cfs @ 4.46 fps)

Summary for Pond P5: CB 3

Inflow Area = 0.790 ac,100.00% Impervious, Inflow Depth > 8.12" for 100 Year Storm event
Inflow = 6.63 cfs @ 12.09 hrs, Volume= 0.535 af
Outflow = 6.63 cfs @ 12.09 hrs, Volume= 0.535 af, Atten= 0%, Lag= 0.0 min
Primary = 6.63 cfs @ 12.09 hrs, Volume= 0.535 af
Routed to Pond P4 : DMH 3

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 241.27' @ 12.12 hrs
Flood Elev= 239.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	236.70'	**15.0" Round Culvert** L= 70.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.70' / 236.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=5.01 cfs @ 12.09 hrs HW=240.77' TW=239.62' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 5.01 cfs @ 4.08 fps)

Summary for Pond P6: CB 7

Inflow Area = 0.490 ac, 73.08% Impervious, Inflow Depth > 7.41" for 100 Year Storm event
Inflow = 4.00 cfs @ 12.09 hrs, Volume= 0.302 af
Outflow = 4.00 cfs @ 12.09 hrs, Volume= 0.302 af, Atten= 0%, Lag= 0.0 min
Primary = 4.00 cfs @ 12.09 hrs, Volume= 0.302 af
Routed to Pond P7 : DMH 9

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 249.26' @ 12.19 hrs
Flood Elev= 243.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	240.40'	**15.0" Round Culvert** L= 130.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.40' / 239.70' S= 0.0054 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=244.51' TW=246.95' (Dynamic Tailwater)
↑—**1=Culvert** (Controls 0.00 cfs)

Summary for Pond P7: DMH 9

Inflow Area = 1.438 ac, 90.83% Impervious, Inflow Depth > 7.88" for 100 Year Storm event
Inflow = 11.95 cfs @ 12.09 hrs, Volume= 0.944 af
Outflow = 11.95 cfs @ 12.09 hrs, Volume= 0.944 af, Atten= 0%, Lag= 0.0 min
Primary = 11.95 cfs @ 12.09 hrs, Volume= 0.944 af
Routed to Pond P8 : DMH 8

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 248.95' @ 12.14 hrs
Flood Elev= 245.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	239.60'	**18.0" Round Culvert** L= 65.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 239.60' / 239.20' S= 0.0062 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=5.06 cfs @ 12.09 hrs HW=246.92' TW=246.36' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 5.06 cfs @ 2.86 fps)

Summary for Pond P8: DMH 8

Inflow Area = 1.504 ac, 91.23% Impervious, Inflow Depth > 7.89" for 100 Year Storm event
Inflow = 12.51 cfs @ 12.09 hrs, Volume= 0.989 af
Outflow = 12.51 cfs @ 12.09 hrs, Volume= 0.989 af, Atten= 0%, Lag= 0.0 min
Primary = 12.51 cfs @ 12.09 hrs, Volume= 0.989 af
Routed to Pond P10 : DMH 7

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 246.95' @ 12.10 hrs
Flood Elev= 244.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	239.10'	**18.0" Round Culvert** L= 285.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 239.10' / 237.65' S= 0.0051 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=11.32 cfs @ 12.09 hrs HW=246.36' TW=241.82' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 11.32 cfs @ 6.41 fps)

Summary for Pond P9: CB 6

Inflow Area = 0.067 ac,100.00% Impervious, Inflow Depth > 8.12" for 100 Year Storm event
Inflow = 0.56 cfs @ 12.09 hrs, Volume= 0.045 af
Outflow = 0.56 cfs @ 12.09 hrs, Volume= 0.045 af, Atten= 0%, Lag= 0.0 min
Primary = 0.56 cfs @ 12.09 hrs, Volume= 0.045 af
Routed to Pond P8 : DMH 8

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 246.97' @ 12.15 hrs
Flood Elev= 244.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	239.40'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 239.40' / 239.20' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=243.94' TW=246.35' (Dynamic Tailwater)
↑—**1=Culvert** (Controls 0.00 cfs)

Summary for Link OP1: 1008-79-11F

Inflow Area = 5.304 ac, 30.97% Impervious, Inflow Depth > 5.57" for 100 Year Storm event
Inflow = 13.50 cfs @ 12.17 hrs, Volume= 2.461 af
Primary = 13.50 cfs @ 12.17 hrs, Volume= 2.461 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Link OP2: ROADSIDE SWALE

Inflow Area = 3.708 ac, 0.26% Impervious, Inflow Depth > 5.12" for 100 Year Storm event
Inflow = 19.01 cfs @ 12.17 hrs, Volume= 1.583 af
Primary = 19.01 cfs @ 12.17 hrs, Volume= 1.583 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Link OP3: 1010-79-17A

Inflow Area = 1.951 ac, 0.00% Impervious, Inflow Depth > 2.26" for 100 Year Storm event
Inflow = 5.16 cfs @ 12.10 hrs, Volume= 0.367 af
Primary = 5.16 cfs @ 12.10 hrs, Volume= 0.367 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Summary for Link OP4: WETLANDS

Inflow Area = 9.380 ac, 64.20% Impervious, Inflow Depth > 4.97" for 100 Year Storm event
Inflow = 41.77 cfs @ 12.16 hrs, Volume= 3.883 af
Primary = 41.77 cfs @ 12.16 hrs, Volume= 3.883 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs

Section 2.2

Proposed Conditions
Pipe Summary & Analysis

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	2R	210.00	209.40	60.0	0.0100	0.013	0.0	24.0	0.0
2	3PR	167.70	165.00	90.0	0.0300	0.013	0.0	18.0	0.0
3	4PR	172.00	171.80	20.0	0.0100	0.013	0.0	12.0	0.0
4	5PR	214.00	212.00	20.0	0.1000	0.013	0.0	12.0	0.0
5	P10R	237.55	235.70	100.0	0.0185	0.013	0.0	24.0	0.0
6	P11R	237.75	237.65	10.0	0.0100	0.013	0.0	12.0	0.0
7	P12R	235.80	235.70	10.0	0.0100	0.013	0.0	15.0	0.0
8	P13R	236.70	235.90	80.0	0.0100	0.013	0.0	15.0	0.0
9	P15R	240.00	233.10	120.0	0.0575	0.013	0.0	12.0	0.0
10	P17R	234.10	233.10	35.0	0.0286	0.013	0.0	12.0	0.0
11	P18R	233.40	233.10	60.0	0.0050	0.013	0.0	12.0	0.0
12	P1R	240.20	238.30	210.0	0.0090	0.013	0.0	15.0	0.0
13	P20R	175.10	171.85	65.0	0.0500	0.013	0.0	15.0	0.0
14	P2R	238.20	235.90	100.0	0.0230	0.013	0.0	18.0	0.0
15	P3R	238.40	238.30	10.0	0.0100	0.013	0.0	12.0	0.0
16	P4R	235.90	235.80	10.0	0.0100	0.013	0.0	15.0	0.0
17	P5R	236.70	236.00	70.0	0.0100	0.013	0.0	15.0	0.0
18	P6R	240.40	239.70	130.0	0.0054	0.013	0.0	15.0	0.0
19	P7R	239.60	239.20	65.0	0.0062	0.013	0.0	18.0	0.0
20	P8R	239.10	237.65	285.0	0.0051	0.013	0.0	18.0	0.0
21	P9R	239.40	239.20	10.0	0.0200	0.013	0.0	12.0	0.0
22	P14	235.80	234.70	40.0	0.0275	0.013	0.0	24.0	0.0
23	P16	233.90	233.10	80.0	0.0100	0.013	0.0	24.0	0.0
24	P19	186.00	175.20	180.0	0.0600	0.013	0.0	15.0	0.0
25	P21	151.80	150.00	90.0	0.0200	0.013	0.0	12.0	0.0

Summary for Reach 1R: SWALE

Inflow Area = 1.105 ac, 87.52% Impervious, Inflow Depth > 2.24" for 10 Year Storm event
Inflow = 3.77 cfs @ 12.16 hrs, Volume= 0.206 af
Outflow = 3.75 cfs @ 12.17 hrs, Volume= 0.206 af, Atten= 1%, Lag= 0.8 min
Routed to Reach 2R : PLUNGE POOL

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.92 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.26 fps, Avg. Travel Time= 2.4 min

Peak Storage= 230 cf @ 12.17 hrs
Average Depth at Peak Storage= 0.65' , Surface Width= 3.92'
Bank-Full Depth= 1.50' Flow Area= 6.8 sf, Capacity= 34.54 cfs

0.00' x 1.50' deep channel, n= 0.069 Riprap, 6-inch
Side Slope Z-value= 3.0 '/' Top Width= 9.00'
Length= 180.0' Slope= 0.0889 '/'
Inlet Invert= 230.00', Outlet Invert= 214.00'

Summary for Reach 2R: PLUNGE POOL

Inflow Area = 1.841 ac, 52.51% Impervious, Inflow Depth > 2.14" for 10 Year Storm event
Inflow = 5.18 cfs @ 12.15 hrs, Volume= 0.329 af
Outflow = 5.19 cfs @ 12.15 hrs, Volume= 0.329 af, Atten= 0%, Lag= 0.1 min
Routed to Pond P19 : WET BASIN 1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.84 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.12 fps, Avg. Travel Time= 0.5 min

Peak Storage= 53 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.65' , Surface Width= 1.87'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 22.62 cfs

24.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 60.0' Slope= 0.0100 '/'
Inlet Invert= 210.00', Outlet Invert= 209.40'

Summary for Reach 3PR: DMH13

Inflow Area = 2.787 ac, 52.47% Impervious, Inflow Depth > 2.46" for 10 Year Storm event
Inflow = 2.79 cfs @ 12.38 hrs, Volume= 0.570 af
Outflow = 2.79 cfs @ 12.38 hrs, Volume= 0.570 af, Atten= 0%, Lag= 0.1 min
Routed to Pond P21 : WET BASIN 2

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.45 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.05 fps, Avg. Travel Time= 0.5 min

Peak Storage= 34 cf @ 12.38 hrs
Average Depth at Peak Storage= 0.40' , Surface Width= 1.32'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 18.19 cfs

18.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 90.0' Slope= 0.0300 '/'
Inlet Invert= 167.70', Outlet Invert= 165.00'

