Stormwater Management Report

for:

Common Driveway

85 & 95 West Street
Northborough, MA 01532

Project Proponent:

Brant L. Viner
Margaret Harling

P.O. Box 295
Ellsworth, ME 04605

REVISED
April 14, 2021

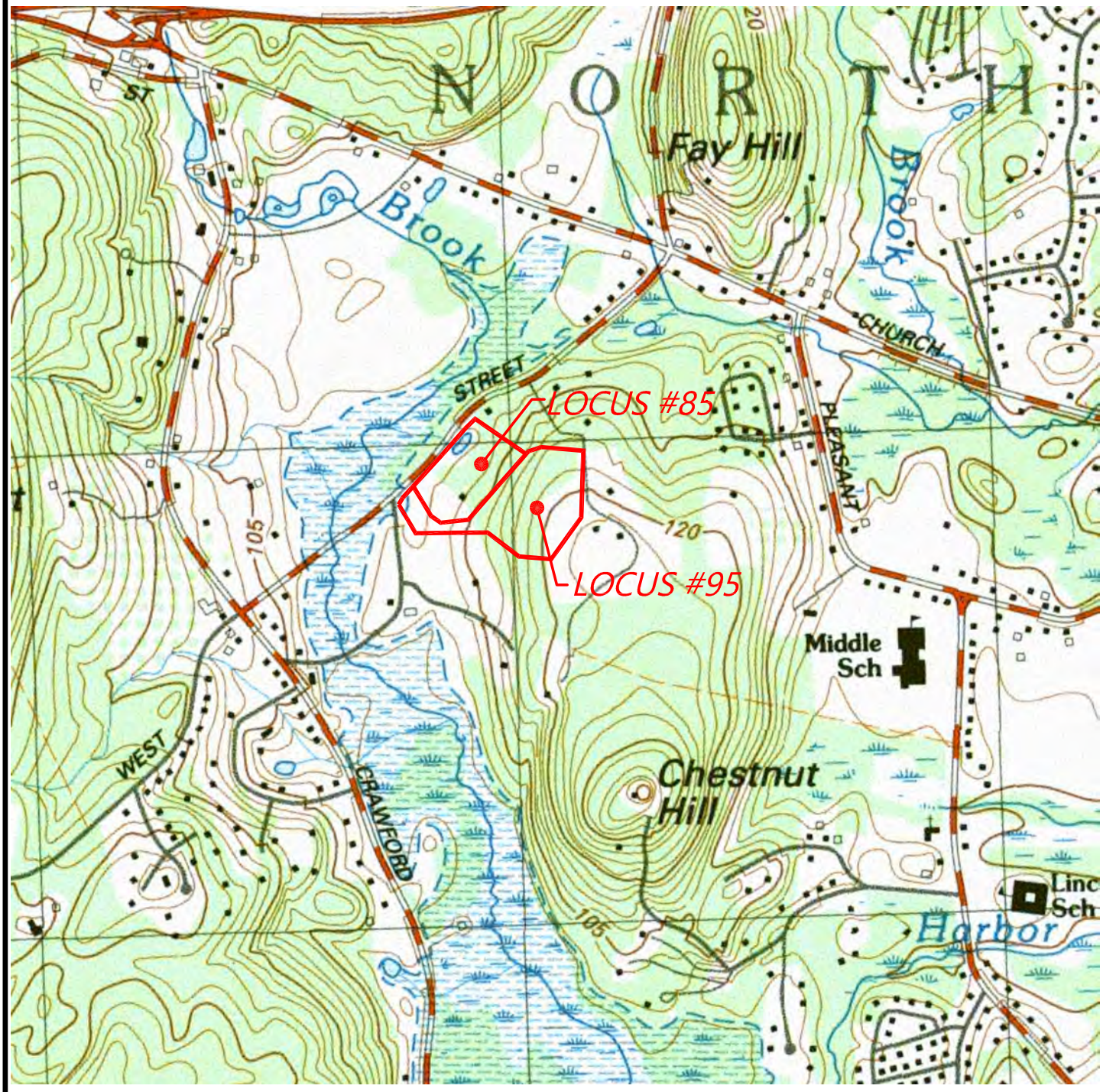
Gregory B. Scotchie, P.E

WDA DESIGN GROUP

31 EAST MAIN STREET WESTBOROUGH, MA 01581 508.366.6552
WDA-DG.com

TABLE OF CONTENTS TOC

LOCUS MAP



0 1,000 2,000 3,000' ±

PREPARED BY:

WDA DESIGN GROUP

31 EAST MAIN STREET WESTBOROUGH, MA | 508.366.6552
7 CENTRAL STREET PROVIDENCE, RI | 401.274.1360
WDA-DG.COM

TITLE: USGS LOCUS PLAN
85 & 95 West Street
Northborough, MA

PREPARED FOR: BRANT L. VINER &
MARGARET HARLING
PO Box 295
Ellsworth, ME 04605

SOURCE: USGS Topographic Map

N

DATE:	07/10/18	*FILE NO.:*	1207001	*DRAWN BY:*	BPW
JOB NO.:	1207.00	*DWG NO.:*		*REV DATE:*	__/__/__
				REV. NO.:	__

PURPOSE

Hydrologic, hydraulic, and water quality analysis and design calculations have been performed in accordance with the Town of Northborough Stormwater Management Rules and Regulations for the site work proposed on a common driveway located at 85 & 95 West Street in Northborough, MA. The calculations were performed to design stormwater collection and attenuation facilities for the site and to demonstrate that the project will meet the stormwater management standards of the Town of Northborough and the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Regulations.

This report describes the existing project site, the proposed project, and analyses performed to develop a stormwater management system that will protect public safety and convenience and minimize environmental impacts.

PROJECT SITE

The Locus Parcels are located on the south side of West Street. 85 West Street contains a single-family home and outbuildings, with a paved driveway accessing from West Street and contains approximately 6.6 acres and has 623.34' of frontage along West Street, beginning approximately 235 northeast of the Cherry Street intersection. 95 West Street is an undeveloped parcel, generally located behind (east) of 85 West Street, but also with frontage along West Street. The undeveloped land at 95 West Street contains 10.7 ± acres and has 235.54 feet of frontage along West Street with the frontage beginning at the intersection with Cherry Street. The properties are located entirely within the Residential B (RB) Zoning District, with a portion of the front area of the lots contained within the Zone 3 Groundwater Overlay District. The property is bound to north by West Street and land of the Commonwealth (DCR) to the north side of the road, and by single family development around the east, south and west. A portion of each property contains an area of Zone A, 100-year flood zone, as shown on the Flood Insurance Rate Map for the Town of Northborough (Community Panel # 25027C0633F, effective date July 16, 2014). The flood zone is associated with Cold Harbor Brook which is located several hundred feet to the north of the property. The flood zone noted for 85 West Street encompasses a small pond located at the front of the property adjacent to West Street. This pond discharges flows via a riser pipe to a culvert under West Street which discharges flows into an intermittent stream channel to the north. This flood zone is indicated at elevation 321.3 to 321.4'. The flood zone noted for 95 West Street is shown located within the field area near the corner of West Street and Cherry Street. This also is connected to a culvert which conveys flows from the field area under Cherry Street. This flood zone in this location is noted as elevation 318.7 to 318.8'. The Property does not contain a designated area of priority habitat of rare species or wildlife, or vernal pools (potential or certified), according to the Natural Heritage Atlas, valid from August 1, 2017.

Soils mapped on-site by the NRCS are primarily Paxton fine sandy loam (map units 305C, 306B/C and 307D), Windsor loamy sand (255B), Chatfield-Holli-Rock outcrop complex (102C) and Woodbridge fine sandy loam (312B).

Two areas of bordering vegetated wetlands were identified on the property, as well as a small, isolated wetland. The isolated wetland is very small (150 sf) and would only be jurisdictional under the local Wetlands Bylaw. WDA delineated the on-site resource areas on April 27, 2018 and these boundaries were determined upon review of the existing vegetation, soils and hydrologic conditions, as well as other visual indicators. Soils along the wetland boundary were reviewed utilizing a hand auger and Munsell soil color chart. All flags have been field survey located and shown on the attached plans.

The first and largest wetland delineated is located on the land of 85 West Street, generally bordering the small pond and adjacent seeps. This wetland is delineated with blue survey flagging, labeled by flag series WF-1 to WF-91. A small area of upland located in the interior of the wetland was delineated near the easterly side of the wetland, this is defined by flags WF-UA to WF-UI. The wetland boundary begins generally at the edge of the access driveway and West Street and runs along West Street, around the pond and back into the front portion of the property. The pond appears to be a historically manmade pond, approximately 17,000 sf surface area. A 12" vertical standpipe located within the pond, near the West Street side, discharges highwater flows into a 12" corrugated metal culvert which runs under West Street and into an intermittent stream channel. This stream eventually connects with Cold Harbor Brook, approximately 250' to the northwest. Two seeps, one located near the northerly property boundary and the other on the south end of the pond, feed intermittent flows down to the pond, and generally the wetland flagging around and associated with the pond and the seep are delineated by flags WF-20 to WF-74. A natural drainage divide near WF-74 also directs seasonal seeps to the west, near the driveway and West Street, essentially flags WF- 19 to WF-74. During our site visit on April 27, standing water was observed generally around WF-1 to WF-5 and WF-78 to WF-82 and WF-87-91. The wetland areas as defined above are predominately wooded shrub with herbaceous understory, specifically: red maple, elm, gray birch, pussy willow, silky dogwood, highbush blueberry, winterberry, cattail, jewelweed, skunk cabbage, cinnamon and sensitive fern. Adjacent upland areas are dominated by white pine, oak, black and white birch, hickory, ash, red maple, sugar maple, black cherry, hornbeam, teaberry, Pennsylvania sedge and multiflora rose.

The second wetland area is located on the 95 West Street property, within a field area in the southwest portion of the property, near the West and Cherry Street intersection. This wetland receives additional seasonal seeps or stormflows from a shallow grass channel which emanates from a culvert under an adjacent driveway and lawn area, located off site to the south. A shallow channel located at the westerly edge of the wetland directs seasonal flows/seeps to a culvert under Cherry Street. This wetland system is predominately a wet meadow, containing herbaceous species and limited shrubs and trees. This wetland system is delineated by flag series WF-100 to WF-119. Dominate species identified during our site visit were; soft rush, reed canary grass, sensitive fern, goldenrod, cattail, goldenrod, pussy willow, silky dogwood and red maple. Adjacent upland field areas, although not fully grown out, had indicators of miscellaneous field grasses, ground ivy, clover, and goldenrod. These areas have been historically mowed as well.

The final wetland area delineated is a small, isolated wet area located along the southern edge of the driveway, approximately 115' southeast of West Street, where the driveway splits into two. This wetland is approximately 150 square feet in size and is covered under the Northborough Wetland bylaw and Regulations. This area is delineated by flag series IW-A to IW-E. Wetland vegetation in this area is comprised mainly of; buttonbush, soft rush, tussock sedge, woolgrass and goldenrod.

The attached Existing Hydrology Plan shows the project design point(s) and contributing drainage areas with existing land cover types. The analyzed design points are (DP-1) near the intersection of Cherry Street and West Street, and the 12" vertical standpipe in the pond (DP-2).

PROPOSED PROJECT

The proposed work is considered a new development project. The applicant is proposing to build a common drive to subdivide the above-mentioned lots into six (6) lots with single-family dwellings constructed per Town of Northborough Development Standards. The project will utilize conventional stormwater management techniques including grass lined swales, deep sump catch basins, subsurface infiltration chambers, and a stormwater pond for the treatment and mitigation of stormwater. Clearing of the site will occur to accommodate the common driveway and associated infrastructure for the residential lots.

A stormwater management plan has been developed to meet the requirements of the Town of Northborough and the MassDEP Stormwater Standards. Runoff will flow overland via sheet flow or shallow concentrated flow towards grass swales along either side of the common drive. Water quality inlets will collect the flow from the grassed swale before the flow enters the subsurface infiltration and dry extended detention systems.

Soils mapped on-site by the NRCS are primarily Paxton fine sandy loam (map units 305C, 306B/C and 307D), Windsor loamy sand (255B), Chatfield-Holli-Rock outcrop complex (102C) and Woodbridge fine sandy loam (312B). Three of the five underground basins are within the Windsor loamy sand (255B) and the other two infiltration basins are in the Paxton fine sandy loam. The three underground basins with Windsor loamy sand are dry extended detention ponds due to poor infiltration rates. The proposed detention pond will not infiltrate stormwater due to the proximity of the 100-yr floodplain.

STORMWATER MANAGEMENT STANDARDS

STANDARD #1 – NO NEW UNTREATED DISCHARGES

The stormwater collection systems have been designed so that stormwater runoff from the asphalt paved areas is treated through a treatment train consisting of grass lined swales, deep-sump, hooded drop inlets, stormwater infiltration system and a detention basin. Additionally, all outlets have been designed so that there will be no erosion or scour to the wetlands of the Commonwealth.

STANDARD #2 – PEAK RATE ATTENUATION

METHODOLOGY

United States Soil Conservation Service, "Urban Hydrology for Small Watersheds, Technical Release Number 55 (TR-55) methods (HydroCAD 10.10-4b) were utilized to develop runoff hydrographs for watershed areas affected by the proposed development. Existing and proposed runoff hydrographs were developed for the 2, 10-, and 100-year, 24-hour rainfall events to develop a stormwater management system that will limit post-development peak runoff rates to pre-development levels.

The proposed stormwater management plan has been designed to meet the requirements of the Town of Northborough and the MassDEP Stormwater Management Standards. The project will limit peak rates of runoff from the site and will infiltrate runoff to approximate existing groundwater recharge.

ANALYSIS SUMMARY

To assess the impact of the proposed development on peak runoff rates onto down-gradient properties, hydrologic calculations were performed for each of three (3) design storms at the two (2) design points. The calculations refer to runoff quantities at the final design points, Design Point 1 (DP-1) near the intersection of Cherry Street and West Street and the other, DP-2) is an existing pond adjacent to West Street. Stormwater runoff from the rooftops will be routed to infiltration chambers located on their respective lots.

Calculations of peak runoff rates for existing and proposed site conditions are summarized in Table I for comparison of peak runoff rates for the design point for the three design storm events. A proposed hydrology plan is provided showing the various sub-watersheds draining to the proposed stormwater management facilities. Stormwater runoff from the overland areas not tributary to the stormwater management facilities will drain by sheet flow or shallow concentrated flow along the existing flow patterns to the design points.

Table I demonstrates that the proposed stormwater management system will be effective in limiting peak rates of runoff from the subject property to approximate pre-development levels. Table II indicates the change in stormwater runoff volume. Table III and IV provide data on the existing and proposed ground cover areas.

TABLE I: EXISTING AND PROPOSED PEAK RUNOFF

DRAINAGE AREA	DESIGN STORM EVENT / PEAK RUNOFF (cfs)		
	2-Year	10-Year	100-Year
Existing (DP-1)	2.2	6.8	15.8
Proposed (DP-1)	1.6	6.8	15.8
Existing (DP-2)	5.8	14.3	30.0
Proposed (DP-2)	4.5	14.3	29.7

TABLE II: EXISTING AND PROPOSED RUNOFF VOLUMES

DRAINAGE AREA	DESIGN STORM EVENT / VOLUME (cf)		
	2-Year	10-Year	100-Year
Existing (DP-1)	16,513	43,029	95,956
Proposed (DP-1)	9,307	33,856	85,255
Existing (DP-2)	34,323	78,960	162,568
Proposed (DP-2)	28,641	72,445	155,640

TABLE III: EXISTING GROUND COVER

EXISTING GROUND COVER	HYDROLOGIC SOIL GROUP (HSG)				
	HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Total (sq-ft)
>75% Grass cover, Good	65,785	0	49420	11,365	126,570
Paved Parking	10	0	7,674	2,340	10,025
Roofs	0	0	2,657	0	2,657
Water	0	0	11,813	5,791	17,604
Woods, Good	0	25,377	550,292	21,760	597,430
Total Area	65,795	25,377	621,856	41,257	754,285

TABLE IV: PROPPOSED GROUND COVER

PROPOSED GROUND COVER	HYDROLOGIC SOIL GROUP (HSG)				
	HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Total (sq-ft)
>75% Grass cover, Good	57,233	0	168,545	9,399	235,177
Paved Parking	8,556	0	39,995	420	45,971
Roofs	0	0	16,716	0	16,716
Water	0	0	11,813	5,791	17,604
Woods, Good	0	25,377	387,792	25648	438817
Total Area	65,789	25,377	621,861	41,258	754,285

TABLE V: WATER SURFACE ELEVATIONS

STORMWATER FACILITY	100-YR STORM EVENT WATER ELEVATION (FT)	TOP/BERM ELEVATION	Existing Ground Elevations (ft)	Proposed Grade Elevations (ft)	Bottom of Stone/Invert (ft)	Redox Elevation (ft)	Provided Separation to SHGW (ft)	Observed Infiltration Rates
POND (1P)	320.6	322.0	321.0	320.0	N/A	N/A	N/A	N/A
INF-103	327.3	N/A	327.0	328.7	326.0	323.0	3.0	0.276
INF-104	327.1	N/A	325.0	329.6	325.1	323.0	2.1	3.072
INF -105	348.8	N/A	347.2	351.0	346.5	344.1	2.4	1.284
INF -106	355.4	N/A	355.0	359.0	351.3	349.2	2.1	1.758
INF -201	338.2	N/A	336.2	340.7	336.2	333.2	3.0	2.262

STANDARD #3 – STORMWATER RECHARGE

Groundwater recharge is provided within the five (5) subsurface infiltration systems INF-103, -104, -105, -106, and -201. The test pits have been performed throughout the site and in areas where infiltration is proposed. The test pit data is provided in the appendix. Soil textures identified in the C horizon were Loam-Fine Sandy Loam for Pond (1P), Loamy Sand for INF-103, Medium Sand for INF-104, Fine Sandy Loam for INF-105 and 106, and Loamy Sand for INF-201. Double-ring infiltrometer tests were performed to determine infiltration rates for INF-103, -104. A hydraulic conductivity by Guelph permeameter test was performed to determine infiltration rates for INF-105, -106, and 201. Infiltration testing data is provided in the Appendix. The proposed detention pond will not infiltrate stormwater due to high ground water level. The Static Method was used in sizing the infiltration systems.

The table below provides a summary of the attached groundwater recharge calculations. Calculations are based on HSG A, C, and D. The required volume of groundwater recharge is equal to 1.0", 0.25" and 0.1" over the proposed impervious area for A, C, and D soils.

REQUIRED (CF)	PROVIDED (CF)
1,648	11,166

CAPTURE AREA ADJUSTMENT

Total Impervious Area = 80,291 sf
Impervious Area Draining to Infiltration Facilities = 45,378 sf
Ratio = 80,291 / 45,378 = 1.77
*Adjusted Required Infiltration Volume (Rv) = 1.77 x 1,648 cf = 2,916 cf

ADJUSTED REQUIRED (CF)	PROVIDED (CF)
2,916	11,166

DRAWDOWN CALCULATIONS

$$Time = \frac{\mathrm{Rv}}{(K)(Bottom\ Area)}$$

Rv = Storage Volume (cubic feet)
K = Saturated Hydraulic Conductivity (inches per hour)

Drawdown times for all basins are shown in the Stormwater Standards Calculations section of the appendix.

STANDARD #4 – WATER QUALITY VOLUME

Water quality measures will be designed to provide a minimum of 80% Total Suspended Solids (TSS) removal, and to treat 0.5 of runoff prior to discharging to the bordering vegetated wetland. The water quality volume

is achieved by providing a static storage volume below the outlet in the infiltration basin and within the subsurface infiltration facility.

REQUIRED (CF)	PROVIDED (CF)
2,325	11,166

Over 80% TSS removal will be provided through the use of the following two treatment trains: 1) grass lined swale 2) deep sump drop inlet, 3) subsurface infiltration systems, or 1) grass lined swale 2) deep sump drop inlet, 3) extended dry detention pond. Water quality calculations for all outfalls are shown in the Stormwater Standards Calculations section of the appendix.

STANDARD #5 – LAND USES WITH HIGHER POTENTIAL POLLUTANT LOADS (LUHPPLS)

The proposed project is not considered a land use with Higher Potential Pollutant Loads therefore, Standard #5 is not applicable.

STANDARD #6 – CRITICAL AREAS

The proposed project will not discharge near or to a Critical Area. Appropriate water quality and TSS removal Best Management Practices (BMPs) have been specified to satisfy Standard #6.

STANDARD #7 – REDEVELOPMENT PROJECT

The proposed project not considered a redevelopment project therefore, Standard #7 is not applicable.

STANDARD #8 – CONSTRUCTION POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL

As the total project area is over one acre, a Notice of Intent (NOI) must be filed with the US EPA and a Stormwater Pollution Prevention Plan (SWPPP) shall be retained on-site during construction. The attached draft project SWPPP has been developed in accordance with the current MA Construction General Permit (CGP). The draft SWPPP is included as part of this Stormwater Management Report for compliance with the Standards.

STANDARD #9 – OPERATION AND MAINTENANCE PLAN

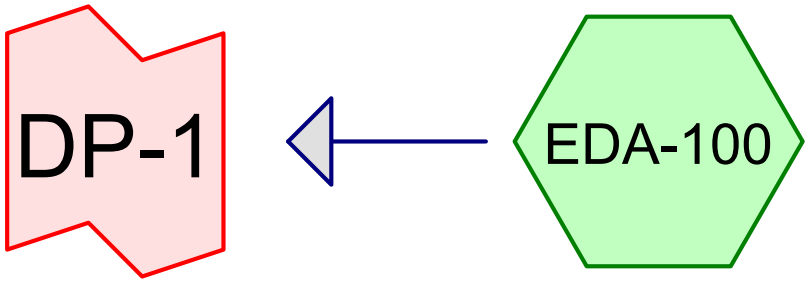
The attached Operation and Maintenance Plan describes the requisite long-term operation and maintenance of all on-site stormwater Best Management Practices (BMPs) and hydraulic drainage system. The Operation and Maintenance Plan also describes source control for the prevention of pollution to also serve as the Long-Term Pollution Prevention Plan (LTPPP).

STANDARD #10 – PROHIBITION OF ILLICIT DISCHARGES

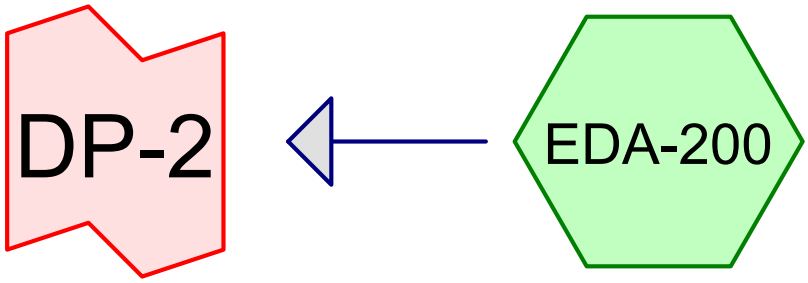
An Illicit Discharge Compliance Statement will be provided by the Owner/Applicant prior to the discharge of stormwater to post-construction BMPs.