Summary for Reach 4PR: CB12

Inflow Area = 0.193 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 0.87 cfs @ 12.09 hrs, Volume= 0.069 af
Outflow = 0.88 cfs @ 12.09 hrs, Volume= 0.069 af, Atten= 0%, Lag= 0.1 min
Routed to Reach 3PR : DMH13

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.74 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.31 fps, Avg. Travel Time= 0.3 min

Peak Storage= 5 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.34' , Surface Width= 0.95'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.56 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 20.0' Slope= 0.0100 '/'
Inlet Invert= 172.00', Outlet Invert= 171.80'

Summary for Reach 5PR: CB11

Inflow Area = 0.183 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 0.83 cfs @ 12.09 hrs, Volume= 0.065 af
Outflow = 0.83 cfs @ 12.09 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min
Routed to Pond P19 : WET BASIN 1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.36 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.90 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.18' , Surface Width= 0.77'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 11.27 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 20.0' Slope= 0.1000 '/'
Inlet Invert= 214.00', Outlet Invert= 212.00'

Summary for Reach P10R: DMH7

Inflow Area = 2.657 ac, 95.04% Impervious, Inflow Depth > 4.18" for 10 Year Storm event
Inflow = 11.74 cfs @ 12.10 hrs, Volume= 0.926 af
Outflow = 11.75 cfs @ 12.10 hrs, Volume= 0.926 af, Atten= 0%, Lag= 0.1 min
Routed to Pond P14 : SC-740 (1)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 9.14 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.20 fps, Avg. Travel Time= 0.5 min

Peak Storage= 129 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.86' , Surface Width= 1.98'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 30.77 cfs

24.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 100.0' Slope= 0.0185 '/'
Inlet Invert= 237.55', Outlet Invert= 235.70'

Summary for Reach P11R: CB5

Inflow Area = 0.206 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 0.93 cfs @ 12.09 hrs, Volume= 0.074 af
Outflow = 0.93 cfs @ 12.09 hrs, Volume= 0.074 af, Atten= 0%, Lag= 0.0 min
Routed to Reach P10R : DMH7

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.81 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.34 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.35' , Surface Width= 0.95'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.56 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 10.0' Slope= 0.0100 '/'
Inlet Invert= 237.75', Outlet Invert= 237.65'

Summary for Reach P12R: DMH6

Inflow Area = 0.817 ac,100.00% Impervious, Inflow Depth > 4.30" for 10 Year Storm event
Inflow = 3.71 cfs @ 12.09 hrs, Volume= 0.293 af
Outflow = 3.71 cfs @ 12.09 hrs, Volume= 0.293 af, Atten= 0%, Lag= 0.0 min
Routed to Pond P14 : SC-740 (1)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.44 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.96 fps, Avg. Travel Time= 0.1 min

Peak Storage= 7 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.68' , Surface Width= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 6.46 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 10.0' Slope= 0.0100 '/'
Inlet Invert= 235.80', Outlet Invert= 235.70'

Summary for Reach P13R: CB4

Inflow Area = 0.817 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 3.70 cfs @ 12.09 hrs, Volume= 0.293 af
Outflow = 3.71 cfs @ 12.09 hrs, Volume= 0.293 af, Atten= 0%, Lag= 0.2 min
Routed to Reach P12R : DMH6

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.44 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.96 fps, Avg. Travel Time= 0.7 min

Peak Storage= 55 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.68' , Surface Width= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 6.46 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 80.0' Slope= 0.0100 '/'
Inlet Invert= 236.70', Outlet Invert= 235.90'

Summary for Reach P15R: CB8

Inflow Area = 0.336 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 1.53 cfs @ 12.09 hrs, Volume= 0.121 af
Outflow = 1.53 cfs @ 12.09 hrs, Volume= 0.121 af, Atten= 0%, Lag= 0.2 min
Routed to Pond P16 : SC-740 (2)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.22 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.86 fps, Avg. Travel Time= 0.7 min

Peak Storage= 22 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.29' , Surface Width= 0.90'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 8.54 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 120.0' Slope= 0.0575 '/'
Inlet Invert= 240.00', Outlet Invert= 233.10'

Summary for Reach P17R: CB9

Inflow Area = 0.355 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 1.61 cfs @ 12.09 hrs, Volume= 0.127 af
Outflow = 1.61 cfs @ 12.09 hrs, Volume= 0.127 af, Atten= 0%, Lag= 0.1 min
Routed to Pond P16 : SC-740 (2)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.48 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.28 fps, Avg. Travel Time= 0.3 min

Peak Storage= 9 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.35' , Surface Width= 0.96'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.02 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 35.0' Slope= 0.0286 '/'
Inlet Invert= 234.10', Outlet Invert= 233.10'

Summary for Reach P18R: CB10

Inflow Area = 0.414 ac, 66.66% Impervious, Inflow Depth > 3.44" for 10 Year Storm event
Inflow = 1.67 cfs @ 12.09 hrs, Volume= 0.118 af
Outflow = 1.67 cfs @ 12.09 hrs, Volume= 0.118 af, Atten= 0%, Lag= 0.3 min
Routed to Pond P16 : SC-740 (2)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.43 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.25 fps, Avg. Travel Time= 0.8 min

Peak Storage= 29 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.60' , Surface Width= 0.98'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.52 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 60.0' Slope= 0.0050 '/'
Inlet Invert= 233.40', Outlet Invert= 233.10'

Summary for Reach P1R: CB1

Inflow Area = 0.767 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 3.48 cfs @ 12.09 hrs, Volume= 0.275 af
Outflow = 3.48 cfs @ 12.10 hrs, Volume= 0.275 af, Atten= 0%, Lag= 0.6 min
Routed to Reach P2R : DMH1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.16 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.86 fps, Avg. Travel Time= 1.9 min

Peak Storage= 142 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.67' , Surface Width= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 6.14 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 210.0' Slope= 0.0090 '/'
Inlet Invert= 240.20', Outlet Invert= 238.30'

Summary for Reach P20R: DMH12

Inflow Area = 2.594 ac, 48.93% Impervious, Inflow Depth > 2.32" for 10 Year Storm event
Inflow = 2.55 cfs @ 12.51 hrs, Volume= 0.501 af
Outflow = 2.55 cfs @ 12.51 hrs, Volume= 0.501 af, Atten= 0%, Lag= 0.1 min
Routed to Reach 3PR : DMH13

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.87 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.55 fps, Avg. Travel Time= 0.3 min

Peak Storage= 19 cf @ 12.51 hrs
Average Depth at Peak Storage= 0.36' , Surface Width= 1.13'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 14.44 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 65.0' Slope= 0.0500 '/'
Inlet Invert= 175.10', Outlet Invert= 171.85'

Summary for Reach P2R: DMH1

Inflow Area = 1.889 ac,100.00% Impervious, Inflow Depth > 4.30" for 10 Year Storm event
Inflow = 8.56 cfs @ 12.09 hrs, Volume= 0.678 af
Outflow = 8.57 cfs @ 12.09 hrs, Volume= 0.678 af, Atten= 0%, Lag= 0.2 min
Routed to Pond P14 : SC-740 (1)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 9.17 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.30 fps, Avg. Travel Time= 0.5 min

Peak Storage= 93 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.78' , Surface Width= 1.50'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 15.93 cfs

18.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 100.0' Slope= 0.0230 '/'
Inlet Invert= 238.20', Outlet Invert= 235.90'

Summary for Reach P3R: CB2

Inflow Area = 0.175 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 0.79 cfs @ 12.09 hrs, Volume= 0.063 af
Outflow = 0.79 cfs @ 12.09 hrs, Volume= 0.063 af, Atten= 0%, Lag= 0.0 min
Routed to Reach P2R : DMH1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.64 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.27 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.32' , Surface Width= 0.93'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.56 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 10.0' Slope= 0.0100 '/'
Inlet Invert= 238.40', Outlet Invert= 238.30'

Summary for Reach P4R: DMH3

Inflow Area = 0.790 ac,100.00% Impervious, Inflow Depth > 4.30" for 10 Year Storm event
Inflow = 3.59 cfs @ 12.09 hrs, Volume= 0.283 af
Outflow = 3.59 cfs @ 12.09 hrs, Volume= 0.283 af, Atten= 0%, Lag= 0.0 min
Routed to Pond P14 : SC-740 (1)

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.40 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.94 fps, Avg. Travel Time= 0.1 min

Peak Storage= 7 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.67' , Surface Width= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 6.46 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 10.0' Slope= 0.0100 '/'
Inlet Invert= 235.90', Outlet Invert= 235.80'

Summary for Reach P5R: CB3

Inflow Area = 0.790 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 3.58 cfs @ 12.09 hrs, Volume= 0.283 af
Outflow = 3.59 cfs @ 12.09 hrs, Volume= 0.283 af, Atten= 0%, Lag= 0.2 min
Routed to Reach P4R : DMH3

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.39 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.94 fps, Avg. Travel Time= 0.6 min

Peak Storage= 47 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.67' , Surface Width= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 6.46 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 70.0' Slope= 0.0100 '/'
Inlet Invert= 236.70', Outlet Invert= 236.00'

Summary for Reach P6R: CB7

Inflow Area = 0.490 ac, 73.08% Impervious, Inflow Depth > 3.64" for 10 Year Storm event
Inflow = 2.06 cfs @ 12.09 hrs, Volume= 0.149 af
Outflow = 2.06 cfs @ 12.10 hrs, Volume= 0.149 af, Atten= 0%, Lag= 0.5 min
Routed to Reach P7R : DMH9

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.73 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.32 fps, Avg. Travel Time= 1.6 min

Peak Storage= 72 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.58' , Surface Width= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.74 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 130.0' Slope= 0.0054 '/'
Inlet Invert= 240.40', Outlet Invert= 239.70'

Summary for Reach P7R: DMH9

Inflow Area = 1.438 ac, 90.83% Impervious, Inflow Depth > 4.08" for 10 Year Storm event
Inflow = 6.35 cfs @ 12.09 hrs, Volume= 0.489 af
Outflow = 6.36 cfs @ 12.09 hrs, Volume= 0.489 af, Atten= 0%, Lag= 0.2 min
Routed to Reach P8R : DMH8

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.14 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.85 fps, Avg. Travel Time= 0.6 min

Peak Storage= 80 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.99' , Surface Width= 1.42'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 8.24 cfs

18.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 65.0' Slope= 0.0062 '/'
Inlet Invert= 239.60', Outlet Invert= 239.20'

Summary for Reach P8R: DMH8

Inflow Area = 1.504 ac, 91.23% Impervious, Inflow Depth > 4.09" for 10 Year Storm event
Inflow = 6.66 cfs @ 12.09 hrs, Volume= 0.512 af
Outflow = 6.57 cfs @ 12.11 hrs, Volume= 0.512 af, Atten= 1%, Lag= 0.8 min
Routed to Reach P10R : DMH7

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.78 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.75 fps, Avg. Travel Time= 2.7 min

Peak Storage= 392 cf @ 12.11 hrs
Average Depth at Peak Storage= 1.09' , Surface Width= 1.34'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 7.49 cfs

18.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 285.0' Slope= 0.0051 '/'
Inlet Invert= 239.10', Outlet Invert= 237.65'

Summary for Reach P9R: CB6

Inflow Area = 0.067 ac,100.00% Impervious, Inflow Depth > 4.31" for 10 Year Storm event
Inflow = 0.30 cfs @ 12.09 hrs, Volume= 0.024 af
Outflow = 0.30 cfs @ 12.09 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min
Routed to Reach P8R : DMH8

Routing by Dyn-Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.52 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 1.22 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.17' , Surface Width= 0.74'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.04 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 10.0' Slope= 0.0200 '/'
Inlet Invert= 239.40', Outlet Invert= 239.20'

Section 3.1

Treatment Train TSS
Calculations

Version 1, Automated: Mar. 4, 2008

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: Wet Basin 1 (Node P19)

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Sediment Forebay	0.25	1.00	0.25	0.75
Wet Basin	0.80	0.75	0.60	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Total TSS Removal = 85%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: Pie Hill Warehousing
Prepared By: CLR
Date: 4/4/2022

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet
must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

Version 1, Automated: Mar. 4, 2008

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

TSS Removal Calculation Worksheet

Location: Wet Basin 2 (Node P21)

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Sediment Forebay	0.25	1.00	0.25	0.75
Wet Basin	0.80	0.75	0.60	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Total TSS Removal = 85%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: Pie Hill Warehousing
Prepared By: CLR
Date: 4/4/2022

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet
must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

Version 1, Automated: Mar. 4, 2008

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: SC-740 1 (Node P14)

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Subsurface Infiltration Structure	0.80	0.75	0.60	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Total TSS Removal = 85%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: Pie Hill Warehousing
Prepared By: CLR
Date: 6/28/2022

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

TSS Removal Calculation Worksheet

Location: SC-740 1 (Node P14)

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Subsurface Infiltration Structure	0.80	0.75	0.60	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Total TSS Removal = 85%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: Pie Hill Warehousing
Prepared By: CLR
Date: 6/28/2022

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet
must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

Section 3.2

Test Pit Data

FIELDSTONE
LAND CONSULTANTS, PLLC
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www.FieldstoneLandConsultants.com

TEST PIT DATA
JOSEPH GULLA
TAX MAP 1010 LOT 79-17
46 OLD FERRY ROAD
METHUEN, MA

12/3/19
Test Pit #1
0-10"- Asphalt/mix
10-20"- 10YR 4/6 Dark yellowish brown fine sandy loam, granular friable
20-96"- 2.5Y 5/6 Light olive brown fine sandy loam, weak blocky
ESHWT = 96" **Observed water = None** **Ledge/boulders = None** **Roots = None**

12/3/19
Test Pit #2
0-6"- Asphalt/loam/disturbed
6-96"- 2.5 Y 5/6 Light olive brown fine sandy loam, massive firm
ESHWT = 60"+* **Observed water = None** **Ledge/boulders = None** **Roots = 48"**

12/3/19
Test Pit #3
0-12" – 10YR 3/3 Dark brown loam, granular friable
12-30" – 10 YR 4/6 Dark yellowish brown fine sandy loam
30-60" – 2.5 Y 5/6 Light olive brown fine sandy loam, massive firm
60-96" – 2.5 Y 4/3 Olive brown fine sandy loam, massive firm
ESHWT = 60"+* **Observed water = None** **Ledge/boulders = None** **Roots=48"**

12/3/19
Test Pit #4
0-12" – 10YR 3/3 Dark brown loam, granular friable
12-20" – 10 YR 4/6 Dark yellowish brown fine sandy loam
20-60" – 2.5 Y 5/6 Light olive brown fine sandy loam, massive firm
60-96" – 2.5 Y 4/3 Olive brown fine sandy loam, massive firm
ESHWT = 60"+* **Observed water =None** **Ledge/boulders = None** **Roots =50"**

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12/3/19
Test Pit #5
0-6" – 10YR 3/3 Dark brown loam granular friable
6-20" – 10 YR 4/6 Dark yellowish brown fine sandy loam
20-60" – 2.5 Y 5/6 Light olive brown fine sandy loam, massive firm
60-96" – 2.5 Y 4/3 Olive brown fine sandy loam, massive firm
ESHWT = 60"+* Observed water = None Ledge/boulders = None Roots = 96"

12/3/19
Test Pit #6
0-6" – 10YR 3/3 Dark brown loam granular friable
6-20" – 10 YR 4/6 Dark yellowish brown fine sandy loam
20-60" – 2.5 Y 5/6 Light olive brown fine sandy loam, massive firm
60-96" – 2.5 Y 4/3 Olive brown fine sandy loam, massive firm
ESHWT = 60"+* Observed water = None Ledge/boulders = None Roots =50""+

12/3/19
Test Pit #7
0-6" – 10YR 3/3 Dark brown loam, granular friable
6-20" – 10 YR 4/6 Dark yellowish brown, fine sandy loam
20-60" – 2.5 Y 5/6 Light olive brown fine sandy loam, massive firm
60-96" – 2.5 Y 4/3 Olive brown fine sandy loam, massive firm
ESHWT = 60"+* Observed water = None Ledge/boulders = None Roots =55"

6/23/20
Deep Hole #1
0-10" – 10YR 3/3 Dark brown loam, granular friable
10-28" – 10 YR 4/6 Dark yellowish brown loamy fine sand, granular, friable
28-40" – 2.5 Y 6/4 Light yellowish brown gravelly loamy fine sand, massive, moderately firm
40-115" – 2.5 Y 4/3 Olive brown fine sandy loam, massive/blocky, moderately firm
ESHWT = 115"* Observed water = None Ledge/boulders = None Roots =90"
Percolation Test #1: Perc Rate= 2 minutes per inch at 72"

6/23/20
Deep Hole #2
0-12" – 10YR 3/3 Dark brown loam, granular friable
12-26" – 10 YR 4/6 Dark yellowish brown gravelly loamy sand, granular, friable
26-48" – 10 YR 5/6 Yellowish brown gravelly loamy fine-to-medium sand, granular, friable
48-115" – 2.5 Y 6/3 Light yellowish brown fine sandy loam, weak blocky, moderately firm
ESHWT = 115"* Observed water = None Ledge/boulders = None Roots =90"

6/23/20
Deep Hole #3
0-12" – 10YR 3/3 Dark brown loam, granular friable
12-24" – 10 YR 4/6 Dark yellowish brown gravelly loamy sand, granular, friable
24-45" – 10 YR 5/6 Yellowish brown gravelly loamy fine-to-medium sand, granular, friable
45-115" – 2.5 Y 6/3 Light yellowish brown, fine sandy loam, weak blocky, moderately firm
ESHWT = 115"* **Observed water = None** **Ledge/boulders = None** **Roots =90"**
Percolation Test #2: Perc Rate= 3 minutes per inch at 84"

6/23/20
Deep Hole #4
0-10" – 10YR 3/3 Dark brown loam, granular friable
10-22" – 10 YR 4/6 Dark yellowish brown gravelly loamy sand, granular, friable
22-32" – 10 YR 5/6 Yellowish brown gravelly loamy fine-to-medium sand, granular, friable
32-115" – 2.5 Y 6/3 Light yellowish brown fine sandy loam, weak blocky, moderately firm
ESHWT = 115"* **Observed water = None** **Ledge/boulders = None** **Roots =86"**

6/23/20
Deep Hole #5
0-6" – 10YR 3/3 Dark brown loam, granular friable
6-20" – 10 YR 5/6 Yellowish brown gravelly loamy fine-to-medium sand, granular, friable
20-48" – 2.5 Y 6/3 Light yellowish brown gravelly fine-to-medium sand, massive, friable
48-112" – 2.5 Y 4/3 Olive brown gravelly sandy loam, massive/blocky, firm
ESHWT = 90"* **Observed water = None** **Ledge/boulders = None** **Roots =86"**

6/23/20
Deep Hole #6
0-8" – 10YR 3/3 Dark brown loam, granular friable
8-24" – 10 YR 5/6 Yellowish brown gravelly loamy fine-to-medium sand, granular, friable
24-50" – 2.5 Y 6/3 Light yellowish brown gravelly fine-to-medium sand, massive, friable
50-96" – 2.5 Y 4/3 Olive brown gravelly sandy loam, massive/blocky, firm
ESHWT = 90"* **Observed water = None** **Ledge/boulders = None** **Roots =80"**
Percolation Test #3: Perc Rate= 70 minutes per inch at 84"

6/23/20
Deep Hole #7
0-8" – 10YR 3/3 Dark brown loam, granular friable
8-24" – 10 YR 5/6 Yellowish brown gravelly loamy fine-to-medium sand, granular, friable
24-60" – 2.5 Y 6/3 Light yellowish brown gravelly fine-to-medium sand, massive, friable
60-106" – 2.5 Y 4/3 Olive brown gravelly sandy loam, massive/blocky, firm
ESHWT = 100"* **Observed water = None** **Ledge/boulders = None** **Roots =100"**
Percolation Test #4: Perc Rate= 46 minutes per inch at 72"