MASSACHUSETTS STORMWATER REPORT CHECKLIST (Attached)

EXISTING HYDROLOGY



DESIGN POINT 1 EDA-100



DESIGN POINT 2 EDA-200

Subcat Reach Pond Link

Routing Diagram for 85 West Street Northborough JN-1207.03 - Existing
Prepared by WDA Design Group, Printed 4/14/2021

85 West Street Northborough JN-1207.03 - Existing
Prepared by WDA Design Group

TABLE OF CONTENTS

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	Type III 24-hr		Default	24.00	1	3.28	2
2	10-year	Type III 24-hr		Default	24.00	1	5.02	2
3	100-year	Type III 24-hr		Default	24.00	1	7.78	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
65,785	39	>75% Grass cover, Good, HSG A (EDA-100)
49,420	74	>75% Grass cover, Good, HSG C (EDA-100, EDA-200)
11,365	80	>75% Grass cover, Good, HSG D (EDA-100, EDA-200)
10	98	Paved parking, HSG A (EDA-100)
7,674	98	Paved parking, HSG C (EDA-100, EDA-200)
2,340	98	Paved parking, HSG D (EDA-100, EDA-200)
2,657	98	Roofs, HSG C (EDA-100, EDA-200)
11,813	98	Water Surface, HSG C (EDA-200)
5,791	98	Water Surface, HSG D (EDA-200)
25,377	55	Woods, Good, HSG B (EDA-200)
550,292	70	Woods, Good, HSG C (EDA-100, EDA-200)
21,760	77	Woods, Good, HSG D (EDA-200)
754,285	**69**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
65,795	HSG A	EDA-100
25,377	HSG B	EDA-200
621,856	HSG C	EDA-100, EDA-200
41,257	HSG D	EDA-100, EDA-200
0	Other	
754,285		**TOTAL AREA**

85 West Street Northborough JN-1207.03 - Existing

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
65,785	0	49,420	11,365	0	126,570	>75% Grass cover, Good	
10	0	7,674	2,340	0	10,025	Paved parking	
0	0	2,657	0	0	2,657	Roofs	
0	0	11,813	5,791	0	17,604	Water Surface	
0	25,377	550,292	21,760	0	597,430	Woods, Good	
65,795	**25,377**	**621,856**	**41,257**	**0**	**754,285**	**TOTAL AREA**	

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EDA-100: EDA-100 Runoff Area=309,776 sf 3.82% Impervious Runoff Depth=0.64"
Flow Length=1,187' Tc=36.8 min CN=65 Runoff=2.2 cfs 16,513 cf

Subcatchment EDA-200: EDA-200 Runoff Area=444,509 sf 4.15% Impervious Runoff Depth=0.93"
Flow Length=996' Tc=29.3 min CN=71 Runoff=5.8 cfs 34,323 cf

Link DP-1: DESIGN POINT 1 Inflow=2.2 cfs 16,513 cf
Primary=2.2 cfs 16,513 cf

Link DP-2: DESIGN POINT 2 Inflow=5.8 cfs 34,323 cf
Primary=5.8 cfs 34,323 cf

Total Runoff Area = 754,285 sf Runoff Volume = 50,835 cf Average Runoff Depth = 0.81"
95.98% Pervious = 724,000 sf 4.02% Impervious = 30,285 sf

Summary for Subcatchment EDA-100: EDA-100

Runoff = 2.2 cfs @ 12.61 hrs, Volume= 16,513 cf, Depth= 0.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.28"

Area (sf)	CN	Description
38,421	74	>75% Grass cover, Good, HSG C
187,813	70	Woods, Good, HSG C
10	98	Paved parking, HSG A
65,785	39	>75% Grass cover, Good, HSG A
2,362	98	Roofs, HSG C
7,657	98	Paved parking, HSG C
1,789	98	Paved parking, HSG D
5,939	80	>75% Grass cover, Good, HSG D
309,776	65	Weighted Average
297,958		96.18% Pervious Area
11,818		3.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.8	100	0.0140	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
6.9	634	0.0940	1.53		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.1	453	0.0452	1.49		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
36.8	1,187	Total			

Summary for Subcatchment EDA-200: EDA-200

Runoff = 5.8 cfs @ 12.46 hrs, Volume= 34,323 cf, Depth= 0.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.28"

Area (sf)	CN	Description
25,377	55	Woods, Good, HSG B
362,479	70	Woods, Good, HSG C
10,999	74	>75% Grass cover, Good, HSG C
295	98	Roofs, HSG C
11,813	98	Water Surface, HSG C
17	98	Paved parking, HSG C
5,791	98	Water Surface, HSG D
551	98	Paved parking, HSG D
21,760	77	Woods, Good, HSG D
5,426	80	>75% Grass cover, Good, HSG D
444,509	71	Weighted Average
426,042		95.85% Pervious Area
18,467		4.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.0	100	0.0270	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
10.3	896	0.0846	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
29.3	996	Total			

Summary for Link DP-1: DESIGN POINT 1

Inflow Area = 309,776 sf, 3.82% Impervious, Inflow Depth = 0.64" for 2-year event
Inflow = 2.2 cfs @ 12.61 hrs, Volume= 16,513 cf
Primary = 2.2 cfs @ 12.61 hrs, Volume= 16,513 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: DESIGN POINT 2

Inflow Area = 444,509 sf, 4.15% Impervious, Inflow Depth = 0.93" for 2-year event
Inflow = 5.8 cfs @ 12.46 hrs, Volume= 34,323 cf
Primary = 5.8 cfs @ 12.46 hrs, Volume= 34,323 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EDA-100: EDA-100 Runoff Area=309,776 sf 3.82% Impervious Runoff Depth=1.67"
Flow Length=1,187' Tc=36.8 min CN=65 Runoff=6.8 cfs 43,029 cf

Subcatchment EDA-200: EDA-200 Runoff Area=444,509 sf 4.15% Impervious Runoff Depth=2.13"
Flow Length=996' Tc=29.3 min CN=71 Runoff=14.3 cfs 78,960 cf

Link DP-1: DESIGN POINT 1 Inflow=6.8 cfs 43,029 cf
Primary=6.8 cfs 43,029 cf

Link DP-2: DESIGN POINT 2 Inflow=14.3 cfs 78,960 cf
Primary=14.3 cfs 78,960 cf

Total Runoff Area = 754,285 sf Runoff Volume = 121,990 cf Average Runoff Depth = 1.94"
95.98% Pervious = 724,000 sf 4.02% Impervious = 30,285 sf

Summary for Subcatchment EDA-100: EDA-100

Runoff = 6.8 cfs @ 12.55 hrs, Volume= 43,029 cf, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (sf)	CN	Description
38,421	74	>75% Grass cover, Good, HSG C
187,813	70	Woods, Good, HSG C
10	98	Paved parking, HSG A
65,785	39	>75% Grass cover, Good, HSG A
2,362	98	Roofs, HSG C
7,657	98	Paved parking, HSG C
1,789	98	Paved parking, HSG D
5,939	80	>75% Grass cover, Good, HSG D
309,776	65	Weighted Average
297,958		96.18% Pervious Area
11,818		3.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.8	100	0.0140	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
6.9	634	0.0940	1.53		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.1	453	0.0452	1.49		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
36.8	1,187	Total			

Summary for Subcatchment EDA-200: EDA-200

Runoff = 14.3 cfs @ 12.43 hrs, Volume= 78,960 cf, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (sf)	CN	Description
25,377	55	Woods, Good, HSG B
362,479	70	Woods, Good, HSG C
10,999	74	>75% Grass cover, Good, HSG C
295	98	Roofs, HSG C
11,813	98	Water Surface, HSG C
17	98	Paved parking, HSG C
5,791	98	Water Surface, HSG D
551	98	Paved parking, HSG D
21,760	77	Woods, Good, HSG D
5,426	80	>75% Grass cover, Good, HSG D
444,509	71	Weighted Average
426,042		95.85% Pervious Area
18,467		4.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.0	100	0.0270	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
10.3	896	0.0846	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
29.3	996	Total			

Summary for Link DP-1: DESIGN POINT 1

Inflow Area = 309,776 sf, 3.82% Impervious, Inflow Depth = 1.67" for 10-year event
Inflow = 6.8 cfs @ 12.55 hrs, Volume= 43,029 cf
Primary = 6.8 cfs @ 12.55 hrs, Volume= 43,029 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: DESIGN POINT 2

Inflow Area = 444,509 sf, 4.15% Impervious, Inflow Depth = 2.13" for 10-year event
Inflow = 14.3 cfs @ 12.43 hrs, Volume= 78,960 cf
Primary = 14.3 cfs @ 12.43 hrs, Volume= 78,960 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EDA-100: EDA-100 Runoff Area=309,776 sf 3.82% Impervious Runoff Depth=3.72"
Flow Length=1,187' Tc=36.8 min CN=65 Runoff=15.8 cfs 95,956 cf

Subcatchment EDA-200: EDA-200 Runoff Area=444,509 sf 4.15% Impervious Runoff Depth=4.39"
Flow Length=996' Tc=29.3 min CN=71 Runoff=30.0 cfs 162,568 cf

Link DP-1: DESIGN POINT 1 Inflow=15.8 cfs 95,956 cf
Primary=15.8 cfs 95,956 cf

Link DP-2: DESIGN POINT 2 Inflow=30.0 cfs 162,568 cf
Primary=30.0 cfs 162,568 cf

Total Runoff Area = 754,285 sf Runoff Volume = 258,524 cf Average Runoff Depth = 4.11"
95.98% Pervious = 724,000 sf 4.02% Impervious = 30,285 sf

Summary for Subcatchment EDA-100: EDA-100

Runoff = 15.8 cfs @ 12.52 hrs, Volume= 95,956 cf, Depth= 3.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.78"

Area (sf)	CN	Description
38,421	74	>75% Grass cover, Good, HSG C
187,813	70	Woods, Good, HSG C
10	98	Paved parking, HSG A
65,785	39	>75% Grass cover, Good, HSG A
2,362	98	Roofs, HSG C
7,657	98	Paved parking, HSG C
1,789	98	Paved parking, HSG D
5,939	80	>75% Grass cover, Good, HSG D
309,776	65	Weighted Average
297,958		96.18% Pervious Area
11,818		3.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.8	100	0.0140	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
6.9	634	0.0940	1.53		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.1	453	0.0452	1.49		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
36.8	1,187	Total			

Summary for Subcatchment EDA-200: EDA-200

Runoff = 30.0 cfs @ 12.41 hrs, Volume= 162,568 cf, Depth= 4.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.78"

Area (sf)	CN	Description
25,377	55	Woods, Good, HSG B
362,479	70	Woods, Good, HSG C
10,999	74	>75% Grass cover, Good, HSG C
295	98	Roofs, HSG C
11,813	98	Water Surface, HSG C
17	98	Paved parking, HSG C
5,791	98	Water Surface, HSG D
551	98	Paved parking, HSG D
21,760	77	Woods, Good, HSG D
5,426	80	>75% Grass cover, Good, HSG D
444,509	71	Weighted Average
426,042		95.85% Pervious Area
18,467		4.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.0	100	0.0270	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
10.3	896	0.0846	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
29.3	996	Total			

Summary for Link DP-1: DESIGN POINT 1

Inflow Area = 309,776 sf, 3.82% Impervious, Inflow Depth = 3.72" for 100-year event
Inflow = 15.8 cfs @ 12.52 hrs, Volume= 95,956 cf
Primary = 15.8 cfs @ 12.52 hrs, Volume= 95,956 cf, Atten= 0%, Lag= 0.0 min

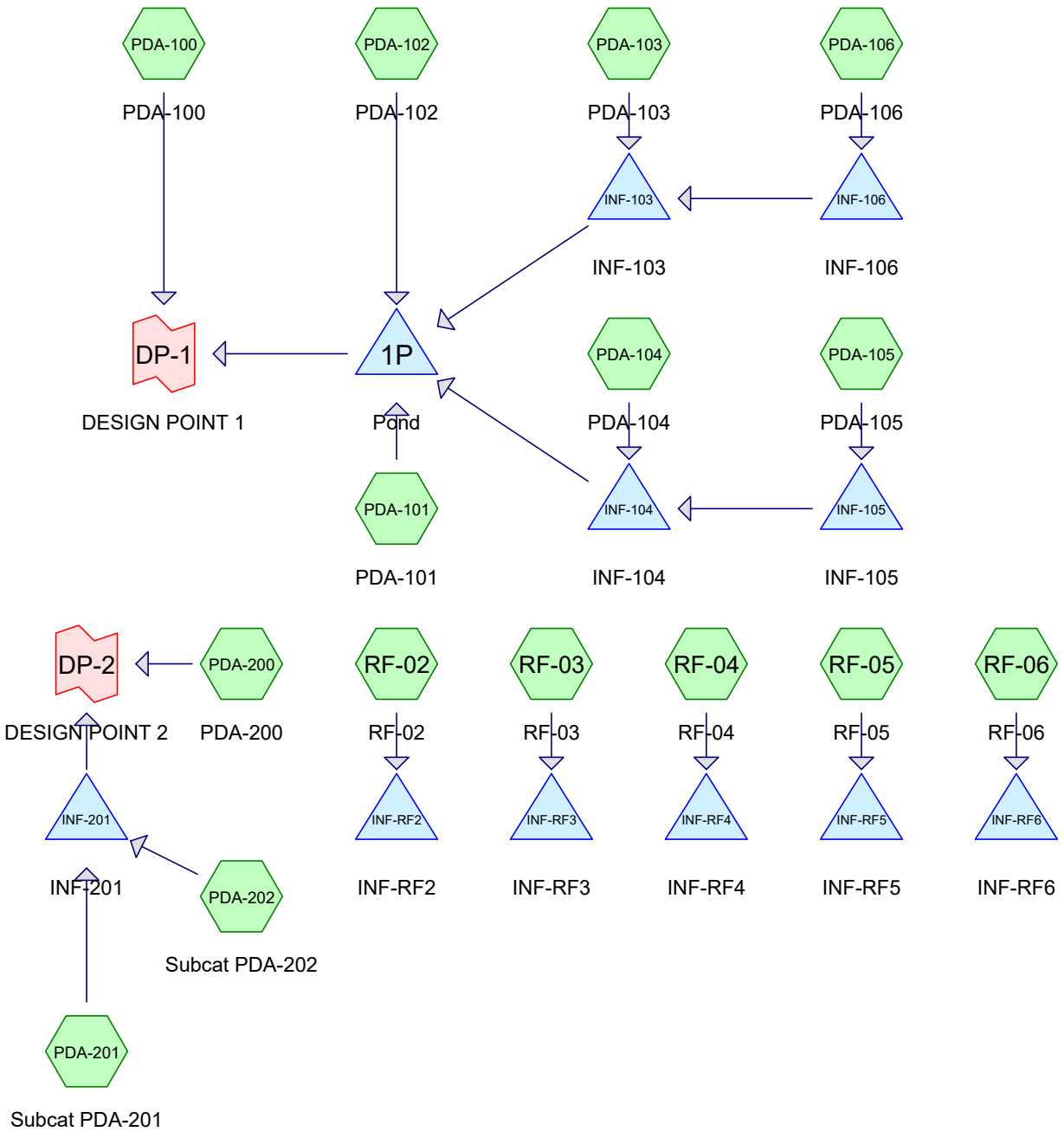
Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: DESIGN POINT 2

Inflow Area = 444,509 sf, 4.15% Impervious, Inflow Depth = 4.39" for 100-year event
Inflow = 30.0 cfs @ 12.41 hrs, Volume= 162,568 cf
Primary = 30.0 cfs @ 12.41 hrs, Volume= 162,568 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

PROPOSED HYDROLOGY



Routing Diagram for 85 West Street Northborough JN-1207.03 - Proposed

Prepared by WDA Design Group, Printed 4/14/2021

TABLE OF CONTENTS

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	Type III 24-hr		Default	24.00	1	3.28	2
2	10-year	Type III 24-hr		Default	24.00	1	5.02	2
3	100-year	Type III 24-hr		Default	24.00	1	7.78	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
57,233	39	>75% Grass cover, Good, HSG A (PDA-100, PDA-101, PDA-102, PDA-200)
168,545	74	>75% Grass cover, Good, HSG C (PDA-100, PDA-101, PDA-102, PDA-103, PDA-104, PDA-105, PDA-106, PDA-200, PDA-201, PDA-202)
9,399	80	>75% Grass cover, Good, HSG D (PDA-102, PDA-200)
8,556	98	Paved parking, HSG A (PDA-100, PDA-101, PDA-102, PDA-200)
36,995	98	Paved parking, HSG C (PDA-101, PDA-102, PDA-103, PDA-104, PDA-105, PDA-106, PDA-200, PDA-201, PDA-202)
420	98	Paved parking, HSG D (PDA-100, PDA-102, PDA-200)
16,716	98	Roofs, HSG C (PDA-102, PDA-200, RF-02, RF-03, RF-04, RF-05, RF-06)
11,813	98	Water Surface, HSG C (PDA-200)
5,791	98	Water Surface, HSG D (PDA-200)
25,377	55	Woods, Good, HSG B (PDA-200)
387,792	70	Woods, Good, HSG C (PDA-100, PDA-102, PDA-104, PDA-105, PDA-106, PDA-200, PDA-201, PDA-202)
25,648	77	Woods, Good, HSG D (PDA-200)
754,285	**71**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
65,789	HSG A	PDA-100, PDA-101, PDA-102, PDA-200
25,377	HSG B	PDA-200
621,861	HSG C	PDA-100, PDA-101, PDA-102, PDA-103, PDA-104, PDA-105, PDA-106, PDA-200, PDA-201, PDA-202, RF-02, RF-03, RF-04, RF-05, RF-06
41,258	HSG D	PDA-100, PDA-102, PDA-200
0	Other	
754,285		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
57,233	0	168,545	9,399	0	235,177	>75% Grass cover, Good	
8,556	0	36,995	420	0	45,971	Paved parking	
0	0	16,716	0	0	16,716	Roofs	
0	0	11,813	5,791	0	17,604	Water Surface	
0	25,377	387,792	25,648	0	438,817	Woods, Good	
65,789	**25,377**	**621,861**	**41,258**	**0**	**754,285**	**TOTAL AREA**	

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PDA-100: PDA-100 Runoff Area=42,967 sf 4.38% Impervious Runoff Depth=0.04"
Tc=6.0 min CN=44 Runoff=0.0 cfs 144 cf

Subcatchment PDA-101: PDA-101 Runoff Area=8,231 sf 34.50% Impervious Runoff Depth=0.44"
Tc=6.0 min CN=60 Runoff=0.1 cfs 302 cf

Subcatchment PDA-102: PDA-102 Runoff Area=64,057 sf 11.83% Impervious Runoff Depth=0.88"
Flow Length=443' Tc=9.8 min CN=70 Runoff=1.2 cfs 4,671 cf

Subcatchment PDA-103: PDA-103 Runoff Area=7,866 sf 52.29% Impervious Runoff Depth=1.99"
Flow Length=368' Slope=0.0720 '/' Tc=6.0 min CN=87 Runoff=0.4 cfs 1,302 cf

Subcatchment PDA-104: PDA-104 Runoff Area=60,851 sf 4.61% Impervious Runoff Depth=1.03"
Flow Length=916' Tc=27.2 min CN=73 Runoff=0.9 cfs 5,245 cf

Subcatchment PDA-105: PDA-105 Runoff Area=92,080 sf 9.15% Impervious Runoff Depth=1.03"
Flow Length=779' Tc=32.7 min CN=73 Runoff=1.3 cfs 7,937 cf

Subcatchment PDA-106: PDA-106 Runoff Area=22,980 sf 57.09% Impervious Runoff Depth=2.07"
Flow Length=489' Slope=0.0460 '/' Tc=7.2 min CN=88 Runoff=1.2 cfs 3,962 cf

Subcatchment PDA-200: PDA-200 Runoff Area=314,613 sf 7.19% Impervious Runoff Depth=0.98"
Flow Length=991' Tc=27.3 min CN=72 Runoff=4.5 cfs 25,684 cf

Subcatchment PDA-201: Subcat PDA-201 Runoff Area=15,861 sf 17.40% Impervious Runoff Depth=1.33"
Tc=6.0 min CN=78 Runoff=0.6 cfs 1,761 cf

Subcatchment PDA-202: Subcat PDA-202 Runoff Area=110,630 sf 0.01% Impervious Runoff Depth=0.93"
Flow Length=838' Tc=32.0 min CN=71 Runoff=1.4 cfs 8,542 cf

Subcatchment RF-02: RF-02 Runoff Area=3,116 sf 100.00% Impervious Runoff Depth=3.05"
Tc=0.0 min CN=98 Runoff=0.3 cfs 791 cf

Subcatchment RF-03: RF-03 Runoff Area=1,685 sf 100.00% Impervious Runoff Depth=3.05"
Tc=0.0 min CN=98 Runoff=0.2 cfs 428 cf

Subcatchment RF-04: RF-04 Runoff Area=3,116 sf 100.00% Impervious Runoff Depth=3.05"
Tc=0.0 min CN=98 Runoff=0.3 cfs 791 cf

Subcatchment RF-05: RF-05 Runoff Area=3,116 sf 100.00% Impervious Runoff Depth=3.05"
Tc=0.0 min CN=98 Runoff=0.3 cfs 791 cf

Subcatchment RF-06: RF-06 Runoff Area=3,116 sf 100.00% Impervious Runoff Depth=3.05"
Tc=0.0 min CN=98 Runoff=0.3 cfs 791 cf

Pond 1P: Pond Peak Elev=320.16' Storage=52 cf Inflow=1.6 cfs 9,164 cf
Outflow=1.6 cfs 9,164 cf

Pond INF-103: INF-103 Peak Elev=326.75' Storage=180 cf Inflow=0.4 cfs 1,302 cf
Discarded=0.0 cfs 292 cf Primary=0.4 cfs 1,010 cf Outflow=0.4 cfs 1,302 cf

Pond INF-104: INF-104 Peak Elev=326.91' Storage=2,317 cf Inflow=1.5 cfs 9,092 cf
Discarded=0.1 cfs 5,911 cf Primary=0.9 cfs 3,181 cf Outflow=1.1 cfs 9,092 cf

Pond INF-105: INF-105 Peak Elev=348.30' Storage=2,082 cf Inflow=1.3 cfs 7,937 cf
Discarded=0.1 cfs 4,090 cf Primary=0.9 cfs 3,847 cf Outflow=1.0 cfs 7,937 cf

Pond INF-106: INF-106 Peak Elev=354.52' Storage=2,305 cf Inflow=1.2 cfs 3,962 cf
Discarded=0.0 cfs 3,962 cf Primary=0.0 cfs 0 cf Outflow=0.0 cfs 3,962 cf

Pond INF-201: INF-201 Peak Elev=338.34' Storage=3,274 cf Inflow=1.5 cfs 10,303 cf
Discarded=0.1 cfs 7,346 cf Primary=0.7 cfs 2,957 cf Outflow=0.8 cfs 10,303 cf

Pond INF-RF2: INF-RF2 Peak Elev=335.70' Storage=116 cf Inflow=0.3 cfs 791 cf
Discarded=0.0 cfs 431 cf Primary=0.3 cfs 360 cf Outflow=0.3 cfs 791 cf

Pond INF-RF3: INF-RF3 Peak Elev=333.57' Storage=106 cf Inflow=0.2 cfs 428 cf
Discarded=0.0 cfs 333 cf Primary=0.1 cfs 95 cf Outflow=0.1 cfs 428 cf

Pond INF-RF4: INF-RF4 Peak Elev=367.70' Storage=116 cf Inflow=0.3 cfs 791 cf
Discarded=0.0 cfs 431 cf Primary=0.3 cfs 360 cf Outflow=0.3 cfs 791 cf

Pond INF-RF5: INF-RF5 Peak Elev=377.70' Storage=116 cf Inflow=0.3 cfs 791 cf
Discarded=0.0 cfs 431 cf Primary=0.3 cfs 360 cf Outflow=0.3 cfs 791 cf

Pond INF-RF6: INF-RF6 Peak Elev=377.70' Storage=116 cf Inflow=0.3 cfs 791 cf
Discarded=0.0 cfs 431 cf Primary=0.3 cfs 360 cf Outflow=0.3 cfs 791 cf

Link DP-1: DESIGN POINT 1 Inflow=1.6 cfs 9,307 cf
Primary=1.6 cfs 9,307 cf

Link DP-2: DESIGN POINT 2 Inflow=4.5 cfs 28,641 cf
Primary=4.5 cfs 28,641 cf

Total Runoff Area = 754,285 sf Runoff Volume = 63,142 cf Average Runoff Depth = 1.00"
89.36% Pervious = 673,994 sf 10.64% Impervious = 80,291 sf

Summary for Subcatchment PDA-100: PDA-100

Runoff = 0.0 cfs @ 15.46 hrs, Volume= 144 cf, Depth= 0.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.28"

Area (sf)	CN	Description
1,794	98	Paved parking, HSG A
37,895	39	>75% Grass cover, Good, HSG A
395	70	Woods, Good, HSG C
2,795	74	>75% Grass cover, Good, HSG C
88	98	Paved parking, HSG D
42,967	44	Weighted Average
41,085		95.62% Pervious Area
1,882		4.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PDA-101: PDA-101

Runoff = 0.1 cfs @ 12.12 hrs, Volume= 302 cf, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.28"

Area (sf)	CN	Description
5,156	39	>75% Grass cover, Good, HSG A
2,334	98	Paved parking, HSG A
235	74	>75% Grass cover, Good, HSG C
506	98	Paved parking, HSG C
8,231	60	Weighted Average
5,391		65.50% Pervious Area
2,840		34.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PDA-102: PDA-102

Runoff = 1.2 cfs @ 12.15 hrs, Volume= 4,671 cf, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.28"

Area (sf)	CN	Description
11,117	39	>75% Grass cover, Good, HSG A
3,051	98	Paved parking, HSG A
19,777	70	Woods, Good, HSG C
25,414	74	>75% Grass cover, Good, HSG C
2,188	98	Paved parking, HSG C
2,272	98	Roofs, HSG C
173	80	>75% Grass cover, Good, HSG D
66	98	Paved parking, HSG D
64,057	70	Weighted Average
56,481		88.17% Pervious Area
7,576		11.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.1840	0.41		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.6	135	0.0770	1.39		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	208	0.0240	0.82	4.10	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.200
9.8	443	Total			

Summary for Subcatchment PDA-103: PDA-103

Runoff = 0.4 cfs @ 12.09 hrs, Volume= 1,302 cf, Depth= 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.28"

Area (sf)	CN	Description
3,753	74	>75% Grass cover, Good, HSG C
4,113	98	Paved parking, HSG C
0	70	Woods, Good, HSG C
7,866	87	Weighted Average
3,753		47.71% Pervious Area
4,113		52.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	368	0.0720	1.42	7.10	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.200
4.3	368	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PDA-104: PDA-104

Runoff = 0.9 cfs @ 12.42 hrs, Volume= 5,245 cf, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.28"

Area (sf)	CN	Description
19,407	74	>75% Grass cover, Good, HSG C
38,640	70	Woods, Good, HSG C
2,804	98	Paved parking, HSG C
60,851	73	Weighted Average
58,047		95.39% Pervious Area
2,804		4.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.0	100	0.0310	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
6.4	583	0.0911	1.51		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.8	233	0.0708	1.41	7.04	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.200
27.2	916	Total			

Summary for Subcatchment PDA-105: PDA-105

Runoff = 1.3 cfs @ 12.50 hrs, Volume= 7,937 cf, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.28"

Area (sf)	CN	Description
65,985	70	Woods, Good, HSG C
8,422	98	Paved parking, HSG C
17,673	74	>75% Grass cover, Good, HSG C
92,080	73	Weighted Average
83,658		90.85% Pervious Area
8,422		9.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.8	100	0.0140	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
3.5	309	0.0883	1.49		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.4	370	0.0700	1.40	7.00	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.200
32.7	779	Total			

Summary for Subcatchment PDA-106: PDA-106

Runoff = 1.2 cfs @ 12.10 hrs, Volume= 3,962 cf, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.28"

Area (sf)	CN	Description
9,097	74	>75% Grass cover, Good, HSG C
13,120	98	Paved parking, HSG C
763	70	Woods, Good, HSG C
22,980	88	Weighted Average
9,860		42.91% Pervious Area
13,120		57.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	489	0.0460	1.13	5.67	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.200

Summary for Subcatchment PDA-200: PDA-200

Runoff = 4.5 cfs @ 12.41 hrs, Volume= 25,684 cf, Depth= 0.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.28"

Area (sf)	CN	Description
25,377	55	Woods, Good, HSG B
36,942	74	>75% Grass cover, Good, HSG C
191,740	70	Woods, Good, HSG C
3,065	39	>75% Grass cover, Good, HSG A
1,377	98	Paved parking, HSG A
295	98	Roofs, HSG C
3,073	98	Paved parking, HSG C
11,813	98	Water Surface, HSG C
5,791	98	Water Surface, HSG D
266	98	Paved parking, HSG D
25,648	77	Woods, Good, HSG D
9,226	80	>75% Grass cover, Good, HSG D
314,613	72	Weighted Average
291,998		92.81% Pervious Area
22,615		7.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.0	100	0.0270	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
2.6	183	0.0567	1.19		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.7	708	0.0889	2.09		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
27.3	991	Total			

Summary for Subcatchment PDA-201: Subcat PDA-201

Runoff = 0.6 cfs @ 12.09 hrs, Volume= 1,761 cf, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.28"

Area (sf)	CN	Description
12,163	74	>75% Grass cover, Good, HSG C
938	70	Woods, Good, HSG C
2,760	98	Paved parking, HSG C
15,861	78	Weighted Average
13,101		82.60% Pervious Area
2,760		17.40% Impervious Area

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

Summary for Subcatchment PDA-202: Subcat PDA-202

Runoff = 1.4 cfs @ 12.48 hrs, Volume= 8,542 cf, Depth= 0.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.28"

Area (sf)	CN	Description
41,066	74	>75% Grass cover, Good, HSG C
10	98	Paved parking, HSG C
69,554	70	Woods, Good, HSG C
110,630	71	Weighted Average
110,620		99.99% Pervious Area
10		0.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.9	100	0.0191	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
8.1	266	0.0480	0.55		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.6	169	0.0650	1.78		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	303	0.0460	11.34	56.72	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.020
32.0	838	Total			

Summary for Subcatchment RF-02: RF-02

Runoff = 0.3 cfs @ 12.00 hrs, Volume= 791 cf, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.28"

Area (sf)	CN	Description
3,116	98	Roofs, HSG C
3,116		100.00% Impervious Area

Summary for Subcatchment RF-03: RF-03

Runoff = 0.2 cfs @ 12.00 hrs, Volume= 428 cf, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.28"

Area (sf)	CN	Description
1,685	98	Roofs, HSG C
1,685		100.00% Impervious Area

Summary for Subcatchment RF-04: RF-04

Runoff = 0.3 cfs @ 12.00 hrs, Volume= 791 cf, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.28"

Area (sf)	CN	Description
3,116	98	Roofs, HSG C
3,116		100.00% Impervious Area

Summary for Subcatchment RF-05: RF-05

Runoff = 0.3 cfs @ 12.00 hrs, Volume= 791 cf, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.28"

Area (sf)	CN	Description
3,116	98	Roofs, HSG C
3,116		100.00% Impervious Area

Summary for Subcatchment RF-06: RF-06

Runoff = 0.3 cfs @ 12.00 hrs, Volume= 791 cf, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.28"

Area (sf)	CN	Description
3,116	98	Roofs, HSG C
3,116		100.00% Impervious Area

Summary for Pond 1P: Pond

Inflow Area = 256,065 sf, 15.18% Impervious, Inflow Depth = 0.43" for 2-year event
Inflow = 1.6 cfs @ 12.14 hrs, Volume= 9,164 cf
Outflow = 1.6 cfs @ 12.15 hrs, Volume= 9,164 cf, Atten= 0%, Lag= 0.4 min
Primary = 1.6 cfs @ 12.15 hrs, Volume= 9,164 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 320.16' @ 12.15 hrs Surf.Area= 363 sf Storage= 52 cf

Plug-Flow detention time= 1.1 min calculated for 9,164 cf (100% of inflow)

Center-of-Mass det. time= 0.8 min (855.8 - 854.9)

Volume	Invert	Avail.Storage	Storage Description
#1	320.00'	1,892 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
320.00	269	0	0
321.00	841	555	555
322.00	1,833	1,337	1,892

Device	Routing	Invert	Outlet Devices
#1	Primary	320.20'	**8.0" Round Culvert** L= 15.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 320.20' / 320.00' S= 0.0133 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf
#2	Primary	320.00'	**10.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=1.6 cfs @ 12.15 hrs HW=320.16' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Controls 0.0 cfs)
└—**2=Broad-Crested Rectangular Weir** (Weir Controls 1.6 cfs @ 0.98 fps)

Summary for Pond INF-103: INF-103

Inflow Area = 30,846 sf, 55.87% Impervious, Inflow Depth = 0.51" for 2-year event
Inflow = 0.4 cfs @ 12.09 hrs, Volume= 1,302 cf
Outflow = 0.4 cfs @ 12.11 hrs, Volume= 1,302 cf, Atten= 4%, Lag= 1.4 min
Discarded = 0.0 cfs @ 9.24 hrs, Volume= 292 cf
Primary = 0.4 cfs @ 12.11 hrs, Volume= 1,010 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 326.75' @ 12.11 hrs Surf.Area= 473 sf Storage= 180 cf

Plug-Flow detention time= 106.7 min calculated for 1,302 cf (100% of inflow)
Center-of-Mass det. time= 106.7 min (924.6 - 817.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	326.00'	310 cf	**12.42'W x 38.07'L x 2.00'H Field A** 945 cf Overall - 171 cf Embedded = 774 cf x 40.0% Voids
#2A	326.50'	171 cf	**ADS_StormTech SC-160LP +Cap** x 25 Inside #1 Effective Size= 18.0"W x 12.0"H => 0.96 sf x 7.12'L = 6.8 cf Overall Size= 25.0"W x 12.0"H x 7.56'L with 0.44' Overlap 25 Chambers in 5 Rows
		481 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	326.56'	**6.0" Vert. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#2	Discarded	326.00'	**0.276 in/hr Exfiltration - Loamy Sand over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 9.24 hrs HW=326.02' (Free Discharge)
↑—**2=Exfiltration - Loamy Sand** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.4 cfs @ 12.11 hrs HW=326.75' TW=320.16' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 0.4 cfs @ 1.48 fps)

Summary for Pond INF-104: INF-104

Inflow Area =	152,931 sf,	7.34% Impervious,	Inflow Depth =	0.71"	for 2-year event
Inflow =	1.5 cfs @	12.73 hrs,	Volume=	9,092 cf	
Outflow =	1.1 cfs @	12.96 hrs,	Volume=	9,092 cf,	Atten= 30%, Lag= 13.8 min
Discarded =	0.1 cfs @	12.06 hrs,	Volume=	5,911 cf	
Primary =	0.9 cfs @	12.96 hrs,	Volume=	3,181 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 326.91' @ 12.96 hrs Surf.Area= 1,889 sf Storage= 2,317 cf

Plug-Flow detention time= 113.6 min calculated for 9,091 cf (100% of inflow)
Center-of-Mass det. time= 113.6 min (985.8 - 872.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	325.10'	1,726 cf	**25.25'W x 74.82'L x 3.50'H Field A** 6,612 cf Overall - 2,297 cf Embedded = 4,315 cf x 40.0% Voids
#2A	325.60'	2,297 cf	**ADS_StormTech SC-740 +Cap** x 50 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 50 Chambers in 5 Rows
		4,023 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	326.64'	**12.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Discarded	325.10'	**3.072 in/hr Exfiltration - Loamy Sand over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 12.06 hrs HW=325.14' (Free Discharge)
↑—**2=Exfiltration - Loamy Sand** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.9 cfs @ 12.96 hrs HW=326.91' TW=320.13' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 0.9 cfs @ 1.78 fps)

Summary for Pond INF-105: INF-105

Inflow Area = 92,080 sf, 9.15% Impervious, Inflow Depth = 1.03" for 2-year event
Inflow = 1.3 cfs @ 12.50 hrs, Volume= 7,937 cf
Outflow = 1.0 cfs @ 12.76 hrs, Volume= 7,937 cf, Atten= 26%, Lag= 15.7 min
Discarded = 0.1 cfs @ 11.89 hrs, Volume= 4,090 cf
Primary = 0.9 cfs @ 12.76 hrs, Volume= 3,847 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 348.30' @ 12.76 hrs Surf.Area= 1,709 sf Storage= 2,082 cf

Plug-Flow detention time= 227.2 min calculated for 7,936 cf (100% of inflow)
Center-of-Mass det. time= 227.2 min (1,115.8 - 888.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	346.50'	1,566 cf	**25.25'W x 67.70'L x 3.50'H Field A** 5,983 cf Overall - 2,067 cf Embedded = 3,915 cf x 40.0% Voids
#2A	347.00'	2,067 cf	**ADS_StormTech SC-740 +Cap** x 45 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 45 Chambers in 5 Rows
		3,633 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	348.04'	**6.0" Vert. Orifice/Grate X 5.00** C= 0.600 Limited to weir flow at low heads
#2	Discarded	346.50'	**1.284 in/hr Exfiltration - Sandy Loam over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 11.89 hrs HW=346.54' (Free Discharge)
↑—**2=Exfiltration - Sandy Loam** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.9 cfs @ 12.76 hrs HW=348.30' TW=326.60' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 0.9 cfs @ 1.75 fps)

Summary for Pond INF-106: INF-106

Inflow Area = 22,980 sf, 57.09% Impervious, Inflow Depth = 2.07" for 2-year event
Inflow = 1.2 cfs @ 12.10 hrs, Volume= 3,962 cf
Outflow = 0.0 cfs @ 11.12 hrs, Volume= 3,962 cf, Atten= 97%, Lag= 0.0 min
Discarded = 0.0 cfs @ 11.12 hrs, Volume= 3,962 cf
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 354.52' @ 16.04 hrs Surf.Area= 1,016 sf Storage= 2,305 cf

Plug-Flow detention time= 539.2 min calculated for 3,962 cf (100% of inflow)
Center-of-Mass det. time= 539.2 min (1,354.3 - 815.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	351.25'	1,753 cf	**28.50'W x 35.64'L x 6.75'H Field A** 6,857 cf Overall - 2,473 cf Embedded = 4,383 cf x 40.0% Voids
#2A	352.00'	2,473 cf	**ADS_StormTech MC-4500 b +Cap** x 21 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 21 Chambers in 3 Rows Cap Storage= +39.5 cf x 2 x 3 rows = 237.0 cf
		4,227 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	355.55'	**6.0" Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Discarded	351.25'	**1.758 in/hr Exfiltration - Sandy Loam over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 11.12 hrs HW=351.32' (Free Discharge)
↑—**2=Exfiltration - Sandy Loam** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=351.25' TW=326.00' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Controls 0.0 cfs)

Summary for Pond INF-201: INF-201

Inflow Area =	126,491 sf,	2.19% Impervious,	Inflow Depth =	0.98"	for 2-year event
Inflow =	1.5 cfs @	12.47 hrs, Volume=	10,303 cf		
Outflow =	0.8 cfs @	12.91 hrs, Volume=	10,303 cf,	Atten= 46%,	Lag= 26.2 min
Discarded =	0.1 cfs @	11.87 hrs, Volume=	7,346 cf		
Primary =	0.7 cfs @	12.91 hrs, Volume=	2,957 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 338.34' @ 12.91 hrs Surf.Area= 2,245 sf Storage= 3,274 cf

Plug-Flow detention time= 215.7 min calculated for 10,302 cf (100% of inflow)
Center-of-Mass det. time= 215.7 min (1,102.2 - 886.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	336.20'	2,040 cf	**30.00'W x 74.82'L x 3.50'H Field A** 7,856 cf Overall - 2,756 cf Embedded = 5,099 cf x 40.0% Voids
#2A	336.70'	2,756 cf	**ADS_StormTech SC-740 +Cap** x 60 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 60 Chambers in 6 Rows
		4,796 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	338.08'	**8.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Primary	338.24'	**6.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#3	Discarded	336.20'	**2.262 in/hr Exfiltration - Sandy Loam over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 11.87 hrs HW=336.24' (Free Discharge)
└**3=Exfiltration - Sandy Loam** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.7 cfs @ 12.91 hrs HW=338.34' TW=0.00' (Dynamic Tailwater)
├**1=Orifice/Grate** (Orifice Controls 0.6 cfs @ 1.72 fps)
└**2=Orifice/Grate** (Orifice Controls 0.1 cfs @ 1.06 fps)

Summary for Pond INF-RF2: INF-RF2

Inflow Area = 3,116 sf,100.00% Impervious, Inflow Depth = 3.05" for 2-year event
Inflow = 0.3 cfs @ 12.00 hrs, Volume= 791 cf
Outflow = 0.3 cfs @ 12.01 hrs, Volume= 791 cf, Atten= 5%, Lag= 0.7 min
Discarded = 0.0 cfs @ 8.99 hrs, Volume= 431 cf
Primary = 0.3 cfs @ 12.01 hrs, Volume= 360 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 335.70' @ 12.01 hrs Surf.Area= 118 sf Storage= 116 cf

Plug-Flow detention time= 69.9 min calculated for 791 cf (100% of inflow)
Center-of-Mass det. time= 69.9 min (820.2 - 750.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	334.00'	129 cf	**11.00'W x 10.74'L x 3.50'H Field A** 413 cf Overall - 92 cf Embedded = 321 cf x 40.0% Voids
#2A	334.50'	92 cf	**ADS_StormTech SC-740 +Cap** x 2 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 2 Chambers in 2 Rows
		220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	334.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	335.38'	**8.0" Round Culvert** L= 52.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 335.38' / 333.00' S= 0.0458 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 8.99 hrs HW=334.04' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.3 cfs @ 12.01 hrs HW=335.70' (Free Discharge)
2=Culvert (Inlet Controls 0.3 cfs @ 1.53 fps)

Summary for Pond INF-RF3: INF-RF3

Inflow Area = 1,685 sf,100.00% Impervious, Inflow Depth = 3.05" for 2-year event
Inflow = 0.2 cfs @ 12.00 hrs, Volume= 428 cf
Outflow = 0.1 cfs @ 12.06 hrs, Volume= 428 cf, Atten= 34%, Lag= 3.5 min
Discarded = 0.0 cfs @ 10.71 hrs, Volume= 333 cf
Primary = 0.1 cfs @ 12.06 hrs, Volume= 95 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 333.57' @ 12.06 hrs Surf.Area= 118 sf Storage= 106 cf

Plug-Flow detention time= 84.3 min calculated for 428 cf (100% of inflow)
Center-of-Mass det. time= 84.3 min (834.7 - 750.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	332.00'	129 cf	**11.00'W x 10.74'L x 3.50'H Field A** 413 cf Overall - 92 cf Embedded = 321 cf x 40.0% Voids
#2A	332.50'	92 cf	**ADS_StormTech SC-740 +Cap** x 2 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 2 Chambers in 2 Rows
		220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	332.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	333.38'	**8.0" Round Culvert** L= 57.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 333.38' / 331.00' S= 0.0418 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 10.71 hrs HW=332.04' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.06 hrs HW=333.57' (Free Discharge)
2=Culvert (Inlet Controls 0.1 cfs @ 1.16 fps)

Summary for Pond INF-RF4: INF-RF4

Inflow Area = 3,116 sf,100.00% Impervious, Inflow Depth = 3.05" for 2-year event
Inflow = 0.3 cfs @ 12.00 hrs, Volume= 791 cf
Outflow = 0.3 cfs @ 12.01 hrs, Volume= 791 cf, Atten= 5%, Lag= 0.7 min
Discarded = 0.0 cfs @ 8.99 hrs, Volume= 431 cf
Primary = 0.3 cfs @ 12.01 hrs, Volume= 360 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 367.70' @ 12.01 hrs Surf.Area= 118 sf Storage= 116 cf

Plug-Flow detention time= 69.9 min calculated for 791 cf (100% of inflow)
Center-of-Mass det. time= 69.9 min (820.2 - 750.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	366.00'	129 cf	**11.00'W x 10.74'L x 3.50'H Field A** 413 cf Overall - 92 cf Embedded = 321 cf x 40.0% Voids
#2A	366.50'	92 cf	**ADS_StormTech SC-740 +Cap** x 2 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 2 Chambers in 2 Rows
		220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	366.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	367.38'	**8.0" Round Culvert** L= 37.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 367.38' / 366.00' S= 0.0373 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 8.99 hrs HW=366.04' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.3 cfs @ 12.01 hrs HW=367.70' (Free Discharge)
↑**2=Culvert** (Inlet Controls 0.3 cfs @ 1.53 fps)

Summary for Pond INF-RF5: INF-RF5

Inflow Area = 3,116 sf,100.00% Impervious, Inflow Depth = 3.05" for 2-year event
Inflow = 0.3 cfs @ 12.00 hrs, Volume= 791 cf
Outflow = 0.3 cfs @ 12.01 hrs, Volume= 791 cf, Atten= 5%, Lag= 0.7 min
Discarded = 0.0 cfs @ 8.99 hrs, Volume= 431 cf
Primary = 0.3 cfs @ 12.01 hrs, Volume= 360 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 377.70' @ 12.01 hrs Surf.Area= 118 sf Storage= 116 cf

Plug-Flow detention time= 69.9 min calculated for 791 cf (100% of inflow)

Center-of-Mass det. time= 69.9 min (820.2 - 750.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	376.00'	129 cf	**11.00'W x 10.74'L x 3.50'H Field A** 413 cf Overall - 92 cf Embedded = 321 cf x 40.0% Voids
#2A	376.50'	92 cf	**ADS_StormTech SC-740 +Cap** x 2 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 2 Chambers in 2 Rows
		220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	377.38'	**8.0" Round Culvert** L= 16.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 377.38' / 376.00' S= 0.0862 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf
#2	Discarded	376.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 8.99 hrs HW=376.04' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.3 cfs @ 12.01 hrs HW=377.70' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 0.3 cfs @ 1.53 fps)

Summary for Pond INF-RF6: INF-RF6

Inflow Area = 3,116 sf,100.00% Impervious, Inflow Depth = 3.05" for 2-year event
Inflow = 0.3 cfs @ 12.00 hrs, Volume= 791 cf
Outflow = 0.3 cfs @ 12.01 hrs, Volume= 791 cf, Atten= 5%, Lag= 0.7 min
Discarded = 0.0 cfs @ 8.99 hrs, Volume= 431 cf
Primary = 0.3 cfs @ 12.01 hrs, Volume= 360 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 377.70' @ 12.01 hrs Surf.Area= 118 sf Storage= 116 cf

Plug-Flow detention time= 69.9 min calculated for 791 cf (100% of inflow)
Center-of-Mass det. time= 69.9 min (820.2 - 750.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	376.00'	129 cf	**11.00'W x 10.74'L x 3.50'H Field A** 413 cf Overall - 92 cf Embedded = 321 cf x 40.0% Voids
#2A	376.50'	92 cf	**ADS_StormTech SC-740 +Cap** x 2 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 2 Chambers in 2 Rows
		220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	377.38'	**8.0" Round Culvert** L= 58.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 377.38' / 376.00' S= 0.0238 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf
#2	Discarded	376.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 8.99 hrs HW=376.04' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.3 cfs @ 12.01 hrs HW=377.70' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 0.3 cfs @ 1.53 fps)

Summary for Link DP-1: DESIGN POINT 1

Inflow Area = 299,032 sf, 13.63% Impervious, Inflow Depth = 0.37" for 2-year event
Inflow = 1.6 cfs @ 12.15 hrs, Volume= 9,307 cf
Primary = 1.6 cfs @ 12.15 hrs, Volume= 9,307 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: DESIGN POINT 2

Inflow Area = 441,104 sf, 5.75% Impervious, Inflow Depth = 0.78" for 2-year event
Inflow = 4.5 cfs @ 12.41 hrs, Volume= 28,641 cf
Primary = 4.5 cfs @ 12.41 hrs, Volume= 28,641 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PDA-100: PDA-100 Runoff Area=42,967 sf 4.38% Impervious Runoff Depth=0.40"
Tc=6.0 min CN=44 Runoff=0.2 cfs 1,442 cf

Subcatchment PDA-101: PDA-101 Runoff Area=8,231 sf 34.50% Impervious Runoff Depth=1.31"
Tc=6.0 min CN=60 Runoff=0.3 cfs 900 cf

Subcatchment PDA-102: PDA-102 Runoff Area=64,057 sf 11.83% Impervious Runoff Depth=2.05"
Flow Length=443' Tc=9.8 min CN=70 Runoff=3.0 cfs 10,949 cf

Subcatchment PDA-103: PDA-103 Runoff Area=7,866 sf 52.29% Impervious Runoff Depth=3.59"
Flow Length=368' Slope=0.0720 '/' Tc=6.0 min CN=87 Runoff=0.7 cfs 2,351 cf

Subcatchment PDA-104: PDA-104 Runoff Area=60,851 sf 4.61% Impervious Runoff Depth=2.30"
Flow Length=916' Tc=27.2 min CN=73 Runoff=2.2 cfs 11,644 cf

Subcatchment PDA-105: PDA-105 Runoff Area=92,080 sf 9.15% Impervious Runoff Depth=2.30"
Flow Length=779' Tc=32.7 min CN=73 Runoff=3.1 cfs 17,619 cf

Subcatchment PDA-106: PDA-106 Runoff Area=22,980 sf 57.09% Impervious Runoff Depth=3.69"
Flow Length=489' Slope=0.0460 '/' Tc=7.2 min CN=88 Runoff=2.1 cfs 7,062 cf

Subcatchment PDA-200: PDA-200 Runoff Area=314,613 sf 7.19% Impervious Runoff Depth=2.21"
Flow Length=991' Tc=27.3 min CN=72 Runoff=10.9 cfs 58,027 cf

Subcatchment PDA-201: Subcat PDA-201 Runoff Area=15,861 sf 17.40% Impervious Runoff Depth=2.73"
Tc=6.0 min CN=78 Runoff=1.2 cfs 3,607 cf

Subcatchment PDA-202: Subcat PDA-202 Runoff Area=110,630 sf 0.01% Impervious Runoff Depth=2.13"
Flow Length=838' Tc=32.0 min CN=71 Runoff=3.4 cfs 19,652 cf

Subcatchment RF-02: RF-02 Runoff Area=3,116 sf 100.00% Impervious Runoff Depth=4.78"
Tc=0.0 min CN=98 Runoff=0.4 cfs 1,242 cf

Subcatchment RF-03: RF-03 Runoff Area=1,685 sf 100.00% Impervious Runoff Depth=4.78"
Tc=0.0 min CN=98 Runoff=0.2 cfs 672 cf

Subcatchment RF-04: RF-04 Runoff Area=3,116 sf 100.00% Impervious Runoff Depth=4.78"
Tc=0.0 min CN=98 Runoff=0.4 cfs 1,242 cf

Subcatchment RF-05: RF-05 Runoff Area=3,116 sf 100.00% Impervious Runoff Depth=4.78"
Tc=0.0 min CN=98 Runoff=0.4 cfs 1,242 cf

Subcatchment RF-06: RF-06 Runoff Area=3,116 sf 100.00% Impervious Runoff Depth=4.78"
Tc=0.0 min CN=98 Runoff=0.4 cfs 1,242 cf

Pond 1P: Pond Peak Elev=320.40' Storage=156 cf Inflow=6.7 cfs 32,413 cf
Outflow=6.7 cfs 32,413 cf

Pond INF-103: INF-103 Peak Elev=326.82' Storage=204 cf Inflow=0.7 cfs 4,157 cf
Discarded=0.0 cfs 313 cf Primary=0.7 cfs 3,845 cf Outflow=0.7 cfs 4,157 cf

Pond INF-104: INF-104 Peak Elev=327.31' Storage=2,841 cf Inflow=4.9 cfs 24,813 cf
Discarded=0.1 cfs 8,094 cf Primary=4.7 cfs 16,719 cf Outflow=4.8 cfs 24,813 cf

Pond INF-105: INF-105 Peak Elev=348.67' Storage=2,513 cf Inflow=3.1 cfs 17,619 cf
Discarded=0.1 cfs 4,449 cf Primary=2.9 cfs 13,170 cf Outflow=3.0 cfs 17,619 cf

Pond INF-106: INF-106 Peak Elev=355.88' Storage=3,246 cf Inflow=2.1 cfs 7,062 cf
Discarded=0.0 cfs 5,256 cf Primary=0.5 cfs 1,807 cf Outflow=0.6 cfs 7,062 cf

Pond INF-201: INF-201 Peak Elev=338.65' Storage=3,731 cf Inflow=3.8 cfs 23,258 cf
Discarded=0.1 cfs 8,840 cf Primary=3.6 cfs 14,418 cf Outflow=3.7 cfs 23,258 cf

Pond INF-RF2: INF-RF2 Peak Elev=335.80' Storage=123 cf Inflow=0.4 cfs 1,242 cf
Discarded=0.0 cfs 518 cf Primary=0.4 cfs 724 cf Outflow=0.4 cfs 1,242 cf