6/23/20
Deep Hole #8
0-6" – 10YR 3/3 Dark brown loam, granular friable
6-24" – 10 YR 5/8 Yellowish brown fine sandy loam, granular, friable
24-36" – 2.5 Y 5/3 Light olive brown, fine sandy loam, massive, friable
36-105" – 2.5 Y 4/3 Olive brown gravelly sandy loam, massive/blocky, firm
ESHWT = 90"*   Observed water = None   Ledge/boulders = None   Roots =86"

6/23/20
Deep Hole #9
0-6" – 10YR 3/3 Dark brown loam, granular friable
6-30" – 10 YR 5/6 Yellowish brown gravelly fine-to-medium sand, granular, friable
30-48" – 2.5 Y 6/3 Light yellowish brown gravelly fine-to-medium sand, moderately firm, massive
48-116" – 2.5 Y 4/3 Olive brown gravelly sandy loam, massive, firm
ESHWT = 90"*   Observed water = None   Ledge/boulders = None   Roots =90"

6/23/20
Deep Hole #10
0-6" – 10YR 3/3 Dark brown loam, granular friable
6-21" – 10 YR 5/6 Yellowish brown gravelly fine-to-medium sand, granular, friable
21-48" – 2.5 Y 6/3 Light yellowish brown gravelly fine-to-medium sand, moderately firm, massive
48-102" – 2.5 Y 4/3 Olive brown gravelly sandy loam, massive, firm
ESHWT = 90"*   Observed water = None   Ledge/boulders = None   Roots =90"

5/17/21
Test Pit #20A
0-14"- 10 YR 3/3 Dark brown loam, granular, friable
14-42"- 2.5 Y 6/4 Light yellowish brown gravelly silt loam, massive, friable
42-110"- 2.5Y 6/4 Light yellowish brown gravelly silt loam, massive, moderately firm
ESHWT = 38"   Observed water = 56"   Ledge/boulders = None   Roots =70"

5/17/21
Test Pit #20B
0-12"- 10 YR 3/3 Dark brown loam, granular, friable
12-40"- 2.5 Y 6/4 Light yellowish brown gravelly silt loam, massive, friable
40-120"- 2.5Y 6/4 Light yellowish brown gravelly silt loam, massive, moderately firm
ESHWT = 38"   Observed water = 60"   Ledge/boulders = None   Roots =64"

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5/17/21
Test Pit #21A
0-10"- 10 YR 3/3 Dark brown loam, granular, friable
10-38"- 10 YR 5/6 Yellowish brown fine sandy loam, granular, friable
38-96"- 2.5Y 6/3 Light yellowish brown fine sandy loam, weak blocky, friable
ESHWT = 56" **Observed water = None** **Ledge/boulders = None** **Roots =60"**

5/17/21
Test Pit #21B
0-4"- 10 YR 3/3 Dark brown loam, granular, friable
4-23"- 10 YR 5/6 Yellowish brown fine sandy loam, granular, friable
23-96"- 2.5Y 6/3 Light yellowish brown gravelly fine sandy loam, weak blocky, friable
ESHWT = 76" **Observed water = None** **Ledge/boulders = None** **Roots =84"**

5/17/21
Test Pit #22A
0-12"- 10 YR 3/3 Dark brown loam, granular, friable
12-48"- 10 YR 5/6 Yellowish brown fine sandy loam, granular, friable
48-96"- 2.5Y 6/3 Light yellowish brown fine sandy loam, weak blocky, friable
ESHWT = 48" **Observed water = 48"** **Ledge/boulders = None** **Roots =54"**

5/17/21
Test Pit #22B
0-4"- 10 YR 3/3 Dark brown loam, granular, friable
4-26"- 10 YR 5/6 Yellowish brown fine sandy loam, granular, friable
26-96"- 2.5Y 6/3 Light yellowish brown fine sandy loam, weak blocky, friable
ESHWT = 50" **Observed water = None** **Ledge/boulders = None** **Roots =52"**

3/24/22
Test Pit #1A
0-6"- 10 YR 3/3 Dark brown loam, granular, friable
6-13"- 2.5 Y 5/6 Light olive brown fine sandy loam, granular, friable
13-78"- 2.5Y 6/3 Light yellowish brown gravelly fine sandy loam, massive, friable
ESHWT = None **Observed water = None** **Ledge/boulders = None** **Roots = 18"**

3/24/22
Test Pit #2A
0-14"- 2.5 Y 5/3 Light olive brown very fine sandy loam, massive, friable. Fill
14-42"- 2.5 Y 5/2 Grayish brown very fine sandy loam, massive, friable. Fill
42-48"- 10 YR 5/1 Gray fine sandy loam, massive, friable. Fill
48-82"- 10 YR 3/3 Dark brown gravelly loam, massive, friable. Fill
ESHWT = None **Observed water = None** **Ledge/boulders = None** **Roots = 4"**

3/24/22
Test Pit #3A
0-9"- 10 YR 3/3 Dark brown stony loam, granular, friable
9-45"- 2.5 Y 5/6 Light olive brown loamy fine-to-medium sand, granular, friable
45-72"- 2.5Y 5/6 Light olive brown gravelly loamy fine sand, massive, friable
ESHWT = None **Observed water = None** **Ledge/boulders = None** **Roots = 18"**

3/24/22
Test Pit #4A
0-14"- 2.5 Y 5/3 Light olive brown very fine sandy loam, massive, friable. Fill
14-36"- 2.5 Y 5/2 Grayish brown very fine sandy loam, massive, friable. Fill
36-48"- 10 YR 5/1 Gray fine sandy loam, massive, friable. Fill
48-74"- 10 YR 3/3 Dark brown gravelly loam, massive, friable. Fill
ESHWT = None **Observed water = None** **Ledge/boulders = None** **Roots = 54"**

3/24/22
Test Pit #5A
0-2"- 2.5 Y 5/3 Light olive brown very fine sandy loam, massive, friable. Fill
2-30"- 2.5 Y 5/2 Grayish brown very fine sandy loam, massive, friable. Fill
30-48"- 10 YR 5/1 Gray fine sandy loam, massive, friable. Fill with construction debris
48-72"- 10 YR 3/3 Dark brown gravelly loam, massive, friable. Fill with construction debris
ESHWT = None **Observed water = None** **Ledge/boulders = None** **Roots = 58"**

3/24/22
Test Pit #6A
0-12"- 10 YR 3/3 Dark brown loam, granular, friable
12-60"- 2.5 Y 6/3 Light yellowish brown fine sandy loam, granular, friable. Extremely stony fill.
ESHWT = None **Observed water = None** **Ledge/boulders = None** **Roots = 48"**

3/24/22
Test Pit #7A
0-2"- 10 YR 3/3 Dark brown loam, granular, friable
2-36"- 2.5 Y 5/2 Grayish brown stony fine sandy loam, granular, friable
36-50"- 2.5 Y 5/2 Grayish brown gravelly fine sandy loam, massive, firm. Till
ESHWT = 36" **Observed water = 36"** **Ledge/boulders = None** **Roots = 38"**

6/23/22
Test Pit #8
0-6"- 10 YR 3/3 Dark brown loam, granular, friable
6-28"- 2.5 Y 5/6 Light olive brown fine sandy loam, granular, friable
28-46"- 10 YR 5/3 Brown fine sandy loam, granular, friable
46-140" - 10 YR 5/3 Brown gravelly fine sandy loam, massive, firm
ESHWT = 96"* **Observed water = None** **Ledge/boulders = None** **Roots = 36"**

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6/23/22
Test Pit #9
0-8"- 10 YR 3/3 Dark brown loam, granular, friable
8-30"- 2.5 Y 5/6 Light olive brown fine sandy loam, granular, friable
30-42"- 10 YR 5/3 Brown fine sandy loam, granular, friable
42-140" - 10 YR 5/3 Brown gravelly fine sandy loam, massive, firm
ESHWT = None **Observed water = None** **Ledge/boulders = None** **Roots = 48"**

6/23/22
Test Pit #10
0-36"- 10 YR 5/3 Brown fine sandy loam, granular, friable
36-150"- 10 YR 5/3 Brown stony fine sandy loam, massive, firm
ESHWT = None **Observed water = None** **Ledge/boulders = None** **Roots = 48"**

6/23/22
Test Pit #11
0-34"- 10 YR 5/3 Brown fine sandy loam, granular, friable
34-130 - 10 YR 5/3 Brown stony fine sandy loam, massive, friable
130-180"- 10 YR 5/3 Brown stony fine sandy loam, subangular blocky, firm
ESHWT = 130" **Observed water = None** **Ledge/boulders = None** **Roots = 12"**

6/23/22
Test Pit #12
0-42"- 10 YR 5/3 Brown fine sandy loam, granular, friable
42-130 - 10 YR 5/3 Brown stony fine sandy loam, massive, friable
130-160"- 10 YR 5/3 Brown stony fine sandy loam, subangular blocky, firm
ESHWT = 132" **Observed water = None** **Ledge/boulders = None** **Roots = 8"**

6/23/22
Test Pit #13
0-36"- 10 YR 5/3 Brown fine sandy loam, granular, friable
36-138 - 10 YR 5/3 Brown stony fine sandy loam, massive, friable
ESHWT = None **Observed water = None** **Ledge/boulders = None** **Roots = 12"**

6/23/22
Test Pit #14
0-48"- 10 YR 5/3 Brown fine sandy loam, granular, friable
48-140 - 10 YR 5/3 Brown stony fine sandy loam, massive, friable
ESHWT = 100" **Observed water = None** **Ledge/boulders = None** **Roots = 18"**

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6/23/22
Test Pit #15
0-30"- 10 YR 5/3 Brown fine sandy loam, granular, friable
30-160"- 10 YR 5/3 Brown stony fine sandy loam, massive, firm
ESHWT = 105" **Observed water = None** **Ledge/boulders = None** **Roots = 24"**

6/23/22
Test Pit #16
0-14"- Gravel/asphalt mix
14-96 - 2.5Y 5/4 Light yellow brown boulder gravel and sand, single grain, loose (fill/rubble)
96-140"- 10 YR 5/3 Brown gravelly fine sandy loam, massive, firm
ESHWT =96" **Observed water = None** **Ledge/boulders = None** **Roots = 84"**