Pond INF-RF3: INF-RF3 Peak Elev=333.67' Storage=113 cf Inflow=0.2 cfs 672 cf
Discarded=0.0 cfs 411 cf Primary=0.2 cfs 260 cf Outflow=0.2 cfs 672 cf

Pond INF-RF4: INF-RF4 Peak Elev=367.80' Storage=123 cf Inflow=0.4 cfs 1,242 cf
Discarded=0.0 cfs 518 cf Primary=0.4 cfs 724 cf Outflow=0.4 cfs 1,242 cf

Pond INF-RF5: INF-RF5 Peak Elev=377.80' Storage=123 cf Inflow=0.4 cfs 1,242 cf
Discarded=0.0 cfs 518 cf Primary=0.4 cfs 724 cf Outflow=0.4 cfs 1,242 cf

Pond INF-RF6: INF-RF6 Peak Elev=377.80' Storage=123 cf Inflow=0.4 cfs 1,242 cf
Discarded=0.0 cfs 518 cf Primary=0.4 cfs 724 cf Outflow=0.4 cfs 1,242 cf

Link DP-1: DESIGN POINT 1 Inflow=6.8 cfs 33,856 cf
Primary=6.8 cfs 33,856 cf

Link DP-2: DESIGN POINT 2 Inflow=14.3 cfs 72,445 cf
Primary=14.3 cfs 72,445 cf

Total Runoff Area = 754,285 sf Runoff Volume = 138,893 cf Average Runoff Depth = 2.21"
89.36% Pervious = 673,994 sf 10.64% Impervious = 80,291 sf

Summary for Subcatchment PDA-100: PDA-100

Runoff = 0.2 cfs @ 12.33 hrs, Volume= 1,442 cf, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (sf)	CN	Description
1,794	98	Paved parking, HSG A
37,895	39	>75% Grass cover, Good, HSG A
395	70	Woods, Good, HSG C
2,795	74	>75% Grass cover, Good, HSG C
88	98	Paved parking, HSG D
42,967	44	Weighted Average
41,085		95.62% Pervious Area
1,882		4.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PDA-101: PDA-101

Runoff = 0.3 cfs @ 12.10 hrs, Volume= 900 cf, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (sf)	CN	Description
5,156	39	>75% Grass cover, Good, HSG A
2,334	98	Paved parking, HSG A
235	74	>75% Grass cover, Good, HSG C
506	98	Paved parking, HSG C
8,231	60	Weighted Average
5,391		65.50% Pervious Area
2,840		34.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PDA-102: PDA-102

Runoff = 3.0 cfs @ 12.14 hrs, Volume= 10,949 cf, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (sf)	CN	Description
11,117	39	>75% Grass cover, Good, HSG A
3,051	98	Paved parking, HSG A
19,777	70	Woods, Good, HSG C
25,414	74	>75% Grass cover, Good, HSG C
2,188	98	Paved parking, HSG C
2,272	98	Roofs, HSG C
173	80	>75% Grass cover, Good, HSG D
66	98	Paved parking, HSG D
64,057	70	Weighted Average
56,481		88.17% Pervious Area
7,576		11.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.1840	0.41		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.6	135	0.0770	1.39		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	208	0.0240	0.82	4.10	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.200
9.8	443	Total			

Summary for Subcatchment PDA-103: PDA-103

Runoff = 0.7 cfs @ 12.09 hrs, Volume= 2,351 cf, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (sf)	CN	Description
3,753	74	>75% Grass cover, Good, HSG C
4,113	98	Paved parking, HSG C
0	70	Woods, Good, HSG C
7,866	87	Weighted Average
3,753		47.71% Pervious Area
4,113		52.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	368	0.0720	1.42	7.10	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.200
4.3	368	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PDA-104: PDA-104

Runoff = 2.2 cfs @ 12.39 hrs, Volume= 11,644 cf, Depth= 2.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (sf)	CN	Description
19,407	74	>75% Grass cover, Good, HSG C
38,640	70	Woods, Good, HSG C
2,804	98	Paved parking, HSG C
60,851	73	Weighted Average
58,047		95.39% Pervious Area
2,804		4.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.0	100	0.0310	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
6.4	583	0.0911	1.51		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.8	233	0.0708	1.41	7.04	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.200
27.2	916	Total			

Summary for Subcatchment PDA-105: PDA-105

Runoff = 3.1 cfs @ 12.46 hrs, Volume= 17,619 cf, Depth= 2.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (sf)	CN	Description
65,985	70	Woods, Good, HSG C
8,422	98	Paved parking, HSG C
17,673	74	>75% Grass cover, Good, HSG C
92,080	73	Weighted Average
83,658		90.85% Pervious Area
8,422		9.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.8	100	0.0140	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
3.5	309	0.0883	1.49		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.4	370	0.0700	1.40	7.00	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.200
32.7	779	Total			

Summary for Subcatchment PDA-106: PDA-106

Runoff = 2.1 cfs @ 12.10 hrs, Volume= 7,062 cf, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (sf)	CN	Description
9,097	74	>75% Grass cover, Good, HSG C
13,120	98	Paved parking, HSG C
763	70	Woods, Good, HSG C
22,980	88	Weighted Average
9,860		42.91% Pervious Area
13,120		57.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	489	0.0460	1.13	5.67	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.200

Summary for Subcatchment PDA-200: PDA-200

Runoff = 10.9 cfs @ 12.40 hrs, Volume= 58,027 cf, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (sf)	CN	Description
25,377	55	Woods, Good, HSG B
36,942	74	>75% Grass cover, Good, HSG C
191,740	70	Woods, Good, HSG C
3,065	39	>75% Grass cover, Good, HSG A
1,377	98	Paved parking, HSG A
295	98	Roofs, HSG C
3,073	98	Paved parking, HSG C
11,813	98	Water Surface, HSG C
5,791	98	Water Surface, HSG D
266	98	Paved parking, HSG D
25,648	77	Woods, Good, HSG D
9,226	80	>75% Grass cover, Good, HSG D
314,613	72	Weighted Average
291,998		92.81% Pervious Area
22,615		7.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.0	100	0.0270	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
2.6	183	0.0567	1.19		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.7	708	0.0889	2.09		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
27.3	991	Total			

Summary for Subcatchment PDA-201: Subcat PDA-201

Runoff = 1.2 cfs @ 12.09 hrs, Volume= 3,607 cf, Depth= 2.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (sf)	CN	Description
12,163	74	>75% Grass cover, Good, HSG C
938	70	Woods, Good, HSG C
2,760	98	Paved parking, HSG C
15,861	78	Weighted Average
13,101		82.60% Pervious Area
2,760		17.40% Impervious Area

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

Summary for Subcatchment PDA-202: Subcat PDA-202

Runoff = 3.4 cfs @ 12.48 hrs, Volume= 19,652 cf, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (sf)	CN	Description
41,066	74	>75% Grass cover, Good, HSG C
10	98	Paved parking, HSG C
69,554	70	Woods, Good, HSG C
110,630	71	Weighted Average
110,620		99.99% Pervious Area
10		0.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.9	100	0.0191	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
8.1	266	0.0480	0.55		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.6	169	0.0650	1.78		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	303	0.0460	11.34	56.72	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.020
32.0	838	Total			

Summary for Subcatchment RF-02: RF-02

Runoff = 0.4 cfs @ 12.00 hrs, Volume= 1,242 cf, Depth= 4.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (sf)	CN	Description
3,116	98	Roofs, HSG C
3,116		100.00% Impervious Area

Summary for Subcatchment RF-03: RF-03

Runoff = 0.2 cfs @ 12.00 hrs, Volume= 672 cf, Depth= 4.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (sf)	CN	Description
1,685	98	Roofs, HSG C
1,685		100.00% Impervious Area

Summary for Subcatchment RF-04: RF-04

Runoff = 0.4 cfs @ 12.00 hrs, Volume= 1,242 cf, Depth= 4.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (sf)	CN	Description
3,116	98	Roofs, HSG C
3,116		100.00% Impervious Area

Summary for Subcatchment RF-05: RF-05

Runoff = 0.4 cfs @ 12.00 hrs, Volume= 1,242 cf, Depth= 4.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (sf)	CN	Description
3,116	98	Roofs, HSG C
3,116		100.00% Impervious Area

Summary for Subcatchment RF-06: RF-06

Runoff = 0.4 cfs @ 12.00 hrs, Volume= 1,242 cf, Depth= 4.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (sf)	CN	Description
3,116	98	Roofs, HSG C
3,116		100.00% Impervious Area

Summary for Pond 1P: Pond

Inflow Area = 256,065 sf, 15.18% Impervious, Inflow Depth = 1.52" for 10-year event
Inflow = 6.7 cfs @ 12.48 hrs, Volume= 32,413 cf
Outflow = 6.7 cfs @ 12.49 hrs, Volume= 32,413 cf, Atten= 0%, Lag= 0.3 min
Primary = 6.7 cfs @ 12.49 hrs, Volume= 32,413 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 320.40' @ 12.49 hrs Surf.Area= 500 sf Storage= 156 cf

Plug-Flow detention time= 0.6 min calculated for 32,410 cf (100% of inflow)

Center-of-Mass det. time= 0.6 min (829.8 - 829.2)

Volume	Invert	Avail.Storage	Storage Description
#1	320.00'	1,892 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
320.00	269	0	0
321.00	841	555	555
322.00	1,833	1,337	1,892

Device	Routing	Invert	Outlet Devices
#1	Primary	320.20'	**8.0" Round Culvert** L= 15.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 320.20' / 320.00' S= 0.0133 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf
#2	Primary	320.00'	**10.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=6.6 cfs @ 12.49 hrs HW=320.40' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.1 cfs @ 1.22 fps)
└—**2=Broad-Crested Rectangular Weir** (Weir Controls 6.5 cfs @ 1.62 fps)

Summary for Pond INF-103: INF-103

Inflow Area = 30,846 sf, 55.87% Impervious, Inflow Depth = 1.62" for 10-year event
Inflow = 0.7 cfs @ 12.09 hrs, Volume= 4,157 cf
Outflow = 0.7 cfs @ 12.47 hrs, Volume= 4,157 cf, Atten= 2%, Lag= 23.3 min
Discarded = 0.0 cfs @ 7.57 hrs, Volume= 313 cf
Primary = 0.7 cfs @ 12.47 hrs, Volume= 3,845 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 326.82' @ 12.47 hrs Surf.Area= 473 sf Storage= 204 cf

Plug-Flow detention time= 38.3 min calculated for 4,157 cf (100% of inflow)
Center-of-Mass det. time= 38.4 min (847.6 - 809.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	326.00'	310 cf	**12.42'W x 38.07'L x 2.00'H Field A** 945 cf Overall - 171 cf Embedded = 774 cf x 40.0% Voids
#2A	326.50'	171 cf	**ADS_StormTech SC-160LP +Cap** x 25 Inside #1 Effective Size= 18.0"W x 12.0"H => 0.96 sf x 7.12'L = 6.8 cf Overall Size= 25.0"W x 12.0"H x 7.56'L with 0.44' Overlap 25 Chambers in 5 Rows
		481 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	326.56'	**6.0" Vert. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#2	Discarded	326.00'	**0.276 in/hr Exfiltration - Loamy Sand over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 7.57 hrs HW=326.02' (Free Discharge)
↑—**2=Exfiltration - Loamy Sand** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.7 cfs @ 12.47 hrs HW=326.82' TW=320.40' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 0.7 cfs @ 1.74 fps)

Summary for Pond INF-104: INF-104

Inflow Area =	152,931 sf,	7.34% Impervious,	Inflow Depth =	1.95"	for 10-year event
Inflow =	4.9 cfs @	12.48 hrs,	Volume=	24,813 cf	
Outflow =	4.8 cfs @	12.52 hrs,	Volume=	24,813 cf,	Atten= 1%, Lag= 2.6 min
Discarded =	0.1 cfs @	11.67 hrs,	Volume=	8,094 cf	
Primary =	4.7 cfs @	12.52 hrs,	Volume=	16,719 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 327.31' @ 12.52 hrs Surf.Area= 1,889 sf Storage= 2,841 cf

Plug-Flow detention time= 66.0 min calculated for 24,813 cf (100% of inflow)
Center-of-Mass det. time= 66.0 min (923.7 - 857.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	325.10'	1,726 cf	**25.25'W x 74.82'L x 3.50'H Field A** 6,612 cf Overall - 2,297 cf Embedded = 4,315 cf x 40.0% Voids
#2A	325.60'	2,297 cf	**ADS_StormTech SC-740 +Cap** x 50 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 50 Chambers in 5 Rows
		4,023 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	326.64'	**12.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Discarded	325.10'	**3.072 in/hr Exfiltration - Loamy Sand over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 11.67 hrs HW=325.14' (Free Discharge)
↑—**2=Exfiltration - Loamy Sand** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=4.7 cfs @ 12.52 hrs HW=327.31' TW=320.40' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 4.7 cfs @ 2.79 fps)

Summary for Pond INF-105: INF-105

Inflow Area = 92,080 sf, 9.15% Impervious, Inflow Depth = 2.30" for 10-year event
Inflow = 3.1 cfs @ 12.46 hrs, Volume= 17,619 cf
Outflow = 3.0 cfs @ 12.55 hrs, Volume= 17,619 cf, Atten= 4%, Lag= 5.2 min
Discarded = 0.1 cfs @ 10.76 hrs, Volume= 4,449 cf
Primary = 2.9 cfs @ 12.55 hrs, Volume= 13,170 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 348.67' @ 12.55 hrs Surf.Area= 1,709 sf Storage= 2,513 cf

Plug-Flow detention time= 111.6 min calculated for 17,619 cf (100% of inflow)
Center-of-Mass det. time= 111.6 min (976.1 - 864.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	346.50'	1,566 cf	**25.25'W x 67.70'L x 3.50'H Field A** 5,983 cf Overall - 2,067 cf Embedded = 3,915 cf x 40.0% Voids
#2A	347.00'	2,067 cf	**ADS_StormTech SC-740 +Cap** x 45 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 45 Chambers in 5 Rows
		3,633 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	348.04'	**6.0" Vert. Orifice/Grate X 5.00** C= 0.600 Limited to weir flow at low heads
#2	Discarded	346.50'	**1.284 in/hr Exfiltration - Sandy Loam over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 10.76 hrs HW=346.54' (Free Discharge)
↑—**2=Exfiltration - Sandy Loam** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=2.9 cfs @ 12.55 hrs HW=348.67' TW=327.31' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 2.9 cfs @ 2.96 fps)

Summary for Pond INF-106: INF-106

Inflow Area = 22,980 sf, 57.09% Impervious, Inflow Depth = 3.69" for 10-year event
Inflow = 2.1 cfs @ 12.10 hrs, Volume= 7,062 cf
Outflow = 0.6 cfs @ 12.47 hrs, Volume= 7,062 cf, Atten= 73%, Lag= 22.2 min
Discarded = 0.0 cfs @ 9.71 hrs, Volume= 5,256 cf
Primary = 0.5 cfs @ 12.47 hrs, Volume= 1,807 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 355.88' @ 12.47 hrs Surf.Area= 1,016 sf Storage= 3,246 cf

Plug-Flow detention time= 540.4 min calculated for 7,062 cf (100% of inflow)
Center-of-Mass det. time= 540.4 min (1,339.3 - 798.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	351.25'	1,753 cf	**28.50'W x 35.64'L x 6.75'H Field A** 6,857 cf Overall - 2,473 cf Embedded = 4,383 cf x 40.0% Voids
#2A	352.00'	2,473 cf	**ADS_StormTech MC-4500 b +Cap** x 21 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 21 Chambers in 3 Rows Cap Storage= +39.5 cf x 2 x 3 rows = 237.0 cf
		4,227 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	355.55'	**6.0" Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Discarded	351.25'	**1.758 in/hr Exfiltration - Sandy Loam over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 9.71 hrs HW=351.32' (Free Discharge)
↑—**2=Exfiltration - Sandy Loam** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.5 cfs @ 12.47 hrs HW=355.88' TW=326.82' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 0.5 cfs @ 1.97 fps)

Summary for Pond INF-201: INF-201

Inflow Area =	126,491 sf,	2.19% Impervious,	Inflow Depth =	2.21"	for 10-year event
Inflow =	3.8 cfs @	12.44 hrs,	Volume=	23,258 cf	
Outflow =	3.7 cfs @	12.48 hrs,	Volume=	23,258 cf,	Atten= 1%, Lag= 2.8 min
Discarded =	0.1 cfs @	11.13 hrs,	Volume=	8,840 cf	
Primary =	3.6 cfs @	12.48 hrs,	Volume=	14,418 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 338.65' @ 12.48 hrs Surf.Area= 2,245 sf Storage= 3,731 cf

Plug-Flow detention time= 122.9 min calculated for 23,256 cf (100% of inflow)
Center-of-Mass det. time= 122.9 min (985.4 - 862.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	336.20'	2,040 cf	**30.00'W x 74.82'L x 3.50'H Field A** 7,856 cf Overall - 2,756 cf Embedded = 5,099 cf x 40.0% Voids
#2A	336.70'	2,756 cf	**ADS_StormTech SC-740 +Cap** x 60 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 60 Chambers in 6 Rows
		4,796 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	338.08'	**8.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Primary	338.24'	**6.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#3	Discarded	336.20'	**2.262 in/hr Exfiltration - Sandy Loam over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 11.13 hrs HW=336.24' (Free Discharge)
└**3=Exfiltration - Sandy Loam** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=3.6 cfs @ 12.48 hrs HW=338.65' TW=0.00' (Dynamic Tailwater)
├**1=Orifice/Grate** (Orifice Controls 2.5 cfs @ 2.58 fps)
└**2=Orifice/Grate** (Orifice Controls 1.1 cfs @ 2.19 fps)

Summary for Pond INF-RF2: INF-RF2

Inflow Area =	3,116 sf,	100.00% Impervious,	Inflow Depth =	4.78"	for 10-year event
Inflow =	0.4 cfs @	12.00 hrs, Volume=	1,242 cf		
Outflow =	0.4 cfs @	12.01 hrs, Volume=	1,242 cf,	Atten= 4%,	Lag= 0.6 min
Discarded =	0.0 cfs @	7.50 hrs, Volume=	518 cf		
Primary =	0.4 cfs @	12.01 hrs, Volume=	724 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 335.80' @ 12.01 hrs Surf.Area= 118 sf Storage= 123 cf

Plug-Flow detention time= 61.7 min calculated for 1,242 cf (100% of inflow)
Center-of-Mass det. time= 61.7 min (804.1 - 742.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	334.00'	129 cf	**11.00'W x 10.74'L x 3.50'H Field A** 413 cf Overall - 92 cf Embedded = 321 cf x 40.0% Voids
#2A	334.50'	92 cf	**ADS_StormTech SC-740 +Cap** x 2 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 2 Chambers in 2 Rows
		220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	334.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	335.38'	**8.0" Round Culvert** L= 52.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 335.38' / 333.00' S= 0.0458 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 7.50 hrs HW=334.04' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.4 cfs @ 12.01 hrs HW=335.80' (Free Discharge)
2=Culvert (Inlet Controls 0.4 cfs @ 1.74 fps)

Summary for Pond INF-RF3: INF-RF3

Inflow Area = 1,685 sf,100.00% Impervious, Inflow Depth = 4.78" for 10-year event
Inflow = 0.2 cfs @ 12.00 hrs, Volume= 672 cf
Outflow = 0.2 cfs @ 12.01 hrs, Volume= 672 cf, Atten= 6%, Lag= 0.8 min
Discarded = 0.0 cfs @ 9.38 hrs, Volume= 411 cf
Primary = 0.2 cfs @ 12.01 hrs, Volume= 260 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 333.67' @ 12.01 hrs Surf.Area= 118 sf Storage= 113 cf

Plug-Flow detention time= 72.3 min calculated for 672 cf (100% of inflow)
Center-of-Mass det. time= 72.3 min (814.7 - 742.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	332.00'	129 cf	**11.00'W x 10.74'L x 3.50'H Field A** 413 cf Overall - 92 cf Embedded = 321 cf x 40.0% Voids
#2A	332.50'	92 cf	**ADS_StormTech SC-740 +Cap** x 2 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 2 Chambers in 2 Rows
		220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	332.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	333.38'	**8.0" Round Culvert** L= 57.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 333.38' / 331.00' S= 0.0418 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 9.38 hrs HW=332.04' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.01 hrs HW=333.67' (Free Discharge)
2=Culvert (Inlet Controls 0.2 cfs @ 1.45 fps)

Summary for Pond INF-RF4: INF-RF4

Inflow Area = 3,116 sf,100.00% Impervious, Inflow Depth = 4.78" for 10-year event
Inflow = 0.4 cfs @ 12.00 hrs, Volume= 1,242 cf
Outflow = 0.4 cfs @ 12.01 hrs, Volume= 1,242 cf, Atten= 4%, Lag= 0.6 min
Discarded = 0.0 cfs @ 7.50 hrs, Volume= 518 cf
Primary = 0.4 cfs @ 12.01 hrs, Volume= 724 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 367.80' @ 12.01 hrs Surf.Area= 118 sf Storage= 123 cf

Plug-Flow detention time= 61.7 min calculated for 1,242 cf (100% of inflow)
Center-of-Mass det. time= 61.7 min (804.1 - 742.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	366.00'	129 cf	**11.00'W x 10.74'L x 3.50'H Field A** 413 cf Overall - 92 cf Embedded = 321 cf x 40.0% Voids
#2A	366.50'	92 cf	**ADS_StormTech SC-740 +Cap** x 2 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 2 Chambers in 2 Rows
		220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	366.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	367.38'	**8.0" Round Culvert** L= 37.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 367.38' / 366.00' S= 0.0373 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 7.50 hrs HW=366.04' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.4 cfs @ 12.01 hrs HW=367.80' (Free Discharge)
2=Culvert (Inlet Controls 0.4 cfs @ 1.74 fps)

Summary for Pond INF-RF5: INF-RF5

Inflow Area = 3,116 sf,100.00% Impervious, Inflow Depth = 4.78" for 10-year event
Inflow = 0.4 cfs @ 12.00 hrs, Volume= 1,242 cf
Outflow = 0.4 cfs @ 12.01 hrs, Volume= 1,242 cf, Atten= 4%, Lag= 0.6 min
Discarded = 0.0 cfs @ 7.50 hrs, Volume= 518 cf
Primary = 0.4 cfs @ 12.01 hrs, Volume= 724 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 377.80' @ 12.01 hrs Surf.Area= 118 sf Storage= 123 cf

Plug-Flow detention time= 61.7 min calculated for 1,242 cf (100% of inflow)

Center-of-Mass det. time= 61.7 min (804.1 - 742.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	376.00'	129 cf	**11.00'W x 10.74'L x 3.50'H Field A** 413 cf Overall - 92 cf Embedded = 321 cf x 40.0% Voids
#2A	376.50'	92 cf	**ADS_StormTech SC-740 +Cap** x 2 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 2 Chambers in 2 Rows
		220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	377.38'	**8.0" Round Culvert** L= 16.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 377.38' / 376.00' S= 0.0862 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf
#2	Discarded	376.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 7.50 hrs HW=376.04' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.4 cfs @ 12.01 hrs HW=377.80' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 0.4 cfs @ 1.74 fps)

Summary for Pond INF-RF6: INF-RF6

Inflow Area = 3,116 sf,100.00% Impervious, Inflow Depth = 4.78" for 10-year event
Inflow = 0.4 cfs @ 12.00 hrs, Volume= 1,242 cf
Outflow = 0.4 cfs @ 12.01 hrs, Volume= 1,242 cf, Atten= 4%, Lag= 0.6 min
Discarded = 0.0 cfs @ 7.50 hrs, Volume= 518 cf
Primary = 0.4 cfs @ 12.01 hrs, Volume= 724 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 377.80' @ 12.01 hrs Surf.Area= 118 sf Storage= 123 cf

Plug-Flow detention time= 61.7 min calculated for 1,242 cf (100% of inflow)
Center-of-Mass det. time= 61.7 min (804.1 - 742.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	376.00'	129 cf	**11.00'W x 10.74'L x 3.50'H Field A** 413 cf Overall - 92 cf Embedded = 321 cf x 40.0% Voids
#2A	376.50'	92 cf	**ADS_StormTech SC-740 +Cap** x 2 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 2 Chambers in 2 Rows
		220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	377.38'	**8.0" Round Culvert** L= 58.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 377.38' / 376.00' S= 0.0238 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf
#2	Discarded	376.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 7.50 hrs HW=376.04' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.4 cfs @ 12.01 hrs HW=377.80' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 0.4 cfs @ 1.74 fps)

Summary for Link DP-1: DESIGN POINT 1

Inflow Area = 299,032 sf, 13.63% Impervious, Inflow Depth = 1.36" for 10-year event
Inflow = 6.8 cfs @ 12.48 hrs, Volume= 33,856 cf
Primary = 6.8 cfs @ 12.48 hrs, Volume= 33,856 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: DESIGN POINT 2

Inflow Area = 441,104 sf, 5.75% Impervious, Inflow Depth = 1.97" for 10-year event
Inflow = 14.3 cfs @ 12.41 hrs, Volume= 72,445 cf
Primary = 14.3 cfs @ 12.41 hrs, Volume= 72,445 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Time span=0.00-96.00 hrs, dt=0.01 hrs, 9601 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PDA-100: PDA-100 Runoff Area=42,967 sf 4.38% Impervious Runoff Depth=1.53"
Tc=6.0 min CN=44 Runoff=1.4 cfs 5,462 cf