6/23/22
Test Pit #17
0-6"- 10 YR 3/3 Dark brown loam, granular, friable
6-28 - 7.5 YR 4/4 Brown stony fine sandy loam, granular, friable
28-84 - 2.5 Y5/4 Light yellow brown gravelly loamy fine sand, granular, friable
84-120"- 2.5 Y5/4 Light yellow brown gravelly loamy fine sand, granular, friable
ESHWT = 90" **Observed water = None** **Ledge/boulders = None** **Roots = 42"**

Test Pits were logged by:

Christopher A. Guida, CSS, CWS
Certified Soil & Wetland Scientist
MA Soil Evaluator #SE13488

&

Kenneth Robinson, CWS
Certified Wetland Scientist

Note:
** Asterisk denotes observations of seasonal high water estimates based on physical characteristics of the Glacial Till soil properties since there was no diagnostic redoximorphic features, nor any other secondary indicators such as groundwater seepage or free water observed within test pits. All of the test pits with the (*) recorded no actual groundwater table but did contain horizons of dense glacial till commonly associated with these type of glacial deposits and landforms (Glacial Till Drumlins). Additional soil data gathered through geotechnical borings and associated report prepared by Geotechnical Services Inc. confirmed the soil properties and lack of a true groundwater table at greater depths than the surficial test pits conducted. Estimated water tables found in these soil conditions and geographic location on top of hills (Glacial Till Drumlins) are typically considered to be only temporary and perched within portions of the dense soil after storm events or seasonal fluctuations such as spring snow melt.*

Section 3.3

Stormwater Inspection & Maintenance Manual

Pie Hill Warehousing
46 Old Ferry Road, Methuen, Massachusetts
Storm Water Management System
Inspection and Maintenance Manual

Submitted: April 4, 2022

Last Revised: July 22, 2022

Introduction

The operation and maintenance of a storm water management system and its individual components is as critical to system performance as the design. Without proper maintenance, best management practices (BMPs) are likely to become functionally impaired or to fail, providing reduced or no treatment of storm water. Proper operation and maintenance will ensure that the storm water system and individual BMPs will remain effective at removing pollutants as designed and meeting Methuen's water quality objectives. Proper maintenance will:

- Maintain the volume of storm water treated over the long term;
- Sustain the pollutant removal efficiency of the BMP;
- Reduce the risk of re-suspending sediment and other pollutants captured by the BMP;
- Prevent structural deterioration of the BMP and minimize the need for expensive repairs;
- Decrease the potential for failure of the BMP.

The Massachusetts Department of Environmental Protection (MassDEP) Stormwater Handbook requires that the long term maintenance of storm water practices, and stipulates the establishment of a mechanism to provide for ongoing inspections and maintenance.

In accordance with Massachusetts Department of Environmental Protection Stormwater Handbook the mechanism for providing long-term maintenance practices for this development are as follows:

Responsible Maintenance Party:

Owner: Triple G, LLC
46 Alsun Drive
Hollis, NH 03049

Report Information:

- Triple G, LLC or their assigns will be the individual responsible for implementing the required reporting, inspection, and maintenance activities identified in the I & M manual.
- Triple G, LLC or their assigns will maintain all record keeping required by the I & M manual. Any transfer of responsibility for I & M activities or transfer in ownership shall be documented to the City of Methuen DPW in writing.

- Inspection and maintenance reports shall be completed after each inspection. Copies of the report forms to be completed by the inspector are attached at the end of this manual, including:
    - Inspection checklist to be used during each inspection;
    - Inspection and maintenance logs to document each inspection and maintenance activity;
- Copies of each completed inspection and maintenance report will be provided to the Methuen Conservation Commission.

Maintenance Recommendations for Best Management Practices:

The following recommendations are to be used as a guide for the inspection and maintenance of the permanent erosion and sediment control measures.

Stormwater Management Basin

- Basins should be inspected at least twice annually, and following any rainfall event exceeding 2.5 inches in a 24 hour period, with maintenance or rehabilitation conducted as warranted by such inspection.
- Inspect, repair and remove debris from headwalls, end sections and riprap aprons.
- Remove woody vegetation from the Stormwater Management Basin with periodic mowing of embankments.
- Inspection and repair of embankments and spillways as required.
- Remove accumulated sediment from basin bottom and crushed stone as necessary.
- Dispose of sediments and other wastes in conformance with applicable local, state and federal regulations.
- If an infiltration system does not drain within 72-hours following a rainfall event, then a qualified professional should assess the condition of the facility to determine measures required to restore infiltration function, including but not limited to removal of accumulated sediments or reconstruction of the infiltration basin.

Conveyance Swales

- Inspect swales at least semi-annually.
- Remove accumulated sediment from swales when the sediment exceeds the height of the grass in the swale.
- Repair any damage in the swales as a result of erosion immediately after the inspection to restore the treatment function and prevent further damage to the swales.
- Dispose of sediments and other wastes in conformance with applicable local, state and federal regulations.

Sediment Forebays

- Inspect Forebays monthly for first year to determine sediment load. If sediment load is heavy then maintain monthly inspections. If sediment load is light then reduce inspection accordingly but inspect at least semi-annually.
- Remove trash upon inspection and accumulated sedimentation when sediments have accumulated to within 6 inches of the outlet and/or when there is evidence of excessive sediment being conveyed to downstream BMP.
- Repair any damage in the forebay as a result of erosion immediately after the inspection to minimize sediment transport.
- Dispose of sediments and other wastes in conformance with applicable local, state and federal regulations.

Stormtech Chambers

- See Attached.

Outlet Protection - Riprap Aprons

- Inspect the outlet protection annually for damage and deterioration. Repair damages immediately.
- Remove debris from apron area.

Inspection Checklist /Maintenance Logs

The inspection checklist and maintenance logs following this report shall be used as a guide for the inspection reporting for this project.

Mosquito Control in Stormwater Management Practices

Both aboveground and underground stormwater BMPs have the potential to serve as mosquito breeding areas. Good design, proper operation and maintenance and treatment with larvicides can minimize this potential.

EPA recommends that stormwater treatment practices dewater within 3 days (72 hours) to reduce the number of mosquitoes that mature to adults, since the aquatic stage of many mosquito species is 7 to 10 days. Massachusetts has had a 72-hour dewatering rule in its Stormwater Management Standards since 1996. The 2008 technical specifications for BMPs set forth in Volume 2, Chapter 2 of the Massachusetts Stormwater Handbook also concur with this practice by requiring that all stormwater practices designed to drain do so within 72 hours.

Some stormwater practices are designed to include permanent wet pools. These practices – if maintained properly – can limit mosquito breeding by providing habitat for mosquito predators. Additional measures that can be taken to reduce mosquito populations include increasing water circulation, attracting mosquito predators by adding suitable habitat, and applying larvicides.

The Massachusetts State Reclamation and Mosquito Control Board (SRMCB), through the Massachusetts Mosquito Control Districts, can undertake further mosquito control actions specifically for the purpose of mosquito control pursuant to Massachusetts General Law Chapter 252. The Mosquito Control Board, http://www.mass.gov/eea/agencies/agr/pesticides/mosquito/, describes mosquito control methods and is in the process of developing guidance documents that describe Best Management Practices for mosquito control projects.

The SRMCB and Mosquito Control Districts are not responsible for operating and maintaining stormwater BMPs to reduce mosquito populations. The owners of property that construct the stormwater BMPs or municipalities that "accept" them through local subdivision approval are responsible for their maintenance.[1] The SRMCB is composed of officials from MassDEP, Department of Agricultural Resources, and Department of Conservation and Recreation. The nine (9) Mosquito Control Districts overseen by the SRMCB are located throughout Massachusetts, covering 176 municipalities.

Construction Period Best Management Practices for Mosquito Control

To minimize mosquito breeding during construction, it is essential that the following actions be taken to minimize the creation of standing pools by taking the following actions:

- ***Minimize Land Disturbance:*** Minimizing land disturbance reduces the likelihood of mosquito breeding by reducing silt in runoff that will cause construction period controls to clog and retain standing pools of water for more than 72 hours.
- ***Catch Basin inlets:*** Inspect and refresh filter fabric, hay bales, filter socks or stone dams on a regular basis to ensure that any stormwater ponded at the inlet drains within 8 hours after precipitation stops. Shorter periods may be necessary to avoid hydroplaning in roads caused by water ponded at the catch basin inlet. Treat catch basin sumps with larvicides such as *Bacillus sphaericus* (*Bs*) using a licensed pesticide applicator.
- ***Check Dams:*** If temporary check dams are used during the construction period to lag peak rate of runoff or pond runoff for exfiltration, inspect and repair the check dams on a regular basis to ensure that any stormwater ponded behind the check dam drains within 72 hours.

- ***Design construction period sediment traps*** to dewater within 72 hours after precipitation. Because these traps are subject to high silt loads and tend to clog, treat them with the larvicide *Bs* after it rains from June through October, until the first frost occurs.
- ***Construction period open conveyances:*** When temporary manmade ditches are used for channelizing construction period runoff, inspect them on a regular basis to remove any accumulated sediment to restore flow capacity to the temporary ditch.
- ***Revegetating Disturbed Surfaces:*** Revegetating disturbed surfaces reduces sediment in runoff that will cause construction period controls to clog and retain standing pools of water for greater than 72 hours.
- ***Sediment fences/hay bale barriers:*** When inspections find standing pools of water beyond the 24-hour period after a storm, take action to restore barrier to its normal function.

<u>Post-Construction Stormwater Treatment Practices</u>

- Mosquito control begins with the environmentally sensitive site design. Environmentally sensitive site design that minimizes impervious surfaces reduces the amount of stormwater runoff. Disconnecting runoff using the LID Site Design credits outlined in the Massachusetts Stormwater Handbook reduces the amount of stormwater that must be conveyed to a treatment practice. Utilizing green roofs minimizes runoff from smaller storms. Storage media must be designed to dewater within 72 hours after precipitation.
- Mosquito control continues with the selection of structural stormwater BMPs that are unlikely to become breeding grounds for mosquitoes, such as:
  - ***Bioretention Areas/Rain Gardens/Sand Filter:*** These practices tend not to result in mosquito breeding. If any level spreaders, weirs or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
  - ***Infiltration Trenches:*** This practice tends not to result in mosquito breeding. If any level spreaders, weirs, or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
- Another mosquito control strategy is to select BMPs that can become habitats for mosquito predators, such as:
  - ***Constructed Stormwater Wetlands:*** Habitat features can be incorporated in constructed stormwater wetlands to attract dragonflies, amphibians, turtles, birds, bats, and other natural predators of mosquitoes.
  - ***Wet Basins:*** Wet basins can be designed to incorporate fish habitat features, such as deep pools. Introduce fish in consultation with Massachusetts Division of Fisheries and Wildlife. Vegetation within wet basins designed as fish habitat must be properly managed to ensure that vegetation does not overtake the habitat. Proper design to ensure that no low circulation or "dead" zones are created may reduce the potential for mosquito breeding. Introducing bubblers may increase water circulation in the wet basin.

Effective mosquito controls require proponents to design structural BMPs to prevent ponding and facilitate maintenance and, if necessary, the application of larvicides. Examples of such design practices include the following:

- ***Basins:*** Provide perimeter access around wet basins, extended dry detention basins and dry detention basins for both larviciding and routine maintenance. Control vegetation to ensure that access pathways stay open.

- ***BMPs without a permanent pool of water:*** All structural BMPs that do not rely on a permanent pool of water must drain and completely dewater within 72 hours after precipitation. This includes dry detention basins, extended dry detention basins, infiltration basins, and dry water quality swales. Use underdrains at extended dry detention basins to drain the small pools that form due to accumulation of silts. Wallace indicates that extended dry extended detention basins may breed more mosquitoes than wet basins. It is, therefore, imperative to design outlets from extended dry detention basins to completely dewater within the 72-hour period.
- ***Energy Dissipators and Flow Spreaders:*** Currier and Moeller, 2000 indicate that shallow recesses in energy dissipators and flow spreaders trap water where mosquitoes breed. Set the riprap in grout to reduce the shallow recesses and minimize mosquito breeding.
- ***Outlet control structures:*** Debris trapped in small orifices or on trash racks of outlet control structures such as multiple stage outlet risers may clog the orifices or the trash rack, causing a standing pool of water. Optimize the orifice size or trash rack mesh size to provide required peak rate attenuation/water quality detention/retention time while minimizing clogging.
- ***Rain Barrels and Cisterns:*** Seal lids to reduce the likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over inlets. The cistern system should be designed to ensure that all collected water is drained into it within 72 hours.
- ***Subsurface Structures, Deep Sump Catch Basins, Oil Grit Separators, and Leaching Catch Basins:*** Seal all manhole covers to reduce likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over the outlet (CALTRANS 2004).

The Operation and Maintenance Plan should provide for mosquito prevention and control.

- ***Check dams:*** Inspect permanent check dams on the schedule set forth in the O&M Plan. Inspect check dams 72 hours after storms for standing water ponding behind the dam. Take corrective action if standing water is found.
- ***Cisterns:*** Apply *Bs* larvicide in the cistern if any evidence of mosquitoes is found. The Operation and Maintenance Plan shall specify how often larvicides should be applied to waters in the cistern.
- ***Water quality swales:*** Remove and properly dispose of any accumulated sediment as scheduled in the Operation and Maintenance Plan.
- ***Larvicide Treatment:*** The Operation and Maintenance Plan must include measures to minimize mosquito breeding, including larviciding.
- The party identified in the Operation and Maintenance Plan as responsible for maintenance shall see that larvicides are applied as necessary to the following stormwater treatment practices: catch basins, oil/grit separators, wet basins, wet water quality swales, dry extended detention basins, infiltration basins, and constructed stormwater wetlands. The Operation and Maintenance Plan must ensure that all larvicides are applied by a licensed pesticide applicator and in compliance with all pesticide label requirements.
- The Operation and Maintenance Plan should identify the appropriate larvicide and the time and method of application. For example, *Bacillus sphaericus (Bs*), the preferred larvicide for stormwater BMPs, should be hand-broadcast.[2] Alternatively, Altosid, a Methopren product, may be used. Because some practices are designed to dewater between storms, such as dry extended detention and infiltration basins, the Operation and Maintenance Plan should provide that larviciding must be conducted during or immediately after wet weather, when the detention or infiltration basin has a standing pool of water, unless a product is used that can withstand extended dry periods.

Inspection Checklist

- ☐ Riprap Aprons at Headwall Outlets
- ☐ Conveyance Swales
- ☐ Stormtech Chambers
- ☐ Sediment Forebays and Stormwater Basins
- ☐ Spillways
- ☐ Headwall Inlets and Outlets
- ☐ Mosquito Control

Inspection and Maintenance Log

	BMP	Inspection Date	Inspected By	Maintenance Required?	Maintenance Performed
1				❑Yes ❑No	
2				❑Yes ❑No	
3				❑Yes ❑No	
4				❑Yes ❑No	
5				❑Yes ❑No	
6				❑Yes ❑No	
7				❑Yes ❑No	
8				❑Yes ❑No	
9				❑Yes ❑No	

Deicing Log					
Air Temp.	Weather Conditions	Date of Application	Type of Deicer Used	Amount of Deicer Used	Deicer Applied By

StormTech®

Detention • Retention • Water Quality

An ADS company

Isolator® Row O&M Manual

ADS®

THE MOST ADVANCED NAME IN WATER MANAGEMENT SOLUTIONS™

THE ISOLATOR® ROW

INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-160LP, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160LP, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

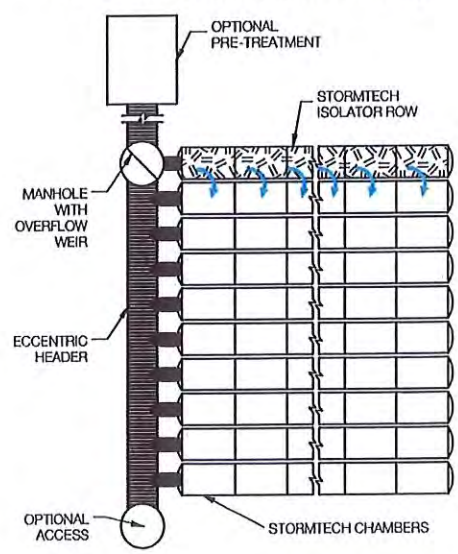
The Isolator Row is typically designed to capture the "first flush" and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

StormTech Isolator Row with Overflow Spillway (not to scale)



ISOLATOR ROW INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

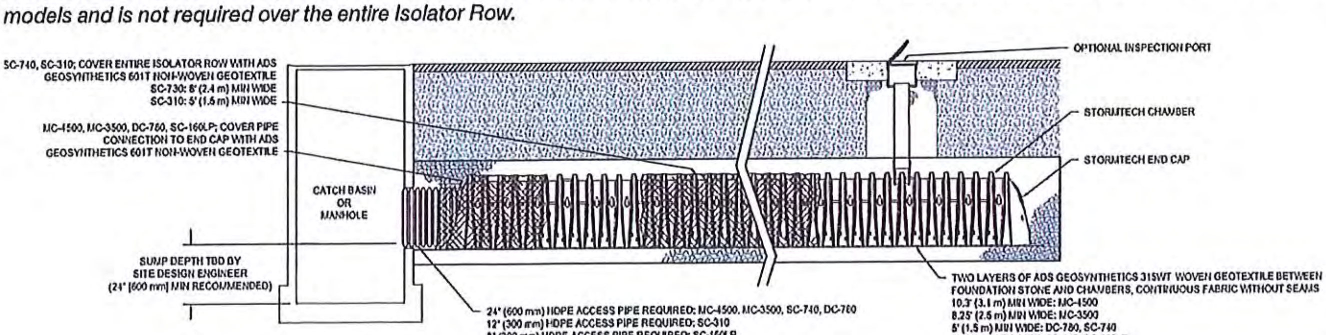
MAINTENANCE

The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row.



ADS

ISOLATOR ROW STEP BY STEP MAINTENANCE PROCEDURES

STEP 1
Inspect Isolator Row for sediment.

A) Inspection ports (if present)
   i. Remove lid from floor box frame
   ii. Remove cap from inspection riser
   iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
   iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.

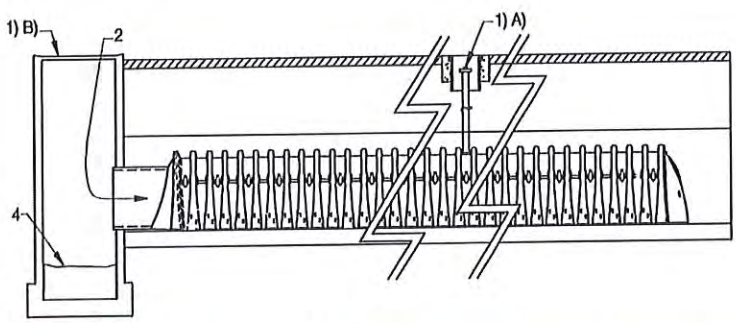
B) All Isolator Rows
   i. Remove cover from manhole at upstream end of Isolator Row
   ii. Using a flashlight, inspect down Isolator Row through outlet pipe
      1. Mirrors on poles or cameras may be used to avoid a confined space entry
      2. Follow OSHA regulations for confined space entry if entering manhole
   iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2
Clean out Isolator Row using the JetVac process.

A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

STEP 3
Replace all caps, lids and covers, record observations and actions.