Subcatchment PDA-101: PDA-101 Runoff Area=8,231 sf 34.50% Impervious Runoff Depth=3.17"
Tc=6.0 min CN=60 Runoff=0.7 cfs 2,174 cf

Subcatchment PDA-102: PDA-102 Runoff Area=64,057 sf 11.83% Impervious Runoff Depth=4.28"
Flow Length=443' Tc=9.8 min CN=70 Runoff=6.5 cfs 22,825 cf

Subcatchment PDA-103: PDA-103 Runoff Area=7,866 sf 52.29% Impervious Runoff Depth=6.24"
Flow Length=368' Slope=0.0720 '/' Tc=6.0 min CN=87 Runoff=1.3 cfs 4,087 cf

Subcatchment PDA-104: PDA-104 Runoff Area=60,851 sf 4.61% Impervious Runoff Depth=4.62"
Flow Length=916' Tc=27.2 min CN=73 Runoff=4.5 cfs 23,405 cf

Subcatchment PDA-105: PDA-105 Runoff Area=92,080 sf 9.15% Impervious Runoff Depth=4.62"
Flow Length=779' Tc=32.7 min CN=73 Runoff=6.2 cfs 35,416 cf

Subcatchment PDA-106: PDA-106 Runoff Area=22,980 sf 57.09% Impervious Runoff Depth=6.35"
Flow Length=489' Slope=0.0460 '/' Tc=7.2 min CN=88 Runoff=3.6 cfs 12,166 cf

Subcatchment PDA-200: PDA-200 Runoff Area=314,613 sf 7.19% Impervious Runoff Depth=4.50"
Flow Length=991' Tc=27.3 min CN=72 Runoff=22.5 cfs 118,031 cf

Subcatchment PDA-201: Subcat PDA-201 Runoff Area=15,861 sf 17.40% Impervious Runoff Depth=5.19"
Tc=6.0 min CN=78 Runoff=2.2 cfs 6,857 cf

Subcatchment PDA-202: Subcat PDA-202 Runoff Area=110,630 sf 0.01% Impervious Runoff Depth=4.39"
Flow Length=838' Tc=32.0 min CN=71 Runoff=7.2 cfs 40,460 cf

Subcatchment RF-02: RF-02 Runoff Area=3,116 sf 100.00% Impervious Runoff Depth=7.54"
Tc=0.0 min CN=98 Runoff=0.7 cfs 1,958 cf

Subcatchment RF-03: RF-03 Runoff Area=1,685 sf 100.00% Impervious Runoff Depth=7.54"
Tc=0.0 min CN=98 Runoff=0.4 cfs 1,059 cf

Subcatchment RF-04: RF-04 Runoff Area=3,116 sf 100.00% Impervious Runoff Depth=7.54"
Tc=0.0 min CN=98 Runoff=0.7 cfs 1,958 cf

Subcatchment RF-05: RF-05 Runoff Area=3,116 sf 100.00% Impervious Runoff Depth=7.54"
Tc=0.0 min CN=98 Runoff=0.7 cfs 1,958 cf

Subcatchment RF-06: RF-06 Runoff Area=3,116 sf 100.00% Impervious Runoff Depth=7.54"
Tc=0.0 min CN=98 Runoff=0.7 cfs 1,958 cf

Pond 1P: Pond Peak Elev=320.65' Storage=297 cf Inflow=14.7 cfs 79,793 cf
Outflow=14.7 cfs 79,793 cf

Pond INF-103: INF-103 Peak Elev=327.52' Storage=390 cf Inflow=3.3 cfs 10,509 cf
Discarded=0.0 cfs 334 cf Primary=3.2 cfs 10,175 cf Outflow=3.2 cfs 10,509 cf

Pond INF-104: INF-104 Peak Elev=327.87' Storage=3,454 cf Inflow=9.9 cfs 54,026 cf
Discarded=0.1 cfs 9,407 cf Primary=9.7 cfs 44,619 cf Outflow=9.8 cfs 54,026 cf

Pond INF-105: INF-105 Peak Elev=349.83' Storage=3,519 cf Inflow=6.2 cfs 35,416 cf
Discarded=0.1 cfs 4,795 cf Primary=5.9 cfs 30,621 cf Outflow=5.9 cfs 35,416 cf

Pond INF-106: INF-106 Peak Elev=357.39' Storage=3,979 cf Inflow=3.6 cfs 12,166 cf
Discarded=0.0 cfs 5,745 cf Primary=2.4 cfs 6,422 cf Outflow=2.4 cfs 12,166 cf

Pond INF-201: INF-201 Peak Elev=339.36' Storage=4,489 cf Inflow=7.8 cfs 47,317 cf
Discarded=0.1 cfs 9,708 cf Primary=7.5 cfs 37,609 cf Outflow=7.7 cfs 47,317 cf

Pond INF-RF2: INF-RF2 Peak Elev=335.94' Storage=133 cf Inflow=0.7 cfs 1,958 cf
Discarded=0.0 cfs 601 cf Primary=0.6 cfs 1,357 cf Outflow=0.6 cfs 1,958 cf

Pond INF-RF3: INF-RF3 Peak Elev=333.76' Storage=120 cf Inflow=0.4 cfs 1,059 cf
Discarded=0.0 cfs 499 cf Primary=0.3 cfs 560 cf Outflow=0.3 cfs 1,059 cf

Pond INF-RF4: INF-RF4 Peak Elev=367.94' Storage=133 cf Inflow=0.7 cfs 1,958 cf
Discarded=0.0 cfs 601 cf Primary=0.6 cfs 1,357 cf Outflow=0.6 cfs 1,958 cf

Pond INF-RF5: INF-RF5 Peak Elev=377.94' Storage=133 cf Inflow=0.7 cfs 1,958 cf
Discarded=0.0 cfs 601 cf Primary=0.6 cfs 1,357 cf Outflow=0.6 cfs 1,958 cf

Pond INF-RF6: INF-RF6 Peak Elev=377.94' Storage=133 cf Inflow=0.7 cfs 1,958 cf
Discarded=0.0 cfs 601 cf Primary=0.6 cfs 1,357 cf Outflow=0.6 cfs 1,958 cf

Link DP-1: DESIGN POINT 1 Inflow=15.8 cfs 85,255 cf
Primary=15.8 cfs 85,255 cf

Link DP-2: DESIGN POINT 2 Inflow=29.7 cfs 155,640 cf
Primary=29.7 cfs 155,640 cf

Total Runoff Area = 754,285 sf Runoff Volume = 279,775 cf Average Runoff Depth = 4.45"
89.36% Pervious = 673,994 sf 10.64% Impervious = 80,291 sf

Summary for Subcatchment PDA-100: PDA-100

Runoff = 1.4 cfs @ 12.11 hrs, Volume= 5,462 cf, Depth= 1.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.78"

Area (sf)	CN	Description
1,794	98	Paved parking, HSG A
37,895	39	>75% Grass cover, Good, HSG A
395	70	Woods, Good, HSG C
2,795	74	>75% Grass cover, Good, HSG C
88	98	Paved parking, HSG D
42,967	44	Weighted Average
41,085		95.62% Pervious Area
1,882		4.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PDA-101: PDA-101

Runoff = 0.7 cfs @ 12.09 hrs, Volume= 2,174 cf, Depth= 3.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.78"

Area (sf)	CN	Description
5,156	39	>75% Grass cover, Good, HSG A
2,334	98	Paved parking, HSG A
235	74	>75% Grass cover, Good, HSG C
506	98	Paved parking, HSG C
8,231	60	Weighted Average
5,391		65.50% Pervious Area
2,840		34.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PDA-102: PDA-102

Runoff = 6.5 cfs @ 12.14 hrs, Volume= 22,825 cf, Depth= 4.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.78"

Area (sf)	CN	Description
11,117	39	>75% Grass cover, Good, HSG A
3,051	98	Paved parking, HSG A
19,777	70	Woods, Good, HSG C
25,414	74	>75% Grass cover, Good, HSG C
2,188	98	Paved parking, HSG C
2,272	98	Roofs, HSG C
173	80	>75% Grass cover, Good, HSG D
66	98	Paved parking, HSG D
64,057	70	Weighted Average
56,481		88.17% Pervious Area
7,576		11.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	100	0.1840	0.41		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.6	135	0.0770	1.39		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	208	0.0240	0.82	4.10	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.200
9.8	443	Total			

Summary for Subcatchment PDA-103: PDA-103

Runoff = 1.3 cfs @ 12.08 hrs, Volume= 4,087 cf, Depth= 6.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.78"

Area (sf)	CN	Description
3,753	74	>75% Grass cover, Good, HSG C
4,113	98	Paved parking, HSG C
0	70	Woods, Good, HSG C
7,866	87	Weighted Average
3,753		47.71% Pervious Area
4,113		52.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	368	0.0720	1.42	7.10	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.200
4.3	368	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PDA-104: PDA-104

Runoff = 4.5 cfs @ 12.37 hrs, Volume= 23,405 cf, Depth= 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.78"

Area (sf)	CN	Description
19,407	74	>75% Grass cover, Good, HSG C
38,640	70	Woods, Good, HSG C
2,804	98	Paved parking, HSG C
60,851	73	Weighted Average
58,047		95.39% Pervious Area
2,804		4.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.0	100	0.0310	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
6.4	583	0.0911	1.51		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.8	233	0.0708	1.41	7.04	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.200
27.2	916	Total			

Summary for Subcatchment PDA-105: PDA-105

Runoff = 6.2 cfs @ 12.46 hrs, Volume= 35,416 cf, Depth= 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.78"

Area (sf)	CN	Description
65,985	70	Woods, Good, HSG C
8,422	98	Paved parking, HSG C
17,673	74	>75% Grass cover, Good, HSG C
92,080	73	Weighted Average
83,658		90.85% Pervious Area
8,422		9.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.8	100	0.0140	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
3.5	309	0.0883	1.49		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.4	370	0.0700	1.40	7.00	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.200
32.7	779	Total			

Summary for Subcatchment PDA-106: PDA-106

Runoff = 3.6 cfs @ 12.10 hrs, Volume= 12,166 cf, Depth= 6.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.78"

Area (sf)	CN	Description
9,097	74	>75% Grass cover, Good, HSG C
13,120	98	Paved parking, HSG C
763	70	Woods, Good, HSG C
22,980	88	Weighted Average
9,860		42.91% Pervious Area
13,120		57.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	489	0.0460	1.13	5.67	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.200

Summary for Subcatchment PDA-200: PDA-200

Runoff = 22.5 cfs @ 12.38 hrs, Volume= 118,031 cf, Depth= 4.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.78"

Area (sf)	CN	Description
25,377	55	Woods, Good, HSG B
36,942	74	>75% Grass cover, Good, HSG C
191,740	70	Woods, Good, HSG C
3,065	39	>75% Grass cover, Good, HSG A
1,377	98	Paved parking, HSG A
295	98	Roofs, HSG C
3,073	98	Paved parking, HSG C
11,813	98	Water Surface, HSG C
5,791	98	Water Surface, HSG D
266	98	Paved parking, HSG D
25,648	77	Woods, Good, HSG D
9,226	80	>75% Grass cover, Good, HSG D
314,613	72	Weighted Average
291,998		92.81% Pervious Area
22,615		7.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.0	100	0.0270	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
2.6	183	0.0567	1.19		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.7	708	0.0889	2.09		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
27.3	991	Total			

Summary for Subcatchment PDA-201: Subcat PDA-201

Runoff = 2.2 cfs @ 12.09 hrs, Volume= 6,857 cf, Depth= 5.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.78"

Area (sf)	CN	Description
12,163	74	>75% Grass cover, Good, HSG C
938	70	Woods, Good, HSG C
2,760	98	Paved parking, HSG C
15,861	78	Weighted Average
13,101		82.60% Pervious Area
2,760		17.40% Impervious Area

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

Summary for Subcatchment PDA-202: Subcat PDA-202

Runoff = 7.2 cfs @ 12.44 hrs, Volume= 40,460 cf, Depth= 4.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.78"

Area (sf)	CN	Description
41,066	74	>75% Grass cover, Good, HSG C
10	98	Paved parking, HSG C
69,554	70	Woods, Good, HSG C
110,630	71	Weighted Average
110,620		99.99% Pervious Area
10		0.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.9	100	0.0191	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
8.1	266	0.0480	0.55		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.6	169	0.0650	1.78		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	303	0.0460	11.34	56.72	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.020
32.0	838	Total			

Summary for Subcatchment RF-02: RF-02

Runoff = 0.7 cfs @ 12.00 hrs, Volume= 1,958 cf, Depth= 7.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.78"

Area (sf)	CN	Description
3,116	98	Roofs, HSG C
3,116		100.00% Impervious Area

Summary for Subcatchment RF-03: RF-03

Runoff = 0.4 cfs @ 12.00 hrs, Volume= 1,059 cf, Depth= 7.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.78"

Area (sf)	CN	Description
1,685	98	Roofs, HSG C
1,685		100.00% Impervious Area

Summary for Subcatchment RF-04: RF-04

Runoff = 0.7 cfs @ 12.00 hrs, Volume= 1,958 cf, Depth= 7.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.78"

Area (sf)	CN	Description
3,116	98	Roofs, HSG C
3,116		100.00% Impervious Area

Summary for Subcatchment RF-05: RF-05

Runoff = 0.7 cfs @ 12.00 hrs, Volume= 1,958 cf, Depth= 7.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.78"

Area (sf)	CN	Description
3,116	98	Roofs, HSG C
3,116		100.00% Impervious Area

Summary for Subcatchment RF-06: RF-06

Runoff = 0.7 cfs @ 12.00 hrs, Volume= 1,958 cf, Depth= 7.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.78"

Area (sf)	CN	Description
3,116	98	Roofs, HSG C
3,116		100.00% Impervious Area

Summary for Pond 1P: Pond

Inflow Area = 256,065 sf, 15.18% Impervious, Inflow Depth = 3.74" for 100-year event
Inflow = 14.7 cfs @ 12.18 hrs, Volume= 79,793 cf
Outflow = 14.7 cfs @ 12.18 hrs, Volume= 79,793 cf, Atten= 0%, Lag= 0.3 min
Primary = 14.7 cfs @ 12.18 hrs, Volume= 79,793 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 320.65' @ 12.18 hrs Surf.Area= 642 sf Storage= 297 cf

Plug-Flow detention time= 0.7 min calculated for 79,793 cf (100% of inflow)

Center-of-Mass det. time= 0.5 min (825.3 - 824.8)

Volume	Invert	Avail.Storage	Storage Description
#1	320.00'	1,892 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
320.00	269	0	0
321.00	841	555	555
322.00	1,833	1,337	1,892

Device	Routing	Invert	Outlet Devices
#1	Primary	320.20'	**8.0" Round Culvert** L= 15.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 320.20' / 320.00' S= 0.0133 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf
#2	Primary	320.00'	**10.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=14.7 cfs @ 12.18 hrs HW=320.65' TW=0.00' (Dynamic Tailwater)
↑ **1=Culvert** (Inlet Controls 0.5 cfs @ 1.81 fps)
└ **2=Broad-Crested Rectangular Weir** (Weir Controls 14.2 cfs @ 2.18 fps)

Summary for Pond INF-103: INF-103

Inflow Area =	30,846 sf,	55.87% Impervious,	Inflow Depth =	4.09" for 100-year event
Inflow =	3.3 cfs @	12.14 hrs, Volume=	10,509 cf	
Outflow =	3.2 cfs @	12.17 hrs, Volume=	10,509 cf,	Atten= 2%, Lag= 1.8 min
Discarded =	0.0 cfs @	5.59 hrs, Volume=	334 cf	
Primary =	3.2 cfs @	12.17 hrs, Volume=	10,175 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 327.52' @ 12.17 hrs Surf.Area= 473 sf Storage= 390 cf

Plug-Flow detention time= 17.6 min calculated for 10,508 cf (100% of inflow)
Center-of-Mass det. time= 17.7 min (812.4 - 794.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	326.00'	310 cf	**12.42'W x 38.07'L x 2.00'H Field A** 945 cf Overall - 171 cf Embedded = 774 cf x 40.0% Voids
#2A	326.50'	171 cf	**ADS_StormTech SC-160LP +Cap** x 25 Inside #1 Effective Size= 18.0"W x 12.0"H => 0.96 sf x 7.12'L = 6.8 cf Overall Size= 25.0"W x 12.0"H x 7.56'L with 0.44' Overlap 25 Chambers in 5 Rows
		481 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	326.56'	**6.0" Vert. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#2	Discarded	326.00'	**0.276 in/hr Exfiltration - Loamy Sand over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 5.59 hrs HW=326.02' (Free Discharge)
↑—**2=Exfiltration - Loamy Sand** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=3.2 cfs @ 12.17 hrs HW=327.52' TW=320.65' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 3.2 cfs @ 4.06 fps)

Summary for Pond INF-104: INF-104

Inflow Area = 152,931 sf, 7.34% Impervious, Inflow Depth = 4.24" for 100-year event
Inflow = 9.9 cfs @ 12.47 hrs, Volume= 54,026 cf
Outflow = 9.8 cfs @ 12.50 hrs, Volume= 54,026 cf, Atten= 1%, Lag= 2.2 min
Discarded = 0.1 cfs @ 10.45 hrs, Volume= 9,407 cf
Primary = 9.7 cfs @ 12.50 hrs, Volume= 44,619 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 327.87' @ 12.50 hrs Surf.Area= 1,889 sf Storage= 3,454 cf

Plug-Flow detention time= 36.7 min calculated for 54,021 cf (100% of inflow)
Center-of-Mass det. time= 36.7 min (880.4 - 843.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	325.10'	1,726 cf	**25.25'W x 74.82'L x 3.50'H Field A** 6,612 cf Overall - 2,297 cf Embedded = 4,315 cf x 40.0% Voids
#2A	325.60'	2,297 cf	**ADS_StormTech SC-740 +Cap** x 50 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 50 Chambers in 5 Rows
		4,023 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	326.64'	**12.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Discarded	325.10'	**3.072 in/hr Exfiltration - Loamy Sand over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 10.45 hrs HW=325.14' (Free Discharge)
↑—**2=Exfiltration - Loamy Sand** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=9.7 cfs @ 12.50 hrs HW=327.87' TW=320.62' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 9.7 cfs @ 4.10 fps)

Summary for Pond INF-105: INF-105

Inflow Area = 92,080 sf, 9.15% Impervious, Inflow Depth = 4.62" for 100-year event
Inflow = 6.2 cfs @ 12.46 hrs, Volume= 35,416 cf
Outflow = 5.9 cfs @ 12.55 hrs, Volume= 35,416 cf, Atten= 5%, Lag= 5.3 min
Discarded = 0.1 cfs @ 9.13 hrs, Volume= 4,795 cf
Primary = 5.9 cfs @ 12.55 hrs, Volume= 30,621 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 349.83' @ 12.55 hrs Surf.Area= 1,709 sf Storage= 3,519 cf

Plug-Flow detention time= 62.1 min calculated for 35,413 cf (100% of inflow)
Center-of-Mass det. time= 62.2 min (906.6 - 844.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	346.50'	1,566 cf	**25.25'W x 67.70'L x 3.50'H Field A** 5,983 cf Overall - 2,067 cf Embedded = 3,915 cf x 40.0% Voids
#2A	347.00'	2,067 cf	**ADS_StormTech SC-740 +Cap** x 45 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 45 Chambers in 5 Rows
		3,633 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	348.04'	**6.0" Vert. Orifice/Grate X 5.00** C= 0.600 Limited to weir flow at low heads
#2	Discarded	346.50'	**1.284 in/hr Exfiltration - Sandy Loam over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 9.13 hrs HW=346.54' (Free Discharge)
↑—**2=Exfiltration - Sandy Loam** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=5.9 cfs @ 12.55 hrs HW=349.83' TW=327.85' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 5.9 cfs @ 5.98 fps)

Summary for Pond INF-106: INF-106

Inflow Area = 22,980 sf, 57.09% Impervious, Inflow Depth = 6.35" for 100-year event
Inflow = 3.6 cfs @ 12.10 hrs, Volume= 12,166 cf
Outflow = 2.4 cfs @ 12.19 hrs, Volume= 12,166 cf, Atten= 32%, Lag= 5.6 min
Discarded = 0.0 cfs @ 8.17 hrs, Volume= 5,745 cf
Primary = 2.4 cfs @ 12.19 hrs, Volume= 6,422 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 357.39' @ 12.19 hrs Surf.Area= 1,016 sf Storage= 3,979 cf

Plug-Flow detention time= 349.4 min calculated for 12,165 cf (100% of inflow)
Center-of-Mass det. time= 349.5 min (1,133.6 - 784.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	351.25'	1,753 cf	**28.50'W x 35.64'L x 6.75'H Field A** 6,857 cf Overall - 2,473 cf Embedded = 4,383 cf x 40.0% Voids
#2A	352.00'	2,473 cf	**ADS_StormTech MC-4500 b +Cap** x 21 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 21 Chambers in 3 Rows Cap Storage= +39.5 cf x 2 x 3 rows = 237.0 cf
		4,227 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	355.55'	**6.0" Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#2	Discarded	351.25'	**1.758 in/hr Exfiltration - Sandy Loam over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 8.17 hrs HW=351.32' (Free Discharge)
↑—**2=Exfiltration - Sandy Loam** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=2.4 cfs @ 12.19 hrs HW=357.39' TW=327.51' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 2.4 cfs @ 6.07 fps)

Summary for Pond INF-201: INF-201

Inflow Area = 126,491 sf, 2.19% Impervious, Inflow Depth = 4.49" for 100-year event
Inflow = 7.8 cfs @ 12.41 hrs, Volume= 47,317 cf
Outflow = 7.7 cfs @ 12.48 hrs, Volume= 47,317 cf, Atten= 2%, Lag= 4.1 min
Discarded = 0.1 cfs @ 9.58 hrs, Volume= 9,708 cf
Primary = 7.5 cfs @ 12.48 hrs, Volume= 37,609 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 339.36' @ 12.48 hrs Surf.Area= 2,245 sf Storage= 4,489 cf

Plug-Flow detention time= 67.5 min calculated for 47,312 cf (100% of inflow)
Center-of-Mass det. time= 67.6 min (909.9 - 842.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	336.20'	2,040 cf	**30.00'W x 74.82'L x 3.50'H Field A** 7,856 cf Overall - 2,756 cf Embedded = 5,099 cf x 40.0% Voids
#2A	336.70'	2,756 cf	**ADS_StormTech SC-740 +Cap** x 60 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 60 Chambers in 6 Rows
		4,796 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	338.08'	**8.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#2	Primary	338.24'	**6.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#3	Discarded	336.20'	**2.262 in/hr Exfiltration - Sandy Loam over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 9.58 hrs HW=336.24' (Free Discharge)
└**3=Exfiltration - Sandy Loam** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=7.5 cfs @ 12.48 hrs HW=339.36' TW=0.00' (Dynamic Tailwater)
├**1=Orifice/Grate** (Orifice Controls 4.9 cfs @ 4.68 fps)
└**2=Orifice/Grate** (Orifice Controls 2.6 cfs @ 4.49 fps)

Summary for Pond INF-RF2: INF-RF2

Inflow Area = 3,116 sf,100.00% Impervious, Inflow Depth = 7.54" for 100-year event
Inflow = 0.7 cfs @ 12.00 hrs, Volume= 1,958 cf
Outflow = 0.6 cfs @ 12.01 hrs, Volume= 1,958 cf, Atten= 4%, Lag= 0.6 min
Discarded = 0.0 cfs @ 5.21 hrs, Volume= 601 cf
Primary = 0.6 cfs @ 12.01 hrs, Volume= 1,357 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 335.94' @ 12.01 hrs Surf.Area= 118 sf Storage= 133 cf

Plug-Flow detention time= 51.4 min calculated for 1,958 cf (100% of inflow)
Center-of-Mass det. time= 51.4 min (787.4 - 736.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	334.00'	129 cf	**11.00'W x 10.74'L x 3.50'H Field A** 413 cf Overall - 92 cf Embedded = 321 cf x 40.0% Voids
#2A	334.50'	92 cf	**ADS_StormTech SC-740 +Cap** x 2 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 2 Chambers in 2 Rows
		220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	334.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	335.38'	**8.0" Round Culvert** L= 52.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 335.38' / 333.00' S= 0.0458 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 5.21 hrs HW=334.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.6 cfs @ 12.01 hrs HW=335.94' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.6 cfs @ 2.01 fps)

Summary for Pond INF-RF3: INF-RF3

Inflow Area = 1,685 sf,100.00% Impervious, Inflow Depth = 7.54" for 100-year event
Inflow = 0.4 cfs @ 12.00 hrs, Volume= 1,059 cf
Outflow = 0.3 cfs @ 12.01 hrs, Volume= 1,059 cf, Atten= 5%, Lag= 0.7 min
Discarded = 0.0 cfs @ 8.01 hrs, Volume= 499 cf
Primary = 0.3 cfs @ 12.01 hrs, Volume= 560 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 333.76' @ 12.01 hrs Surf.Area= 118 sf Storage= 120 cf

Plug-Flow detention time= 64.2 min calculated for 1,059 cf (100% of inflow)
Center-of-Mass det. time= 64.2 min (800.2 - 736.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	332.00'	129 cf	**11.00'W x 10.74'L x 3.50'H Field A** 413 cf Overall - 92 cf Embedded = 321 cf x 40.0% Voids
#2A	332.50'	92 cf	**ADS_StormTech SC-740 +Cap** x 2 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 2 Chambers in 2 Rows
		220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	332.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	333.38'	**8.0" Round Culvert** L= 57.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 333.38' / 331.00' S= 0.0418 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 8.01 hrs HW=332.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.3 cfs @ 12.01 hrs HW=333.76' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.3 cfs @ 1.65 fps)