STEP 4
Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings: Fixed point to chamber bottom (1)	Stadia Rod Readings: Fixed point to top of sediment (2)	Sediment Depth (1)-(2)	Observations/Actions	Inspector
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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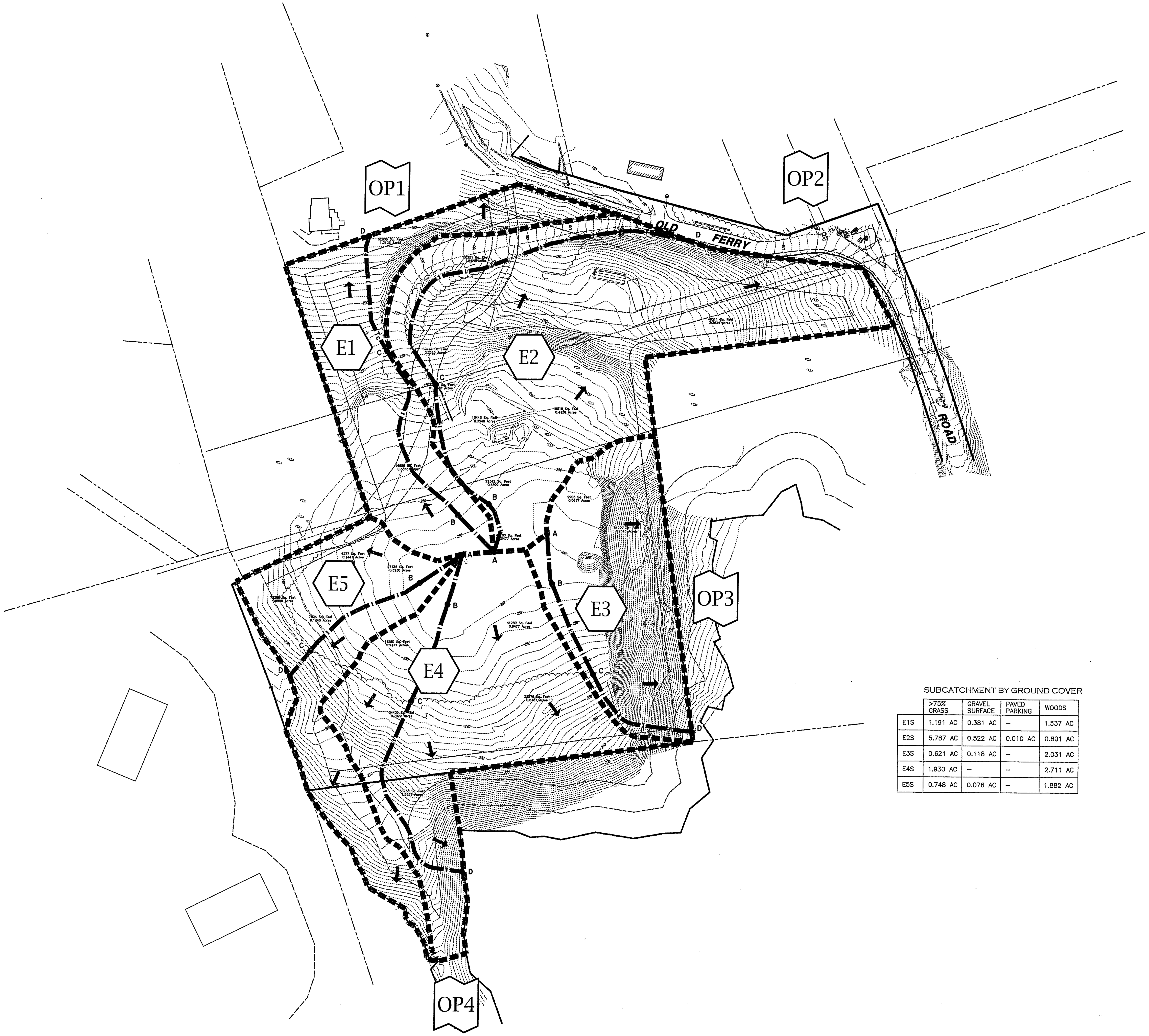
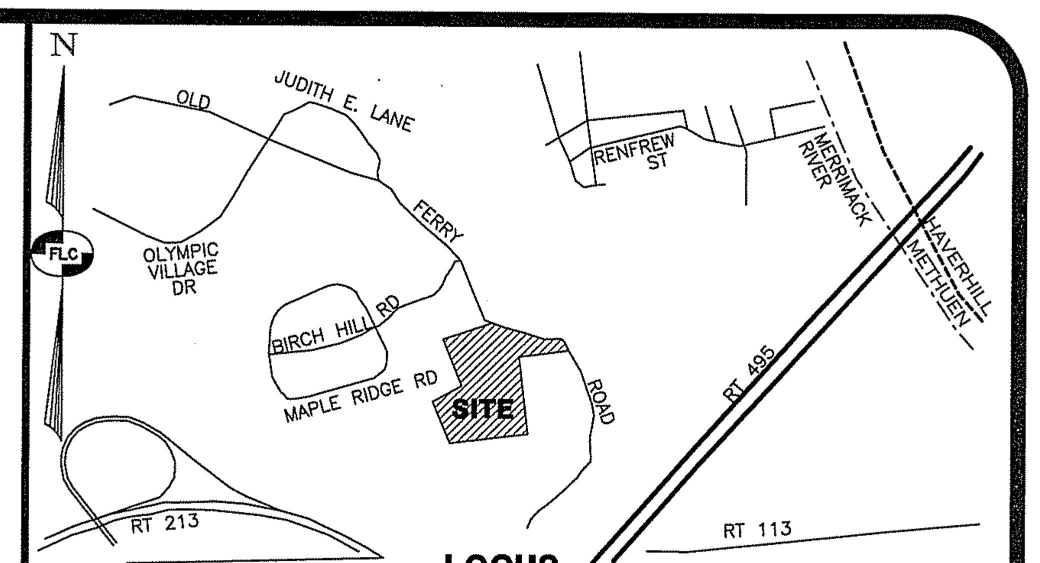
Drainage Plans



	>75% GRASS	GRAVEL SURFACE	PAVED PARKING	WOODS
E1S	1.191 AC	0.381 AC	–	1.537 AC
E2S	5.787 AC	0.522 AC	0.010 AC	0.801 AC
E3S	0.621 AC	0.118 AC	–	2.031 AC
E4S	1.930 AC	–	–	2.711 AC
E5S	0.748 AC	0.076 AC	–	1.882 AC

SUBCATCHMENT BY GROUND COVER



LOCUS
SCALE: 1"=2,000'±

DRAINAGE ANALYSIS

- E2 — SUBCATCHMENT
- R2 — REACH
- P2 — POND OR PIPE
- OP1 — OBSERVATION POINTS
- HYDROLOGIC PATH
- SUBCATCHMENT BOUNDARY
- SURFACE RUNOFF DIRECTION

GRAPHIC SCALES
60' 30' 0 60' 120' 180'
IMPERIAL: 1"=60'

REV.	DATE	DESCRIPTION	C/O	DR	CK
–	–	–		–	–

PRE-DEVELOPMENT DRAINAGE PLAN

PIE HILL WAREHOUSING

TAX MAP 1010 LOT 79-17
(46 OLD FERRY ROAD)
METHUEN, MASSACHUSETTS

PREPARED FOR AND LAND OF:
TRIPLE G, LLC
59 BONANNO COURT, METHUEN, MA 01844

SCALE: 1" = 60'   APRIL 4, 2022

Surveying ⬥ Engineering ⬥ Land Planning ⬥ Permitting ⬥ Septic Designs

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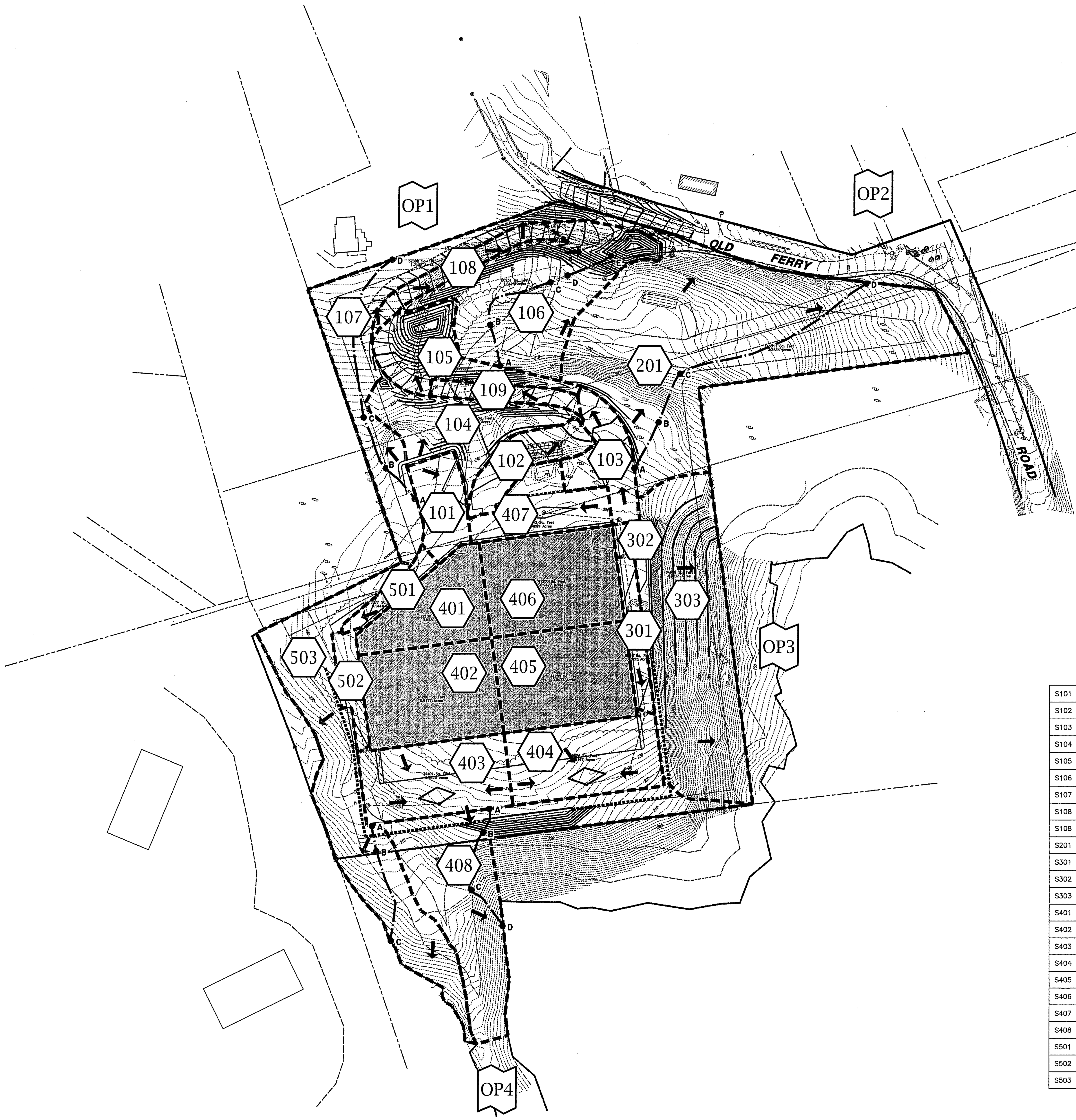
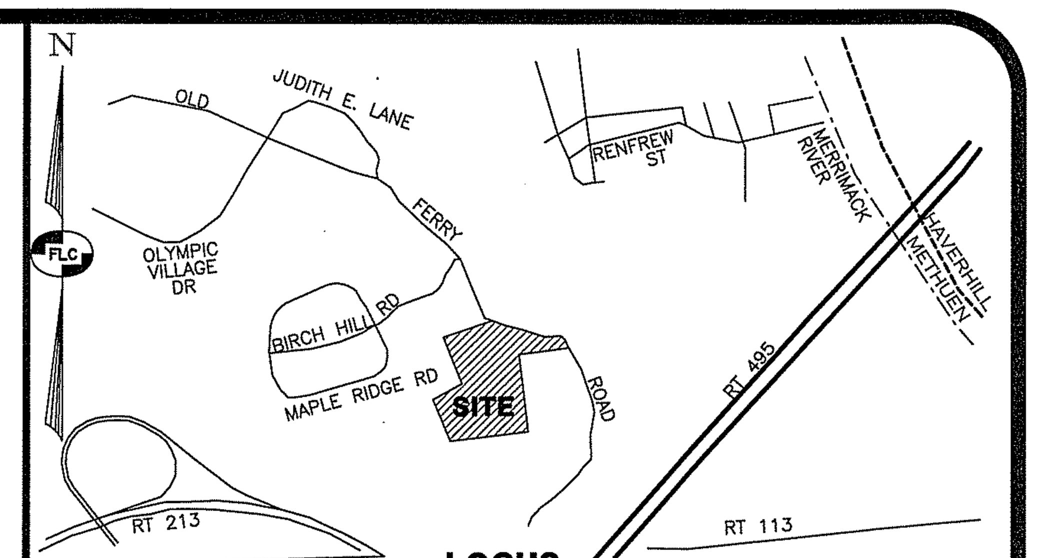




LOCUS
SCALE: 1"=2,000'±

DRAINAGE ANALYSIS

E2 SUBCATCHMENT

R2 REACH

P2 POND OR PIPE

OP1 OBSERVATION POINTS

HYDROLOGIC PATH

SUBCATCHMENT BOUNDARY

SURFACE RUNOFF DIRECTION

SUBCATCHMENT BY GROUND COVER

	>75% GRASS	GRAVEL SURFACE	PAVED PARKING	WOODS	ROOFS
S101	–	–	0.336 AC	–	–
S102	–	–	0.355 AC	–	–
S103	0.138 AC	–	0.276 AC	–	–
S104	0.737 AC	–	–	–	–
S105	0.450 AC	–	0.119 AC	–	–
S106	0.323 AC	–	0.167 AC	0.815 AC	–
S107	0.580 AC	–	0.014 AC	0.618 AC	–
S108	–	–	0.193 AC	–	–
S108	–	–	0.183 AC	–	–
S201	3.095 AC	–	0.010 AC	0.604 AC	–
S301	–	–	0.206 AC	–	–
S302	–	–	0.067 AC	–	–
S303	1.165 AC	–	–	0.787 AC	–
S401	–	–	–	–	0.623 AC
S402	–	–	–	–	0.948 AC
S403	–	–	0.790 AC	–	–
S404	–	–	0.817 AC	–	–
S405	–	–	–	–	0.948 AC
S406	–	–	–	–	0.948 AC
S407	0.132 AC		0.358 AC	–	–
S408	0.640 AC	–	–	0.927 AC	–
S501	–	–	0.144 AC	–	–
S502	–	–	0.175 AC	–	–
S503	0.464 AC	–	–	1.196 AC	–

GRAPHIC SCALES
100' 50' 0 100' 200' 300'
IMPERIAL: 1"=100'

REV.	DATE	DESCRIPTION	C/O	DR	CK
–	–	–		–	–

POST-DEVELOPMENT DRAINAGE PLAN

PIE HILL WAREHOUSING

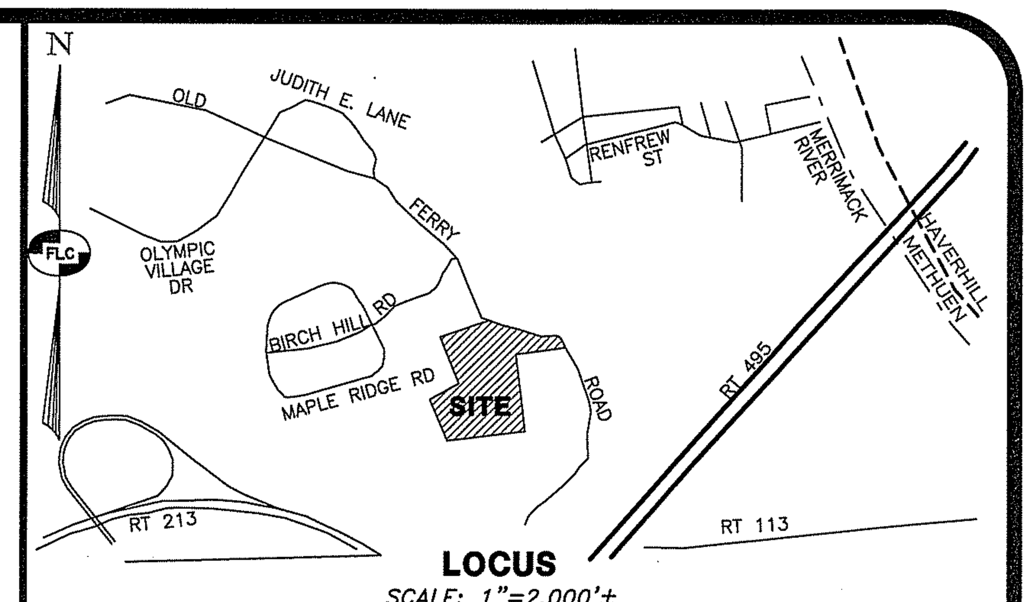
TAX MAP 1010 LOT 79-17
(46 OLD FERRY ROAD)
METHUEN, MASSACHUSETTS

PREPARED FOR AND LAND OF:
TRIPLE G, LLC
59 BONANNO COURT, METHUEN, MA 01844

SCALE: 1" = 100' APRIL 4, 2022

Surveying ◆ Engineering ◆ Land Planning ◆ Permitting ◆ Septic Designs
FIELDSTONE
LAND CONSULTANTS, PLLC
206 Elm Street, Milford, NH 03055
Phone: (603) 672-5456 Fax: (603) 413-5456
www.FieldstoneLandConsultants.com

FILE: 2295DP01.dwg | PROJ. NO. 2295.01 | SHEET: DP-2 | PAGE NO. 2 OF 4



LOCUS
SCALE: 1"=2,000'±

DRAINAGE ANALYSIS

- E2 — SUBCATCHMENT
- R2 — REACH
- P2 — POND OR PIPE
- OP1 — OBSERVATION POINTS
- HYDROLOGIC PATH
- SUBCATCHMENT BOUNDARY
- SURFACE RUNOFF DIRECTION

GRAPHIC SCALES
50' 25' 0 50' 100' 150'
IMPERIAL: 1"=50'

REV.	DATE	DESCRIPTION	C/O	DR	CK
–	–	–		–	–

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SCALE: 1" = 50' APRIL 4, 2022

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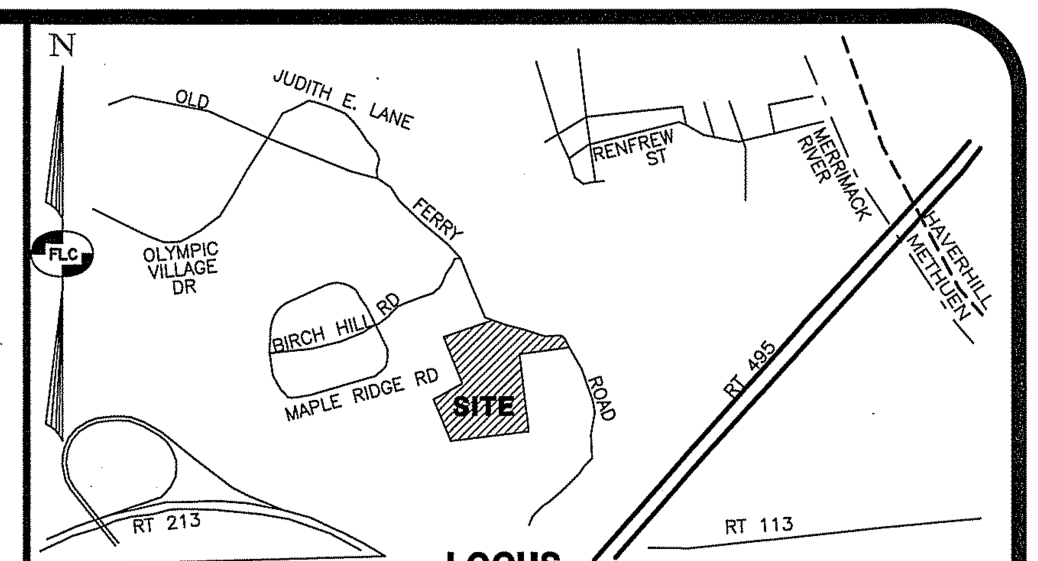

LOCUS
SCALE: 1"=2,000'±

DRAINAGE ANALYSIS

E2	SUBCATCHMENT
R2	REACH
P2	POND OR PIPE
OP1	OBSERVATION POINTS
	HYDROLOGIC PATH
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POST-DEVELOPMENT DRAINAGE PLAN

PIE HILL WAREHOUSING

TAX MAP 1010 LOT 79-17
(46 OLD FERRY ROAD)
METHUEN, MASSACHUSETTS

PREPARED FOR AND LAND OF:
TRIPLE G, LLC
46 ALSUN DRIVE, HOLLIS, NH 03049

SCALE: 1" = 50' APRIL 4, 2022

Surveying ✦ Engineering ✦ Land Planning ✦ Permitting ✦ Septic Designs

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