Summary for Pond INF-RF4: INF-RF4

Inflow Area = 3,116 sf,100.00% Impervious, Inflow Depth = 7.54" for 100-year event
Inflow = 0.7 cfs @ 12.00 hrs, Volume= 1,958 cf
Outflow = 0.6 cfs @ 12.01 hrs, Volume= 1,958 cf, Atten= 4%, Lag= 0.6 min
Discarded = 0.0 cfs @ 5.21 hrs, Volume= 601 cf
Primary = 0.6 cfs @ 12.01 hrs, Volume= 1,357 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 367.94' @ 12.01 hrs Surf.Area= 118 sf Storage= 133 cf

Plug-Flow detention time= 51.4 min calculated for 1,958 cf (100% of inflow)
Center-of-Mass det. time= 51.4 min (787.4 - 736.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	366.00'	129 cf	**11.00'W x 10.74'L x 3.50'H Field A** 413 cf Overall - 92 cf Embedded = 321 cf x 40.0% Voids
#2A	366.50'	92 cf	**ADS_StormTech SC-740 +Cap** x 2 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 2 Chambers in 2 Rows
		220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	366.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	367.38'	**8.0" Round Culvert** L= 37.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 367.38' / 366.00' S= 0.0373 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 5.21 hrs HW=366.04' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.6 cfs @ 12.01 hrs HW=367.94' (Free Discharge)
2=Culvert (Inlet Controls 0.6 cfs @ 2.01 fps)

Summary for Pond INF-RF5: INF-RF5

Inflow Area = 3,116 sf,100.00% Impervious, Inflow Depth = 7.54" for 100-year event
Inflow = 0.7 cfs @ 12.00 hrs, Volume= 1,958 cf
Outflow = 0.6 cfs @ 12.01 hrs, Volume= 1,958 cf, Atten= 4%, Lag= 0.6 min
Discarded = 0.0 cfs @ 5.21 hrs, Volume= 601 cf
Primary = 0.6 cfs @ 12.01 hrs, Volume= 1,357 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 377.94' @ 12.01 hrs Surf.Area= 118 sf Storage= 133 cf

Plug-Flow detention time= 51.4 min calculated for 1,958 cf (100% of inflow)

Center-of-Mass det. time= 51.4 min (787.4 - 736.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	376.00'	129 cf	**11.00'W x 10.74'L x 3.50'H Field A** 413 cf Overall - 92 cf Embedded = 321 cf x 40.0% Voids
#2A	376.50'	92 cf	**ADS_StormTech SC-740 +Cap** x 2 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 2 Chambers in 2 Rows
		220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	377.38'	**8.0" Round Culvert** L= 16.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 377.38' / 376.00' S= 0.0862 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf
#2	Discarded	376.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 5.21 hrs HW=376.04' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.6 cfs @ 12.01 hrs HW=377.94' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 0.6 cfs @ 2.01 fps)

Summary for Pond INF-RF6: INF-RF6

Inflow Area = 3,116 sf,100.00% Impervious, Inflow Depth = 7.54" for 100-year event
Inflow = 0.7 cfs @ 12.00 hrs, Volume= 1,958 cf
Outflow = 0.6 cfs @ 12.01 hrs, Volume= 1,958 cf, Atten= 4%, Lag= 0.6 min
Discarded = 0.0 cfs @ 5.21 hrs, Volume= 601 cf
Primary = 0.6 cfs @ 12.01 hrs, Volume= 1,357 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 377.94' @ 12.01 hrs Surf.Area= 118 sf Storage= 133 cf

Plug-Flow detention time= 51.4 min calculated for 1,958 cf (100% of inflow)
Center-of-Mass det. time= 51.4 min (787.4 - 736.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	376.00'	129 cf	**11.00'W x 10.74'L x 3.50'H Field A** 413 cf Overall - 92 cf Embedded = 321 cf x 40.0% Voids
#2A	376.50'	92 cf	**ADS_StormTech SC-740 +Cap** x 2 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 2 Chambers in 2 Rows
		220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	377.38'	**8.0" Round Culvert** L= 58.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 377.38' / 376.00' S= 0.0238 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf
#2	Discarded	376.00'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 5.21 hrs HW=376.04' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.6 cfs @ 12.01 hrs HW=377.94' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 0.6 cfs @ 2.01 fps)

Summary for Link DP-1: DESIGN POINT 1

Inflow Area = 299,032 sf, 13.63% Impervious, Inflow Depth = 3.42" for 100-year event
Inflow = 15.8 cfs @ 12.17 hrs, Volume= 85,255 cf
Primary = 15.8 cfs @ 12.17 hrs, Volume= 85,255 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Summary for Link DP-2: DESIGN POINT 2

Inflow Area = 441,104 sf, 5.75% Impervious, Inflow Depth = 4.23" for 100-year event
Inflow = 29.7 cfs @ 12.40 hrs, Volume= 155,640 cf
Primary = 29.7 cfs @ 12.40 hrs, Volume= 155,640 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

APPENDICES

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

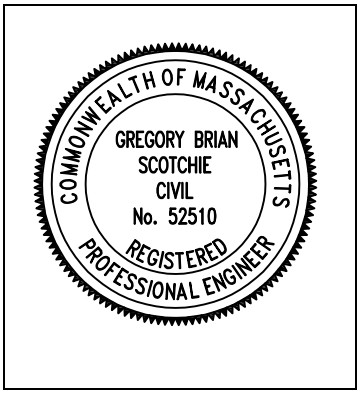
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



4/14/2021
Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

☐ No disturbance to any Wetland Resource Areas

☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☒ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☒ Grass Channel

☐ Green Roof

☒ Other (describe): Infiltration Basins, oil-grit seperators

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

---

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

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

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☒ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☐ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Stormwater Management System
Operation and Maintenance Plan
Long Term Pollution Prevention Plan

85 & 95 West Street
Northborough, MA

April 2021

PREPARED FOR:

Brant L. Viner & Margaret Harling
P.O. Box 295
Ellsworth, ME 04605

RESPONSIBILITY:

The applicant, or assigns will be responsible for implementation of the Operation and Maintenance Plan and Long Term Pollution Prevention Plan for the stormwater management system of a common driveway and associated infrastructure for five single family lots at 85 & 95 West Street and for any corrective action required.

A detailed, written log of all scheduled preventative and corrective maintenance performed for the stormwater management measures must be kept on site, including a record of all inspections and copies of maintenance-related work orders.

Attachment 1, "Inspection and Maintenance Check List" shall be maintained as a record of regularly scheduled inspection and maintenance items as outlined below for every year. Maintenance required and actions taken shall be recorded in Attachment 2, "Inspection and Maintenance Log". The funding, operation, and maintenance of all stormwater management Best Management Practices (BMPs) shall be provided by the Owner, or their appointee.

Maintenance routine and schedule: Routine inspections will be conducted on a monthly basis and thorough investigations will be conducted twice a year. Tasks that are common to all systems include regular removal of accumulated sediments, floatables and debris. Inspections will occur after every major storm event for the first six (6) months after construction. Inspections will be conducted by a qualified person experienced in drainage design and stormwater management systems. Annual notification to the Town Engineer before any maintenance work is performed is required and the Town Engineer shall be afforded the opportunity to inspect the work. Annual reports will be prepared detailing the status of the stormwater system and the maintenance performed. The Town Engineer shall be provided copies of the contract and invoices for all work performed. All material removed from the drainage system shall be properly disposed of off-site. A copy of the annual report will be sent to the Town of Northborough, if requested.

SITE CONDITIONS:

The stormwater management system for the site includes deep-sump, hooded catch basins; closed drainage system (pipe and manholes); stormwater treatment units (proprietary structures); surface detention basins; and subsurface infiltration systems.

DEEP SUMP CATCH BASINS:

1. Catch basins shall be inspected four (4) times per year and cleaned whenever depth of sediment is greater than twenty-four (24) inches.

2. All sediments and hydrocarbons shall be properly handled and disposed in accordance with local, state, and federal guidelines and regulations.

ALL SUBSURFACE INFILTRATION SYSTEMS: INF-103, INF-104, INF-105, INF-106, INF-201 and INF-RF2 THROUGH INF-RF6

1. At a minimum annual inspection are recommended. Initially, the system 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.

2. Inspection ports are provided to allow for observation and cleaning of subsurface facilities. These covers may be buried, requiring clearing to access the infiltration system. 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.

3. Ponded water inside the infiltration facilities after several days may indicate the bottom of the system is clogged. 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 row, clean-out should be performed.

4. Downhill slopes from infiltration areas shall be monitored weekly during construction and monthly thereafter for the first year of operation for signs of breakout. Annual inspection is to occur after the first year. Seepage from downhill slopes shall be an indication of a system failure and corrective action shall be taken.

5. Corrective action for system failure shall include removal and replacement of all stone aggregate and filter fabric. Accumulated sediment shall be removed from the trench bottom and the bottom shall be scarified or tilled to help induce infiltration.

6. Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the 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.

7. Inspect isolator row for sediment
   A. Inspection ports
      1. Remove/open lid on inline drain
      2. Remove and clean filter if installed
      3. Using a flashlight and stadia rod, measure depth of sediment and record on maintenance log
      4. Lower a camera into isolator row plus for visual inspection of sediment levels (optional)
      5. If sediment is at, or above, 3" (80 mm) proceed to step 2. If not, proceed to step 8.
   B. All isolator rows
      1. Remove cover from structure at upstream end of isolator row
      2. Using a flashlight, inspect down the isolator row plus through outlet pipe mirrors on poles or cameras may be used to avoid a confined space entry follow osha regulations for confined space entry if entering manhole
      3. If sediment is at, or above, 3" (80 mm) proceed to step 2. If not, proceed to step 3.

8. Clean out isolator row using the jetvac process
   C. A fixed culvert cleaning nozzle with rear facing spread of 45" (1.1 m) or more is preferred
   D. Apply multiple passes of jetvac until backflush water is clean
   E. Vacuum structure sump as required

9. Replace all covers, grates, filters, and lids; record observations and actions.

10. Inspect and clean basins and manholes upstream of the system.

EXTENDED DRY DETENTION BASIN:

1. The detention basin is to utilized as a temporary sediment trap during construction. Prior to permanent stabilization the basin is to be cleared to six (6") inches below finished grade and topped with clean loam. The basin(s) shall be inspected for accumulated sediment at least twice per year and sediment shall be removed when depth is 12 inches or at least once every 10 years.

2. Basins shall be inspected at least twice per year and immediately following large storm events to determine if the basin is functioning as intended. Inspections should be conducted during wet weather to determine if the basin is meeting the targeted detention times (24-hour average detention time; 72-hour drawdown). The basins shall be checked for slope integrity, soil moisture, vegetative health, soil stability, soil compaction, soil erosion, ponding, and sedimentation. Any necessary repairs shall be made immediately.

3. During the first few months following construction, the basin shall be inspected to ensure that the proposed vegetation becomes adequately established.

4. At least twice during the growing season, the basin, side slopes, and embankments shall be mowed and any accumulated trash and debris removed.

5. To maintain the dense growth of herbaceous vegetation, periodic reseeding may be required.

6. Basins shall not be used for snow removal and yard waste disposal.

7. Outlet control structures, headwalls, and riprap aprons or riprap stilling basins shall be checked a minimum of once per year for evidence of clogging or flow restrictions and cleared as necessary. Any debris or accumulated sediments which could hinder flows shall be removed and disposed.

SPILL CONTAINMENT:

1. In the event of a reportable spill, the Owner or its representative shall also be responsible for closing the cut-off valve in a timely manner and notifying the appropriate authorities of the spill. In the event that spill materials enter the stormwater management basin, the Owner shall be responsible for spill removal and restoration of the basin to its original condition in accordance with all applicable local and state regulations.

2. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

LAWN/LANDSCAPE MAINTENANCE:

1. Apply fertilizers properly; at the proper time of year and at proper application rates to ensure absorption. Pesticides are to be applied by licensed applicators only.

2. Limit lawn watering: chose drought-tolerant landscaping and grasses, and use mulch and compost to retain moisture.

3. Under no circumstance shall the stormwater management system be used for yard waste and landscape debris.

DEICING:

1. The use and loading rates for application of deicing salts should be limited to the minimum required to maintain safe vehicular and pedestrian travel.

2. Alternative materials such as sand or gravel, calcium chloride, and calcium magnesium acetate should be considered in areas adjacent to stormwater management facilities and resource areas.

3. Deicing materials shall be covered to prevent loss and migration.

4. Deicing storage areas shall be located outside the 100-foot buffer zone to any wetlands or waterbodies. Ideally storage shall occur indoors.

SNOW MANAGEMENT:

1. Snow shall be stockpiled in pervious areas where it can slowly infiltrate. Under no circumstance shall the stormwater management system be used for snow storage.

2. Avoid dumping/piling snow over catch basins to prevent blockages and localized flooding of the drainage system.

3. The Owner shall be responsible to manage snow storage on-site and to ensure that snow is not stockpiled in the basin.

4. Sediments deposited from the snow storage areas shall be removed every spring.

SWEEPING OF PAVED SURFACES:

1. All paved surfaces on-site including driveways, loading areas, and parking areas shall be swept at least once annually to remove accumulations of sand, silt, leaves, and other debris.

2. Sweeping should occur in April/May after snowmelt has occurred and thaw has begun. Sweepings shall be disposed of an approved off-site location away from resource areas (wetlands or waterways) and stormwater management facilities.

Attachment 1

INSPECTION CHECKLIST 85 & 95 West Street, Northborough, MA 01532													
FOR YEAR:													
Inspection Item		Inspection Frequency*											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	Subsurface Infiltration System												
	INF-103												
	INF-104												
	INF-105												
	INF-106												
	INF-RF2												
	INF-RF3												
	INF-RF4												
	INF-RF5												
	INF-RF6												
2	Drainage Pipes and Manholes	at least every five years											
3	Deep Sump Catch Basins & Manholes	at least four times per year											

* Actual time of inspecting and maintaining items may vary. Chart shall be used to indicate frequency of events

** This chart shall be used in conjunction with the attached "Stormwater Management Operation and Maintenance Plan" and to any conditions/special conditions as outlined in any Order of Conditions issued by the Northborough Conservation Commission and/or “Declaration of Easements, Covenants, Conditions and Restrictions” document.

Attachment 1

MAINTENANCE CHECKLIST - 85 & 95 West Street, Northborough, MA 01532													
FOR YEAR:													
Maintenance Item		Maintenance Item											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	INF-103												
	INF-104												
	INF-105												
	INF-106												
	INF-RF2												
	INF-RF3												
	INF-RF4												
	INF-RF5												
	INF-RF6												
2	Drainage Pipes and Manholes	at least every five years											
3	Deep Sump Catch Basins & Manholes	at least four times per year											

* Actual time of maintaining items may vary. Chart shall be used to indicate frequency of events

** This chart shall be used in conjunction with the attached "Stormwater Management Operation and Maintenance Plan" and to any conditions/special conditions as outlined in any Order of Conditions issued by the Northborough Conservation Commission and/or “Declaration of Easements, Covenants, Conditions and Restrictions” document.

Name of Applicant: Brant L. Viner & Margaret Harling
Location: 85 & 95 West Street, Northborough, MA 01532

Inspection and Maintenance Log

Inspection No.	Date	Inspections Performed	Maintenance Action Taken
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			

Name of Applicant: Brant L. Viner & Margaret Harling
Location: 85 & 95 West Street, Northborough, MA 01532

Inspection and Maintenance Log

Inspection No.	Date	Inspections Performed	Maintenance Action Taken
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			

Calc. By: GBS Date: 14-Apr-21
Chk. By: Date:

COMMON DRIVEWAY
85 & 95 WEST STREET
Northborough, MA

Groundwater Recharge Calculations

Required Recharge Volume[1]

Rv = F x impervious area

Where: Rv = required recharge volume (acre-feet)

NRCS Hydrologic Soil Type	Approx. Soil Texture	Target Depth Factor (inches)	Impervious Area (acre)	Rv (acre-feet)	Rv (cf)
A	sand	1.00	0.16	0.014	598
B	loam	0.35	0.00	0.000	0
C	silty loam	0.25	1.16	0.024	1,049
D	clay	0.10	0.00	0.000	1
			Total =	**0.038**	**1,648**

Provided Recharge Volume[2]

Infiltration Area	Static Storage Volume (acre-feet)	Static Storage Volume (cf)
INF-103	0.0026	115
INF-104	0.0445	1,937
INF-105	0.0402	1,749
INF-106	0.0696	3,032
INF-201	0.0889	3,873
INF-RF2	0.0021	92
INF-RF3	0.0021	92
INF-RF4	0.0021	92
INF-RF5	0.0021	92
INF-RF6	0.0021	92
Pond-(1P)	0.0000	0
Total =	**0.2563**	**11,166**

Notes:
1.) Refer to Massachusetts Stormwater Handbook Volume 3, Chapter 1, page 15 dated February 2008.
2.) Provided recharge volume is based on the Static Method, refer to Massachusetts Stormwater Handbook Volume 3, Chapter 1, page 18 dated February 2008.

Calc. By: GBS Date: 14-Apr-21
Chk. By: Date:

COMMON DRIVEWAY
85 & 95 WEST STREET
Northborough, MA

Water Quality Calculations

WATER QUALITY TREATMENT VOLUME

V_{WQ} = (D_{WQ}/12 inches/foot) * (A_{IMP} * 43,560 square feet/acre)

Where: V_{WQ} = Required Water Quality Volume (in cubic feet)
D_{WQ} = Water Quality Depth
A_{IMP} = Impervious Area (in acres)

Stormwater Facility	D_{WQ} (inches)	A_{IMP} (acres)	Required V_{WQ} (ft^3)	Provided V_{WQ} (ft^3)
INF-103	0.5	0.0944	171	115
INF-104	0.5	0.0644	117	1,937
INF-105	0.5	0.1933	351	1,749
INF-106	0.5	0.3012	547	3,032
INF-201	0.5	0.0636	115	3,873
INF-RF2	0.5	0.0715	130	92
INF-RF3	0.5	0.0387	70	92
INF-RF4	0.5	0.0715	130	92
INF-RF5	0.5	0.0715	130	92
INF-RF6	0.5	0.0715	130	92
Pond-(1P)	0.5	0.2391	434	0
Total =			2,325	11,166

Notes:
1.) Refer to Massachusetts Stormwater Handbook Volume 3, Chapter 1, page 32 dated February 2008.
2.) Refer to HydroCAD® report.

Rawls Rates 4/14/2021

Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (inches/hour)
sand	A	8.27
loamy sand	A	2.41
sandy loam	B	1.02
loam	B	0.52
silt loam	C	0.27
sandy clay loam	C	0.17
clay loam	D	0.09
silty clay loam	D	0.06
sandy clay	D	0.05
silty clay	D	0.04
clay	D	0.02

Refer to Massachusetts Stormwater Handbook Volume 3, Chapter 1, page 22 dated February 2008.

Stage-Area-Storage for Pond INF-103: INF-103

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
326.00	**473**	0
326.01	473	2
326.02	473	4
326.03	473	6
326.04	473	8
326.05	473	9
326.06	473	11
326.07	473	13
326.08	473	15
326.09	473	17
326.10	473	19
326.11	473	21
326.12	473	23
326.13	473	25
326.14	473	26
326.15	473	28
326.16	473	30
326.17	473	32
326.18	473	34
326.19	473	36
326.20	473	38
326.21	473	40
326.22	473	42
326.23	473	43
326.24	473	45
326.25	473	47
326.26	473	49
326.27	473	51
326.28	473	53
326.29	473	55
326.30	473	57
326.31	473	59
326.32	473	61
326.33	473	62
326.34	473	64
326.35	473	66
326.36	473	68
326.37	473	70
326.38	473	72
326.39	473	74
326.40	473	76
326.41	473	78
326.42	473	79
326.43	473	81
326.44	473	83
326.45	473	85
326.46	473	87
326.47	473	89
326.48	473	91
326.49	473	93
326.50	473	95
326.51	473	98
326.52	473	102
326.53	473	105
326.54	473	108
326.55	473	112
326.56	473	115
326.57	473	119
326.58	473	122
326.59	473	126
326.60	473	129
326.61	473	133
326.62	473	136
326.63	473	140
326.64	473	143
326.65	473	147
326.66	473	150
326.67	473	153
326.68	473	157
326.69	473	160
326.70	473	164
326.71	473	167
326.72	473	170
326.73	473	174
326.74	473	177
326.75	473	180
326.76	473	184
326.77	473	187
326.78	473	190
326.79	473	194
326.80	473	197
326.81	473	200
326.82	473	203
326.83	473	207
326.84	473	210
326.85	473	213
326.86	473	216
326.87	473	220
326.88	473	223
326.89	473	226
326.90	473	229
326.91	473	232
326.92	473	236
326.93	473	239
326.94	473	242
326.95	473	245
326.96	473	248
326.97	473	251
326.98	473	254
326.99	473	258
327.00	473	261
327.01	473	264
327.02	473	267
327.03	473	270

Recharge Volume Provided

Stage-Area-Storage for Pond INF-104: INF-104 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
326.14	1,889	1,205	326.66	1,889	1,966
326.15	1,889	1,220	326.67	1,889	1,980
326.16	1,889	1,235	326.68	1,889	1,994
326.17	1,889	1,250	326.69	1,889	2,008
326.18	1,889	1,265	326.70	1,889	2,022
326.19	1,889	1,280	326.71	1,889	2,037
326.20	1,889	1,295	326.72	1,889	2,051
326.21	1,889	1,310	326.73	1,889	2,065
326.22	1,889	1,325	326.74	1,889	2,079
326.23	1,889	1,340	326.75	1,889	2,093
326.24	1,889	1,355	326.76	1,889	2,107
326.25	1,889	1,369	326.77	1,889	2,121
326.26	1,889	1,384	326.78	1,889	2,135
326.27	1,889	1,399	326.79	1,889	2,148
326.28	1,889	1,414	326.80	1,889	2,162
326.29	1,889	1,429	326.81	1,889	2,176
326.30	1,889	1,444	326.82	1,889	2,190
326.31	1,889	1,458	326.83	1,889	2,204
326.32	1,889	1,473	326.84	1,889	2,218
326.33	1,889	1,488	326.85	1,889	2,232
326.34	1,889	1,503	326.86	1,889	2,245
326.35	1,889	1,517	326.87	1,889	2,259
326.36	1,889	1,532	326.88	1,889	2,273
326.37	1,889	1,547	326.89	1,889	2,286
326.38	1,889	1,561	326.90	1,889	2,300
326.39	1,889	1,576	326.91	1,889	2,314
326.40	1,889	1,591	326.92	1,889	2,327
326.41	1,889	1,605	326.93	1,889	2,341
326.42	1,889	1,620	326.94	1,889	2,355
326.43	1,889	1,635	326.95	1,889	2,368
326.44	1,889	1,649	326.96	1,889	2,382
326.45	1,889	1,664	326.97	1,889	2,395
326.46	1,889	1,678	326.98	1,889	2,409
326.47	1,889	1,693	326.99	1,889	2,422
326.48	1,889	1,707	327.00	1,889	2,435
326.49	1,889	1,722	327.01	1,889	2,449
326.50	1,889	1,736	327.02	1,889	2,462
326.51	1,889	1,751	327.03	1,889	2,476
326.52	1,889	1,765	327.04	1,889	2,489
326.53	1,889	1,780	327.05	1,889	2,502
326.54	1,889	1,794	327.06	1,889	2,515
326.55	1,889	1,809	327.07	1,889	2,529
326.56	1,889	1,823	327.08	1,889	2,542
326.57	1,889	1,837	327.09	1,889	2,555
326.58	1,889	1,852	327.10	1,889	2,568
326.59	1,889	1,866	327.11	1,889	2,581
326.60	1,889	1,880	327.12	1,889	2,594
326.61	1,889	1,895	327.13	1,889	2,607
326.62	1,889	1,909	327.14	1,889	2,621
326.63	1,889	1,923	327.15	1,889	2,634
326.64	1,889	1,937	327.16	1,889	2,647
326.65	1,889	1,952	327.17	1,889	2,660

Recharge Volume Provided

Stage-Area-Storage for Pond INF-105: INF-105 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
347.54	1,709	1,088	348.06	1,709	1,775
347.55	1,709	1,102	348.07	1,709	1,788
347.56	1,709	1,115	348.08	1,709	1,801
347.57	1,709	1,129	348.09	1,709	1,813
347.58	1,709	1,142	348.10	1,709	1,826
347.59	1,709	1,156	348.11	1,709	1,839
347.60	1,709	1,169	348.12	1,709	1,851
347.61	1,709	1,183	348.13	1,709	1,864
347.62	1,709	1,196	348.14	1,709	1,877
347.63	1,709	1,210	348.15	1,709	1,889
347.64	1,709	1,223	348.16	1,709	1,902
347.65	1,709	1,237	348.17	1,709	1,915
347.66	1,709	1,250	348.18	1,709	1,927
347.67	1,709	1,263	348.19	1,709	1,940
347.68	1,709	1,277	348.20	1,709	1,952
347.69	1,709	1,290	348.21	1,709	1,965
347.70	1,709	1,304	348.22	1,709	1,977
347.71	1,709	1,317	348.23	1,709	1,990
347.72	1,709	1,330	348.24	1,709	2,002
347.73	1,709	1,344	348.25	1,709	2,015
347.74	1,709	1,357	348.26	1,709	2,027
347.75	1,709	1,370	348.27	1,709	2,040
347.76	1,709	1,383	348.28	1,709	2,052
347.77	1,709	1,397	348.29	1,709	2,064
347.78	1,709	1,410	348.30	1,709	2,077
347.79	1,709	1,423	348.31	1,709	2,089
347.80	1,709	1,436	348.32	1,709	2,101
347.81	1,709	1,450	348.33	1,709	2,114
347.82	1,709	1,463	348.34	1,709	2,126
347.83	1,709	1,476	348.35	1,709	2,138
347.84	1,709	1,489	348.36	1,709	2,150
347.85	1,709	1,502	348.37	1,709	2,162
347.86	1,709	1,516	348.38	1,709	2,175
347.87	1,709	1,529	348.39	1,709	2,187
347.88	1,709	1,542	348.40	1,709	2,199
347.89	1,709	1,555	348.41	1,709	2,211
347.90	1,709	1,568	348.42	1,709	2,223
347.91	1,709	1,581	348.43	1,709	2,235
347.92	1,709	1,594	348.44	1,709	2,247
347.93	1,709	1,607	348.45	1,709	2,259
347.94	1,709	1,620	348.46	1,709	2,271
347.95	1,709	1,633	348.47	1,709	2,283
347.96	1,709	1,646	348.48	1,709	2,295
347.97	1,709	1,659	348.49	1,709	2,307
347.98	1,709	1,672	348.50	1,709	2,319
347.99	1,709	1,685	348.51	1,709	2,331
348.00	1,709	1,698	348.52	1,709	2,342
348.01	1,709	1,711	348.53	1,709	2,354
348.02	1,709	1,724	348.54	1,709	2,366
348.03	1,709	1,736	348.55	1,709	2,378
348.04	1,709	1,749	348.56	1,709	2,389
348.05	1,709	1,762	348.57	1,709	2,401

Recharge Volume Provided

Stage-Area-Storage for Pond INF-106: INF-106 (continued)

	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
	355.41	1,016	2,939	355.93	1,016	3,275
	355.42	1,016	2,946	355.94	1,016	3,281
	355.43	1,016	2,952	355.95	1,016	3,288
	355.44	1,016	2,959	355.96	1,016	3,294
	355.45	1,016	2,966	355.97	1,016	3,300
	355.46	1,016	2,973	355.98	1,016	3,306
	355.47	1,016	2,979	355.99	1,016	3,312
	355.48	1,016	2,986	356.00	1,016	3,318
	355.49	1,016	2,993	356.01	1,016	3,324
	355.50	1,016	2,999	356.02	1,016	3,330
	355.51	1,016	3,006	356.03	1,016	3,336
	355.52	1,016	3,013	356.04	1,016	3,342
	355.53	1,016	3,019	356.05	1,016	3,348
	355.54	1,016	3,026	356.06	1,016	3,354
Recharge Volume Provided	355.55	1,016	3,032	356.07	1,016	3,360
	355.56	1,016	3,039	356.08	1,016	3,366
	355.57	1,016	3,046	356.09	1,016	3,372
	355.58	1,016	3,052	356.10	1,016	3,378
	355.59	1,016	3,059	356.11	1,016	3,384
	355.60	1,016	3,065	356.12	1,016	3,390
	355.61	1,016	3,072	356.13	1,016	3,396
	355.62	1,016	3,078	356.14	1,016	3,402
	355.63	1,016	3,085	356.15	1,016	3,407
	355.64	1,016	3,091	356.16	1,016	3,413
	355.65	1,016	3,098	356.17	1,016	3,419
	355.66	1,016	3,104	356.18	1,016	3,425
	355.67	1,016	3,111	356.19	1,016	3,431
	355.68	1,016	3,117	356.20	1,016	3,436
	355.69	1,016	3,124	356.21	1,016	3,442
	355.70	1,016	3,130	356.22	1,016	3,448
	355.71	1,016	3,137	356.23	1,016	3,454
	355.72	1,016	3,143	356.24	1,016	3,459
	355.73	1,016	3,150	356.25	1,016	3,465
	355.74	1,016	3,156	356.26	1,016	3,471
	355.75	1,016	3,162	356.27	1,016	3,476
	355.76	1,016	3,169	356.28	1,016	3,482
	355.77	1,016	3,175	356.29	1,016	3,487
	355.78	1,016	3,181	356.30	1,016	3,493
	355.79	1,016	3,188	356.31	1,016	3,499
	355.80	1,016	3,194	356.32	1,016	3,504
	355.81	1,016	3,200	356.33	1,016	3,510
	355.82	1,016	3,207	356.34	1,016	3,515
	355.83	1,016	3,213	356.35	1,016	3,521
	355.84	1,016	3,219	356.36	1,016	3,526
	355.85	1,016	3,226	356.37	1,016	3,531
	355.86	1,016	3,232	356.38	1,016	3,537
	355.87	1,016	3,238	356.39	1,016	3,542
	355.88	1,016	3,244	356.40	1,016	3,548
	355.89	1,016	3,251	356.41	1,016	3,553
	355.90	1,016	3,257	356.42	1,016	3,558
	355.91	1,016	3,263	356.43	1,016	3,563
	355.92	1,016	3,269	356.44	1,016	3,569

Stage-Area-Storage for Pond INF-201: INF-201 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	
337.24	2,245	1,437	337.76	2,245	2,345	
337.25	2,245	1,455	337.77	2,245	2,362	
337.26	2,245	1,472	337.78	2,245	2,379	
337.27	2,245	1,490	337.79	2,245	2,396	
337.28	2,245	1,508	337.80	2,245	2,413	
337.29	2,245	1,526	337.81	2,245	2,429	
337.30	2,245	1,544	337.82	2,245	2,446	
337.31	2,245	1,562	337.83	2,245	2,463	
337.32	2,245	1,580	337.84	2,245	2,480	
337.33	2,245	1,597	337.85	2,245	2,496	
337.34	2,245	1,615	337.86	2,245	2,513	
337.35	2,245	1,633	337.87	2,245	2,530	
337.36	2,245	1,651	337.88	2,245	2,546	
337.37	2,245	1,668	337.89	2,245	2,563	
337.38	2,245	1,686	337.90	2,245	2,580	
337.39	2,245	1,704	337.91	2,245	2,596	
337.40	2,245	1,722	337.92	2,245	2,613	
337.41	2,245	1,739	337.93	2,245	2,629	
337.42	2,245	1,757	337.94	2,245	2,646	
337.43	2,245	1,774	337.95	2,245	2,662	
337.44	2,245	1,792	337.96	2,245	2,679	
337.45	2,245	1,810	337.97	2,245	2,695	
337.46	2,245	1,827	337.98	2,245	2,711	
337.47	2,245	1,845	337.99	2,245	2,728	
337.48	2,245	1,862	338.00	2,245	2,744	
337.49	2,245	1,880	338.01	2,245	2,760	
337.50	2,245	1,897	338.02	2,245	2,776	
337.51	2,245	1,915	338.03	2,245	2,793	
337.52	2,245	1,932	338.04	2,245	2,809	
337.53	2,245	1,950	338.05	2,245	2,825	
337.54	2,245	1,967	338.06	2,245	2,841	
337.55	2,245	1,984	338.07	2,245	2,857	Recharge
337.56	2,245	2,002	338.08	2,245	2,873	Volume
337.57	2,245	2,019	338.09	2,245	2,889	Provided
337.58	2,245	2,037	338.10	2,245	2,905	
337.59	2,245	2,054	338.11	2,245	2,921	
337.60	2,245	2,071	338.12	2,245	2,937	
337.61	2,245	2,088	338.13	2,245	2,953	
337.62	2,245	2,106	338.14	2,245	2,969	
337.63	2,245	2,123	338.15	2,245	2,985	
337.64	2,245	2,140	338.16	2,245	3,001	
337.65	2,245	2,157	338.17	2,245	3,017	
337.66	2,245	2,174	338.18	2,245	3,032	
337.67	2,245	2,192	338.19	2,245	3,048	
337.68	2,245	2,209	338.20	2,245	3,064	
337.69	2,245	2,226	338.21	2,245	3,080	
337.70	2,245	2,243	338.22	2,245	3,095	
337.71	2,245	2,260	338.23	2,245	3,111	
337.72	2,245	2,277	338.24	2,245	3,126	
337.73	2,245	2,294	338.25	2,245	3,142	
337.74	2,245	2,311	338.26	2,245	3,157	
337.75	2,245	2,328	338.27	2,245	3,173	

Stage-Area-Storage for Pond INF-RF2: INF-RF2 (continued)

	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
	335.04	118	66
	335.05	118	67
	335.06	118	67
	335.07	118	68
	335.08	118	69
	335.09	118	70
	335.10	118	71
	335.11	118	71
	335.12	118	72
	335.13	118	73
	335.14	118	74
	335.15	118	74
	335.16	118	75
	335.17	118	76
	335.18	118	77
	335.19	118	77
	335.20	118	78
	335.21	118	79
	335.22	118	80
	335.23	118	80
	335.24	118	81
	335.25	118	82
	335.26	118	83
	335.27	118	83
	335.28	118	84
	335.29	118	85
	335.30	118	86
	335.31	118	87
	335.32	118	87
	335.33	118	88
	335.34	118	89
	335.35	118	90
	335.36	118	90
Recharge	335.37	118	91
Volume	335.38	118	92
Provided	335.39	118	93
	335.40	118	93
	335.41	118	94
	335.42	118	95
	335.43	118	96
	335.44	118	96
	335.45	118	97
	335.46	118	98
	335.47	118	99
	335.48	118	99
	335.49	118	100
	335.50	118	101
	335.51	118	101
	335.52	118	102
	335.53	118	103
	335.54	118	104
	335.55	118	104
	335.56	118	105
	335.57	118	106
	335.58	118	107
	335.59	118	107
	335.60	118	108
	335.61	118	109
	335.62	118	110
	335.63	118	110
	335.64	118	111
	335.65	118	112
	335.66	118	113
	335.67	118	113
	335.68	118	114
	335.69	118	115
	335.70	118	115
	335.71	118	116
	335.72	118	117
	335.73	118	118
	335.74	118	118
	335.75	118	119
	335.76	118	120
	335.77	118	120
	335.78	118	121
	335.79	118	122
	335.80	118	123
	335.81	118	123
	335.82	118	124
	335.83	118	125
	335.84	118	125
	335.85	118	126
	335.86	118	127
	335.87	118	128
	335.88	118	128
	335.89	118	129
	335.90	118	130
	335.91	118	130
	335.92	118	131
	335.93	118	132
	335.94	118	133
	335.95	118	133
	335.96	118	134
	335.97	118	135
	335.98	118	135
	335.99	118	136
	336.00	118	137
	336.01	118	137
	336.02	118	138
	336.03	118	139
	336.04	118	140
	336.05	118	140
	336.06	118	141
	336.07	118	142

Stage-Area-Storage for Pond INF-RF3: INF-RF3 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
333.04	118	66	333.56	118	105
333.05	118	67	333.57	118	106
333.06	118	67	333.58	118	107
333.07	118	68	333.59	118	107
333.08	118	69	333.60	118	108
333.09	118	70	333.61	118	109
333.10	118	71	333.62	118	110
333.11	118	71	333.63	118	110
333.12	118	72	333.64	118	111
333.13	118	73	333.65	118	112
333.14	118	74	333.66	118	113
333.15	118	74	333.67	118	113
333.16	118	75	333.68	118	114
333.17	118	76	333.69	118	115
333.18	118	77	333.70	118	115
333.19	118	77	333.71	118	116
333.20	118	78	333.72	118	117
333.21	118	79	333.73	118	118
333.22	118	80	333.74	118	118
333.23	118	80	333.75	118	119
333.24	118	81	333.76	118	120
333.25	118	82	333.77	118	120
333.26	118	83	333.78	118	121
333.27	118	83	333.79	118	122
333.28	118	84	333.80	118	123
333.29	118	85	333.81	118	123
333.30	118	86	333.82	118	124
333.31	118	87	333.83	118	125
333.32	118	87	333.84	118	125
333.33	118	88	333.85	118	126
333.34	118	89	333.86	118	127
333.35	118	90	333.87	118	128
333.36	118	90	333.88	118	128
Recharge 333.37	118	91	333.89	118	129
Volume 333.38	118	92	333.90	118	130
Provided 333.39	118	93	333.91	118	130
333.40	118	93	333.92	118	131
333.41	118	94	333.93	118	132
333.42	118	95	333.94	118	133
333.43	118	96	333.95	118	133
333.44	118	96	333.96	118	134
333.45	118	97	333.97	118	135
333.46	118	98	333.98	118	135
333.47	118	99	333.99	118	136
333.48	118	99	334.00	118	137
333.49	118	100	334.01	118	137
333.50	118	101	334.02	118	138
333.51	118	101	334.03	118	139
333.52	118	102	334.04	118	140
333.53	118	103	334.05	118	140
333.54	118	104	334.06	118	141
333.55	118	104	334.07	118	142

Stage-Area-Storage for Pond INF-RF4: INF-RF4 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
367.04	118	66
367.05	118	67
367.06	118	67
367.07	118	68
367.08	118	69
367.09	118	70
367.10	118	71
367.11	118	71
367.12	118	72
367.13	118	73
367.14	118	74
367.15	118	74
367.16	118	75
367.17	118	76
367.18	118	77
367.19	118	77
367.20	118	78
367.21	118	79
367.22	118	80
367.23	118	80
367.24	118	81
367.25	118	82
367.26	118	83
367.27	118	83
367.28	118	84
367.29	118	85
367.30	118	86
367.31	118	87
367.32	118	87
367.33	118	88
367.34	118	89
367.35	118	90
367.36	118	90
367.37	118	91
367.38	118	92
367.39	118	93
367.40	118	93
367.41	118	94
367.42	118	95
367.43	118	96
367.44	118	96
367.45	118	97
367.46	118	98
367.47	118	99
367.48	118	99
367.49	118	100
367.50	118	101
367.51	118	101
367.52	118	102
367.53	118	103
367.54	118	104
367.55	118	104
367.56	118	105
367.57	118	106
367.58	118	107
367.59	118	107
367.60	118	108
367.61	118	109
367.62	118	110
367.63	118	110
367.64	118	111
367.65	118	112
367.66	118	113
367.67	118	113
367.68	118	114
367.69	118	115
367.70	118	115
367.71	118	116
367.72	118	117
367.73	118	118
367.74	118	118
367.75	118	119
367.76	118	120
367.77	118	120
367.78	118	121
367.79	118	122
367.80	118	123
367.81	118	123
367.82	118	124
367.83	118	125
367.84	118	125
367.85	118	126
367.86	118	127
367.87	118	128
367.88	118	128
367.89	118	129
367.90	118	130
367.91	118	130
367.92	118	131
367.93	118	132
367.94	118	133
367.95	118	133
367.96	118	134
367.97	118	135
367.98	118	135
367.99	118	136
368.00	118	137
368.01	118	137
368.02	118	138
368.03	118	139
368.04	118	140
368.05	118	140
368.06	118	141
368.07	118	142

Recharge Volume Provided

Stage-Area-Storage for Pond INF-RF5: INF-RF5 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
377.04	118	66	377.56	118	105
377.05	118	67	377.57	118	106
377.06	118	67	377.58	118	107
377.07	118	68	377.59	118	107
377.08	118	69	377.60	118	108
377.09	118	70	377.61	118	109
377.10	118	71	377.62	118	110
377.11	118	71	377.63	118	110
377.12	118	72	377.64	118	111
377.13	118	73	377.65	118	112
377.14	118	74	377.66	118	113
377.15	118	74	377.67	118	113
377.16	118	75	377.68	118	114
377.17	118	76	377.69	118	115
377.18	118	77	377.70	118	115
377.19	118	77	377.71	118	116
377.20	118	78	377.72	118	117
377.21	118	79	377.73	118	118
377.22	118	80	377.74	118	118
377.23	118	80	377.75	118	119
377.24	118	81	377.76	118	120
377.25	118	82	377.77	118	120
377.26	118	83	377.78	118	121
377.27	118	83	377.79	118	122
377.28	118	84	377.80	118	123
377.29	118	85	377.81	118	123
377.30	118	86	377.82	118	124
377.31	118	87	377.83	118	125
377.32	118	87	377.84	118	125
377.33	118	88	377.85	118	126
377.34	118	89	377.86	118	127
377.35	118	90	377.87	118	128
377.36	118	90	377.88	118	128
377.37	118	91	377.89	118	129
377.38	118	92	377.90	118	130
377.39	118	93	377.91	118	130
377.40	118	93	377.92	118	131
377.41	118	94	377.93	118	132
377.42	118	95	377.94	118	133
377.43	118	96	377.95	118	133
377.44	118	96	377.96	118	134
377.45	118	97	377.97	118	135
377.46	118	98	377.98	118	135
377.47	118	99	377.99	118	136
377.48	118	99	378.00	118	137
377.49	118	100	378.01	118	137
377.50	118	101	378.02	118	138
377.51	118	101	378.03	118	139
377.52	118	102	378.04	118	140
377.53	118	103	378.05	118	140
377.54	118	104	378.06	118	141
377.55	118	104	378.07	118	142

Recharge Volume Provided

Stage-Area-Storage for Pond INF-RF6: INF-RF6 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
377.04	118	66
377.05	118	67
377.06	118	67
377.07	118	68
377.08	118	69
377.09	118	70
377.10	118	71
377.11	118	71
377.12	118	72
377.13	118	73
377.14	118	74
377.15	118	74
377.16	118	75
377.17	118	76
377.18	118	77
377.19	118	77
377.20	118	78
377.21	118	79
377.22	118	80
377.23	118	80
377.24	118	81
377.25	118	82
377.26	118	83
377.27	118	83
377.28	118	84
377.29	118	85
377.30	118	86
377.31	118	87
377.32	118	87
377.33	118	88
377.34	118	89
377.35	118	90
377.36	118	90
377.37	118	91
377.38	118	92
377.39	118	93
377.40	118	93
377.41	118	94
377.42	118	95
377.43	118	96
377.44	118	96
377.45	118	97
377.46	118	98
377.47	118	99
377.48	118	99
377.49	118	100
377.50	118	101
377.51	118	101
377.52	118	102
377.53	118	103
377.54	118	104
377.55	118	104
377.56	118	105
377.57	118	106
377.58	118	107
377.59	118	107
377.60	118	108
377.61	118	109
377.62	118	110
377.63	118	110
377.64	118	111
377.65	118	112
377.66	118	113
377.67	118	113
377.68	118	114
377.69	118	115
377.70	118	115
377.71	118	116
377.72	118	117
377.73	118	118
377.74	118	118
377.75	118	119
377.76	118	120
377.77	118	120
377.78	118	121
377.79	118	122
377.80	118	123
377.81	118	123
377.82	118	124
377.83	118	125
377.84	118	125
377.85	118	126
377.86	118	127
377.87	118	128
377.88	118	128
377.89	118	129
377.90	118	130
377.91	118	130
377.92	118	131
377.93	118	132
377.94	118	133
377.95	118	133
377.96	118	134
377.97	118	135
377.98	118	135
377.99	118	136
378.00	118	137
378.01	118	137
378.02	118	138
378.03	118	139
378.04	118	140
378.05	118	140
378.06	118	141
378.07	118	142

Recharge Volume Provided

Hydrograph for Pond INF-103: INF-103

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	
0.00	0.0	0	326.00	0.0	0.0	0.0	
2.00	0.0	0	326.00	0.0	0.0	0.0	
4.00	0.0	0	326.00	0.0	**0.0**	0.0	
6.00	0.0	7	326.04	0.0	**0.0**	0.0	
8.00	0.0	65	326.34	0.0	0.0	0.0	
10.00	0.0	136	326.62	0.0	0.0	0.0	
12.00	**0.8**	**201**	**326.81**	**0.7**	0.0	**0.7**	
14.00	**0.2**	**165**	**326.70**	**0.2**	0.0	**0.2**	
16.00	0.1	149	326.66	0.1	0.0	0.1	
18.00	0.1	138	326.62	0.1	0.0	0.1	
20.00	0.0	132	326.61	0.0	0.0	0.0	
22.00	0.0	128	326.60	0.0	0.0	0.0	
24.00	0.0	125	326.59	0.0	0.0	0.0	
26.00	0.0	100	326.52	0.0	0.0	0.0	
28.00	0.0	79	326.42	0.0	0.0	0.0	
30.00	0.0	57	326.30	0.0	0.0	0.0	
32.00	0.0	35	326.19	0.0	0.0	0.0	
34.00	0.0	13	326.07	0.0	0.0	0.0	
36.00	0.0	0	326.00	0.0	0.0	0.0	Drawdown Time < 72 Hours
38.00	0.0	0	326.00	0.0	0.0	0.0	
40.00	0.0	0	326.00	0.0	0.0	0.0	
42.00	0.0	0	326.00	0.0	0.0	0.0	
44.00	0.0	0	326.00	0.0	0.0	0.0	
46.00	0.0	0	326.00	0.0	0.0	0.0	
48.00	0.0	0	326.00	0.0	0.0	0.0	
50.00	0.0	0	326.00	0.0	0.0	0.0	
52.00	0.0	0	326.00	0.0	0.0	0.0	
54.00	0.0	0	326.00	0.0	0.0	0.0	
56.00	0.0	0	326.00	0.0	0.0	0.0	
58.00	0.0	0	326.00	0.0	0.0	0.0	
60.00	0.0	0	326.00	0.0	0.0	0.0	
62.00	0.0	0	326.00	0.0	0.0	0.0	
64.00	0.0	0	326.00	0.0	0.0	0.0	
66.00	0.0	0	326.00	0.0	0.0	0.0	
68.00	0.0	0	326.00	0.0	0.0	0.0	
70.00	0.0	0	326.00	0.0	0.0	0.0	
72.00	0.0	0	326.00	0.0	0.0	0.0	
74.00	0.0	0	326.00	0.0	0.0	0.0	
76.00	0.0	0	326.00	0.0	0.0	0.0	
78.00	0.0	0	326.00	0.0	0.0	0.0	
80.00	0.0	0	326.00	0.0	0.0	0.0	
82.00	0.0	0	326.00	0.0	0.0	0.0	
84.00	0.0	0	326.00	0.0	0.0	0.0	
86.00	0.0	0	326.00	0.0	0.0	0.0	
88.00	0.0	0	326.00	0.0	0.0	0.0	
90.00	0.0	0	326.00	0.0	0.0	0.0	
92.00	0.0	0	326.00	0.0	0.0	0.0	
94.00	0.0	0	326.00	0.0	0.0	0.0	
96.00	0.0	0	326.00	0.0	0.0	0.0	

Hydrograph for Pond INF-104: INF-104

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	
0.00	0.0	0	325.10	0.0	0.0	0.0	
2.00	0.0	0	325.10	0.0	0.0	0.0	
4.00	0.0	0	325.10	0.0	0.0	0.0	
6.00	0.0	0	325.10	0.0	0.0	0.0	
8.00	0.0	1	325.10	0.0	0.0	0.0	
10.00	0.1	7	325.11	0.1	**0.1**	0.0	
12.00	**2.8**	**2,456**	**327.02**	**1.8**	**0.1**	**1.7**	
14.00	**1.4**	**2,385**	**326.96**	**1.4**	0.1	**1.3**	
16.00	0.7	2,238	326.85	0.7	0.1	0.6	
18.00	0.4	2,141	326.78	0.4	0.1	0.3	
20.00	0.3	2,089	326.75	0.3	0.1	0.2	
22.00	0.2	2,057	326.72	0.2	0.1	0.1	
24.00	0.2	2,018	326.70	0.2	0.1	0.0	
26.00	0.0	1,277	326.19	0.1	0.1	0.0	
28.00	0.0	309	325.51	0.1	0.1	0.0	
30.00	0.0	0	325.10	0.0	0.0	0.0	Drawdown Time < 72 Hours
32.00	0.0	0	325.10	0.0	0.0	0.0	
34.00	0.0	0	325.10	0.0	0.0	0.0	
36.00	0.0	0	325.10	0.0	0.0	0.0	
38.00	0.0	0	325.10	0.0	0.0	0.0	
40.00	0.0	0	325.10	0.0	0.0	0.0	
42.00	0.0	0	325.10	0.0	0.0	0.0	
44.00	0.0	0	325.10	0.0	0.0	0.0	
46.00	0.0	0	325.10	0.0	0.0	0.0	
48.00	0.0	0	325.10	0.0	0.0	0.0	
50.00	0.0	0	325.10	0.0	0.0	0.0	
52.00	0.0	0	325.10	0.0	0.0	0.0	
54.00	0.0	0	325.10	0.0	0.0	0.0	
56.00	0.0	0	325.10	0.0	0.0	0.0	
58.00	0.0	0	325.10	0.0	0.0	0.0	
60.00	0.0	0	325.10	0.0	0.0	0.0	
62.00	0.0	0	325.10	0.0	0.0	0.0	
64.00	0.0	0	325.10	0.0	0.0	0.0	
66.00	0.0	0	325.10	0.0	0.0	0.0	
68.00	0.0	0	325.10	0.0	0.0	0.0	
70.00	0.0	0	325.10	0.0	0.0	0.0	
72.00	0.0	0	325.10	0.0	0.0	0.0	
74.00	0.0	0	325.10	0.0	0.0	0.0	
76.00	0.0	0	325.10	0.0	0.0	0.0	
78.00	0.0	0	325.10	0.0	0.0	0.0	
80.00	0.0	0	325.10	0.0	0.0	0.0	
82.00	0.0	0	325.10	0.0	0.0	0.0	
84.00	0.0	0	325.10	0.0	0.0	0.0	
86.00	0.0	0	325.10	0.0	0.0	0.0	
88.00	0.0	0	325.10	0.0	0.0	0.0	
90.00	0.0	0	325.10	0.0	0.0	0.0	
92.00	0.0	0	325.10	0.0	0.0	0.0	
94.00	0.0	0	325.10	0.0	0.0	0.0	
96.00	0.0	0	325.10	0.0	0.0	0.0	

Hydrograph for Pond INF-105: INF-105

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	
0.00	0.0	0	346.50	0.0	0.0	0.0	
2.00	0.0	0	346.50	0.0	0.0	0.0	
4.00	0.0	0	346.50	0.0	0.0	0.0	
6.00	0.0	0	346.50	0.0	0.0	0.0	
8.00	0.0	1	346.50	0.0	**0.0**	0.0	
10.00	0.2	252	346.87	0.1	**0.1**	0.0	
12.00	**1.7**	**2,172**	**348.38**	**1.4**	0.1	**1.4**	
14.00	**0.9**	**2,063**	**348.29**	**0.9**	0.1	**0.8**	
16.00	0.5	1,965	348.21	0.5	0.1	0.4	
18.00	0.3	1,905	348.16	0.3	0.1	0.2	
20.00	0.2	1,877	348.14	0.2	0.1	0.2	
22.00	0.2	1,861	348.13	0.2	0.1	0.1	
24.00	0.1	1,844	348.11	0.1	0.1	0.1	
26.00	0.0	1,562	347.90	0.1	0.1	0.0	
28.00	0.0	1,196	347.62	0.1	0.1	0.0	
30.00	0.0	830	347.35	0.1	0.1	0.0	
32.00	0.0	464	347.09	0.1	0.1	0.0	
34.00	0.0	99	346.64	0.1	0.1	0.0	
36.00	0.0	0	346.50	0.0	0.0	0.0	Drawdown Time < 72 Hours
38.00	0.0	0	346.50	0.0	0.0	0.0	
40.00	0.0	0	346.50	0.0	0.0	0.0	
42.00	0.0	0	346.50	0.0	0.0	0.0	
44.00	0.0	0	346.50	0.0	0.0	0.0	
46.00	0.0	0	346.50	0.0	0.0	0.0	
48.00	0.0	0	346.50	0.0	0.0	0.0	
50.00	0.0	0	346.50	0.0	0.0	0.0	
52.00	0.0	0	346.50	0.0	0.0	0.0	
54.00	0.0	0	346.50	0.0	0.0	0.0	
56.00	0.0	0	346.50	0.0	0.0	0.0	
58.00	0.0	0	346.50	0.0	0.0	0.0	
60.00	0.0	0	346.50	0.0	0.0	0.0	
62.00	0.0	0	346.50	0.0	0.0	0.0	
64.00	0.0	0	346.50	0.0	0.0	0.0	
66.00	0.0	0	346.50	0.0	0.0	0.0	
68.00	0.0	0	346.50	0.0	0.0	0.0	
70.00	0.0	0	346.50	0.0	0.0	0.0	
72.00	0.0	0	346.50	0.0	0.0	0.0	
74.00	0.0	0	346.50	0.0	0.0	0.0	
76.00	0.0	0	346.50	0.0	0.0	0.0	
78.00	0.0	0	346.50	0.0	0.0	0.0	
80.00	0.0	0	346.50	0.0	0.0	0.0	
82.00	0.0	0	346.50	0.0	0.0	0.0	
84.00	0.0	0	346.50	0.0	0.0	0.0	
86.00	0.0	0	346.50	0.0	0.0	0.0	
88.00	0.0	0	346.50	0.0	0.0	0.0	
90.00	0.0	0	346.50	0.0	0.0	0.0	
92.00	0.0	0	346.50	0.0	0.0	0.0	
94.00	0.0	0	346.50	0.0	0.0	0.0	
96.00	0.0	0	346.50	0.0	0.0	0.0	

Hydrograph for Pond INF-106: INF-106

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.0	0	351.25	0.0	0.0	0.0
2.00	0.0	0	351.25	0.0	0.0	0.0
4.00	0.0	0	351.25	0.0	0.0	0.0
6.00	0.0	2	351.25	0.0	0.0	0.0
8.00	0.1	18	351.30	0.0	**0.0**	0.0
10.00	0.1	393	352.11	0.0	**0.0**	0.0
12.00	**2.1**	**2,942**	**355.41**	**0.0**	0.0	**0.0**
14.00	**0.2**	**3,146**	**355.72**	**0.2**	0.0	**0.2**
16.00	0.1	3,105	355.66	0.1	0.0	0.1
18.00	0.1	3,078	355.62	0.1	0.0	0.0
20.00	0.1	3,063	355.60	0.1	0.0	0.0
22.00	0.0	3,050	355.58	0.0	0.0	0.0
24.00	0.0	3,025	355.54	0.0	0.0	0.0
26.00	0.0	2,741	355.12	0.0	0.0	0.0
28.00	0.0	2,444	354.71	0.0	0.0	0.0
30.00	0.0	2,146	354.30	0.0	0.0	0.0
32.00	0.0	1,848	353.92	0.0	0.0	0.0
34.00	0.0	1,551	353.53	0.0	0.0	0.0
36.00	0.0	1,253	353.16	0.0	0.0	0.0
38.00	0.0	956	352.79	0.0	0.0	0.0
40.00	0.0	658	352.43	0.0	0.0	0.0
42.00	0.0	360	352.07	0.0	0.0	0.0
44.00	0.0	63	351.40	0.0	0.0	0.0
46.00	0.0	0	351.25	0.0	0.0	0.0
48.00	0.0	0	351.25	0.0	0.0	0.0
50.00	0.0	0	351.25	0.0	0.0	0.0
52.00	0.0	0	351.25	0.0	0.0	0.0
54.00	0.0	0	351.25	0.0	0.0	0.0
56.00	0.0	0	351.25	0.0	0.0	0.0
58.00	0.0	0	351.25	0.0	0.0	0.0
60.00	0.0	0	351.25	0.0	0.0	0.0
62.00	0.0	0	351.25	0.0	0.0	0.0
64.00	0.0	0	351.25	0.0	0.0	0.0
66.00	0.0	0	351.25	0.0	0.0	0.0
68.00	0.0	0	351.25	0.0	0.0	0.0
70.00	0.0	0	351.25	0.0	0.0	0.0
72.00	0.0	0	351.25	0.0	0.0	0.0
74.00	0.0	0	351.25	0.0	0.0	0.0
76.00	0.0	0	351.25	0.0	0.0	0.0
78.00	0.0	0	351.25	0.0	0.0	0.0
80.00	0.0	0	351.25	0.0	0.0	0.0
82.00	0.0	0	351.25	0.0	0.0	0.0
84.00	0.0	0	351.25	0.0	0.0	0.0
86.00	0.0	0	351.25	0.0	0.0	0.0
88.00	0.0	0	351.25	0.0	0.0	0.0
90.00	0.0	0	351.25	0.0	0.0	0.0
92.00	0.0	0	351.25	0.0	0.0	0.0
94.00	0.0	0	351.25	0.0	0.0	0.0
96.00	0.0	0	351.25	0.0	0.0	0.0

Drawdown Time < 72 Hours

Hydrograph for Pond INF-201: INF-201

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	
0.00	0.0	0	336.20	0.0	0.0	0.0	
2.00	0.0	0	336.20	0.0	0.0	0.0	
4.00	0.0	0	336.20	0.0	0.0	0.0	
6.00	0.0	0	336.20	0.0	0.0	0.0	
8.00	0.0	1	336.20	0.0	**0.0**	0.0	
10.00	0.2	148	336.37	0.1	**0.1**	0.0	
12.00	**3.3**	**3,588**	**338.55**	**2.7**	0.1	**2.6**	
14.00	**1.1**	**3,342**	**338.38**	**1.2**	0.1	**1.0**	
16.00	0.6	3,214	338.30	0.6	0.1	0.5	
18.00	0.4	3,120	338.24	0.4	0.1	0.2	
20.00	0.3	3,066	338.20	0.3	0.1	0.2	
22.00	0.2	3,034	338.18	0.2	0.1	0.1	
24.00	0.2	2,999	338.16	0.2	0.1	0.1	
26.00	0.0	2,343	337.76	0.1	0.1	0.0	
28.00	0.0	1,497	337.27	0.1	0.1	0.0	
30.00	0.0	651	336.81	0.1	0.1	0.0	
32.00	0.0	0	336.20	0.0	0.0	0.0	Drawdown Time < 72 Hours
34.00	0.0	0	336.20	0.0	0.0	0.0	
36.00	0.0	0	336.20	0.0	0.0	0.0	
38.00	0.0	0	336.20	0.0	0.0	0.0	
40.00	0.0	0	336.20	0.0	0.0	0.0	
42.00	0.0	0	336.20	0.0	0.0	0.0	
44.00	0.0	0	336.20	0.0	0.0	0.0	
46.00	0.0	0	336.20	0.0	0.0	0.0	
48.00	0.0	0	336.20	0.0	0.0	0.0	
50.00	0.0	0	336.20	0.0	0.0	0.0	
52.00	0.0	0	336.20	0.0	0.0	0.0	
54.00	0.0	0	336.20	0.0	0.0	0.0	
56.00	0.0	0	336.20	0.0	0.0	0.0	
58.00	0.0	0	336.20	0.0	0.0	0.0	
60.00	0.0	0	336.20	0.0	0.0	0.0	
62.00	0.0	0	336.20	0.0	0.0	0.0	
64.00	0.0	0	336.20	0.0	0.0	0.0	
66.00	0.0	0	336.20	0.0	0.0	0.0	
68.00	0.0	0	336.20	0.0	0.0	0.0	
70.00	0.0	0	336.20	0.0	0.0	0.0	
72.00	0.0	0	336.20	0.0	0.0	0.0	
74.00	0.0	0	336.20	0.0	0.0	0.0	
76.00	0.0	0	336.20	0.0	0.0	0.0	
78.00	0.0	0	336.20	0.0	0.0	0.0	
80.00	0.0	0	336.20	0.0	0.0	0.0	
82.00	0.0	0	336.20	0.0	0.0	0.0	
84.00	0.0	0	336.20	0.0	0.0	0.0	
86.00	0.0	0	336.20	0.0	0.0	0.0	
88.00	0.0	0	336.20	0.0	0.0	0.0	
90.00	0.0	0	336.20	0.0	0.0	0.0	
92.00	0.0	0	336.20	0.0	0.0	0.0	
94.00	0.0	0	336.20	0.0	0.0	0.0	
96.00	0.0	0	336.20	0.0	0.0	0.0	

Hydrograph for Pond INF-201: INF-201

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.0	0	336.20	0.0	0.0	0.0
2.00	0.0	0	336.20	0.0	0.0	0.0
4.00	0.0	0	336.20	0.0	0.0	0.0
6.00	0.0	0	336.20	0.0	0.0	0.0
8.00	0.0	1	336.20	0.0	**0.0**	0.0
10.00	0.2	148	336.37	0.1	**0.1**	0.0
12.00	**3.3**	**3,588**	**338.55**	**2.7**	0.1	**2.6**
14.00	**1.1**	**3,342**	**338.38**	**1.2**	0.1	**1.0**
16.00	0.6	3,214	338.30	0.6	0.1	0.5
18.00	0.4	3,120	338.24	0.4	0.1	0.2
20.00	0.3	3,066	338.20	0.3	0.1	0.2
22.00	0.2	3,034	338.18	0.2	0.1	0.1
24.00	0.2	2,999	338.16	0.2	0.1	0.1
26.00	0.0	2,343	337.76	0.1	0.1	0.0
28.00	0.0	1,497	337.27	0.1	0.1	0.0
30.00	0.0	651	336.81	0.1	0.1	0.0
32.00	0.0	0	336.20	0.0	0.0	0.0
34.00	0.0	0	336.20	0.0	0.0	0.0
36.00	0.0	0	336.20	0.0	0.0	0.0
38.00	0.0	0	336.20	0.0	0.0	0.0
40.00	0.0	0	336.20	0.0	0.0	0.0
42.00	0.0	0	336.20	0.0	0.0	0.0
44.00	0.0	0	336.20	0.0	0.0	0.0
46.00	0.0	0	336.20	0.0	0.0	0.0
48.00	0.0	0	336.20	0.0	0.0	0.0
50.00	0.0	0	336.20	0.0	0.0	0.0
52.00	0.0	0	336.20	0.0	0.0	0.0
54.00	0.0	0	336.20	0.0	0.0	0.0
56.00	0.0	0	336.20	0.0	0.0	0.0
58.00	0.0	0	336.20	0.0	0.0	0.0
60.00	0.0	0	336.20	0.0	0.0	0.0
62.00	0.0	0	336.20	0.0	0.0	0.0
64.00	0.0	0	336.20	0.0	0.0	0.0
66.00	0.0	0	336.20	0.0	0.0	0.0
68.00	0.0	0	336.20	0.0	0.0	0.0
70.00	0.0	0	336.20	0.0	0.0	0.0
72.00	0.0	0	336.20	0.0	0.0	0.0
74.00	0.0	0	336.20	0.0	0.0	0.0
76.00	0.0	0	336.20	0.0	0.0	0.0
78.00	0.0	0	336.20	0.0	0.0	0.0
80.00	0.0	0	336.20	0.0	0.0	0.0
82.00	0.0	0	336.20	0.0	0.0	0.0
84.00	0.0	0	336.20	0.0	0.0	0.0
86.00	0.0	0	336.20	0.0	0.0	0.0
88.00	0.0	0	336.20	0.0	0.0	0.0
90.00	0.0	0	336.20	0.0	0.0	0.0
92.00	0.0	0	336.20	0.0	0.0	0.0
94.00	0.0	0	336.20	0.0	0.0	0.0
96.00	0.0	0	336.20	0.0	0.0	0.0

Drawdown Time < 72 Hours

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

Location: Outlet 01

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)
Grass Channel	**0.50**	**1.00**	**0.50**	**0.50**
Deep Sump and Hooded Catch Basin	**0.25**	**0.50**	**0.13**	**0.38**
Extended Dry Detention Basin	**0.50**	**0.38**	**0.19**	**0.19**
	0.00	**0.19**	**0.00**	**0.19**
	0.00	**0.19**	**0.00**	**0.19**

Total TSS Removal = **81%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: **85 & 95 West Street**
Prepared By: **GBS**
Date: **2/24/2021**

*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

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

Location: Outlet 02

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)
Grass Channel	0.50	1.00	0.50	0.50
Deep Sump and Hooded Catch Basin	0.25	0.50	0.13	0.38
Infiltration Basin	0.80	0.38	0.30	0.08
	0.00	0.08	0.00	0.08
	0.00	0.08	0.00	0.08

Total TSS Removal = 93%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 85 & 95 West Street
Prepared By: GBS
Date: 2/24/2021

*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

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

Location: Outlet 03

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)
Grass Channel	0.50	1.00	0.50	0.50
Deep Sump and Hooded Catch Basin	0.25	0.50	0.13	0.38
Infiltration Basin	0.80	0.38	0.30	0.08
	0.00	0.08	0.00	0.08
	0.00	0.08	0.00	0.08

Total TSS Removal = 93%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 85 & 95 West Street
Prepared By: GBS
Date: 2/24/2021

*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

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

Location: Outlet 04

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)
Grass Channel	0.50	1.00	0.50	0.50
Deep Sump and Hooded Catch Basin	0.25	0.50	0.13	0.38
Infiltration Basin	0.80	0.38	0.30	0.08
	0.00	0.08	0.00	0.08
	0.00	0.08	0.00	0.08

Total TSS Removal = 93%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 85 & 95 West Street
Prepared By: GBS
Date: 2/24/2021

*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

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

Location: Outlet 05

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)
Grass Channel	0.50	1.00	0.50	0.50
Deep Sump and Hooded Catch Basin	0.25	0.50	0.13	0.38
Infiltration Basin	0.80	0.38	0.30	0.08
	0.00	0.08	0.00	0.08
	0.00	0.08	0.00	0.08

Total TSS Removal = 93%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 85 & 95 West Street
Prepared By: GBS
Date: 2/24/2021

*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

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

Location: Outlet 06

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)
Grass Channel	0.50	1.00	0.50	0.50
Deep Sump and Hooded Catch Basin	0.25	0.50	0.13	0.38
Infiltration Basin	0.80	0.38	0.30	0.08
	0.00	0.08	0.00	0.08
	0.00	0.08	0.00	0.08

Total TSS Removal = 93%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 85 & 95 West Street
Prepared By: GBS
Date: 2/24/2021

*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

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	122.850	0.00	0.00	0.00	0.00	0.00	0.0	1.6	0.0	2.40	8.79	1.36	18	0.70	348.00	348.86	350.49	350.55	354.19	355.62	Pipe - (11)
2	1	130.360	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	2.40	23.41	2.56	18	4.97	348.86	355.34	350.56	355.93	355.62	358.01	Pipe - (12)
3	2	3.500	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	2.40	9.72	1.36	18	0.86	353.62	353.65	355.93	355.93	358.01	355.29	Pipe - (13)
4	End	3.500	0.00	0.53	0.00	0.00	0.36	0.0	34.3	5.0	1.80	11.23	4.05	18	1.14	352.16	352.20	352.57	352.70	352.26	357.88	Pipe - (14)
5	4	33.580	0.53	0.53	0.68	0.36	0.36	33.8	33.8	5.0	1.82	8.88	3.70	18	0.71	352.30	352.54	352.76	353.05	357.88	354.01	Pipe - (15)
6	End	4.750	0.36	2.76	0.40	0.14	0.86	5.0	27.7	5.6	4.83	11.67	5.50	18	1.05	335.15	335.20	335.82	336.04	335.50	340.50	Pipe - (17)
7	6	101.718	0.00	2.40	0.00	0.00	0.72	0.0	26.9	5.7	4.08	38.68	4.21	18	13.57	335.20	349.00	336.04	349.77	340.50	357.68	Pipe - (18)
8	7	48.921	0.77	0.77	0.30	0.23	0.23	19.3	19.3	6.6	1.52	10.62	3.78	18	1.02	350.00	350.50	350.38	350.96	357.68	358.00	Pipe - (19)
9	7	21.705	1.63	1.63	0.30	0.49	0.49	26.7	26.7	5.7	2.78	31.88	7.50	18	9.21	350.00	352.00	350.30	352.63	357.68	359.01	Pipe - (20)
10	End	62.005	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	5.90	10.50	5.57	18	1.00	346.39	347.01	347.20	347.95	348.04	344.64	Pipe - (09)
11	End	6.370	2.11	2.11	0.36	0.76	0.76	24.8	24.8	5.9	4.48	10.19	5.09	18	0.94	347.13	347.19	347.83	348.00	347.27	351.70	Pipe - (10)
12	End	17.329	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	7.50	19.32	7.92	18	2.89	334.00	334.50	334.65	335.56	335.65	337.18	Pipe - (16)
13	End	4.278	0.18	0.18	0.61	0.11	0.11	8.3	8.3	8.8	3.97	0.00	3.91	18	-0.94	326.60	326.56	327.36	327.50	328.03	335.02	Pipe - (06)
14	End	27.140	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	3.20	15.08	4.99	18	2.06	326.00	326.56	326.52	327.24	328.65	328.03	Pipe - (05)
15	End	65.200	1.53	1.53	0.33	0.50	0.50	21.2	21.2	6.3	9.20	27.77	10.16	18	6.99	325.73	330.29	326.32	331.46	325.77	335.02	Pipe - (08)
16	End	38.856	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	9.50	29.37	5.85	18	7.82	322.00	325.04	324.18	326.23	323.65	326.68	Pipe - (07)
17	End	48.757	0.00	1.71	0.00	0.00	0.72	0.0	38.7	4.7	3.39	6.73	3.91	18	0.41	319.70	319.90	320.40	320.68	321.35	324.44	Pipe - (01)
18	17	32.616	0.00	1.60	0.00	0.00	0.65	0.0	38.3	4.7	3.07	8.82	3.28	18	0.71	319.90	320.13	320.88	320.80	324.44	324.67	Pipe - (02)
19	18	10.751	1.12	1.12	0.42	0.47	0.47	38.2	38.2	4.7	2.22	9.06	3.30	18	0.74	320.13	320.21	320.80	320.77	324.67	322.75	Pipe - (04)
20	18	14.678	0.48	0.48	0.38	0.18	0.18	12.2	12.2	7.9	1.43	9.09	2.56	18	0.75	320.13	320.24	320.80	320.69	324.67	322.78	Pipe - (03)
21	17	10.048	0.11	0.11	0.65	0.07	0.07	5.0	5.0	9.8	0.70	3.85	1.89	12	1.00	319.90	320.00	320.88	320.35	324.44	321.98	Pipe - (01.1)
22	End	24.170	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.10	1.19	1.84	8	0.83	320.30	320.50	320.44	320.64	0.00	0.00	Pipe - (21)

Common Driveway 85 West Street | Number of lines: 22 | Run Date: 4/14/2021

NOTES:Intensity = 127.16 / (Inlet time + 17.80) ^ 0.82; Return period =Yrs. 100 ; c = cir e = ellip b = box

Culvert Report for Proposed crossing at Cherry Street

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Apr 14 2021

2-12-INCH STEEL PIPES, Q25

Invert Elev Dn (ft)	=	316.99
Pipe Length (ft)	=	30.74
Slope (%)	=	0.13
Invert Elev Up (ft)	=	317.03
Rise (in)	=	12.0
Shape	=	Circular
Span (in)	=	12.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Circular Culvert
Culvert Entrance	=	Smooth tapered inlet throat
Coeff. K,M,c,Y,k	=	0.534, 0.555, 0.0196, 0.9, 0.2

Embankment

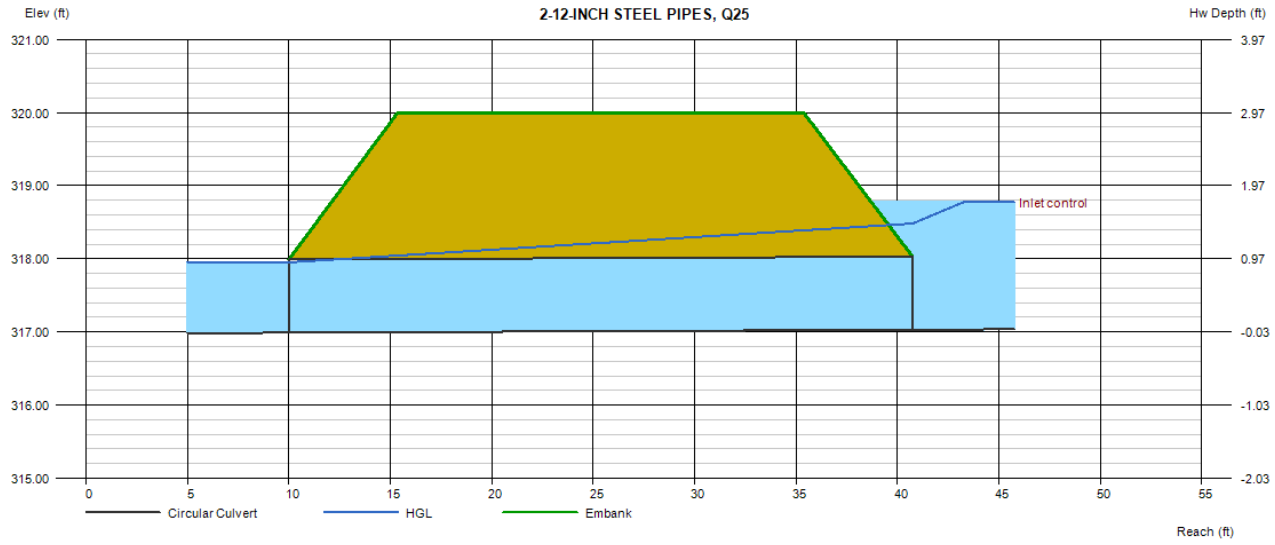
Top Elevation (ft)	=	320.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	10.00

Calculations

Qmin (cfs)	=	1.60
Qmax (cfs)	=	10.30
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	10.30
Qpipe (cfs)	=	10.30
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.64
Veloc Up (ft/s)	=	6.56
HGL Dn (ft)	=	317.95
HGL Up (ft)	=	318.48
Hw Elev (ft)	=	318.77
Hw/D (ft)	=	1.74
Flow Regime	=	Inlet Control



NOAA Atlas 14, Volume 10, Version 3
Location name: Westborough, Massachusetts, USA*
Latitude: 42.2667°, Longitude: -71.6333°
Elevation: 367.67 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**4.09** (3.11-5.36)	**4.86** (3.70-6.40)	**6.12** (4.64-8.08)	**7.18** (5.40-9.52)	**8.63** (6.31-11.9)	**9.72** (7.00-13.7)	**10.9** (7.61-15.8)	**12.1** (8.11-18.1)	**13.9** (9.00-21.5)	**15.4** (9.73-24.2)
10-min	**2.90** (2.20-3.80)	**3.44** (2.62-4.53)	**4.34** (3.29-5.72)	**5.09** (3.83-6.74)	**6.11** (4.48-8.44)	**6.89** (4.95-9.71)	**7.69** (5.39-11.2)	**8.59** (5.75-12.8)	**9.86** (6.38-15.2)	**10.9** (6.89-17.1)
15-min	**2.27** (1.73-2.98)	**2.70** (2.05-3.55)	**3.41** (2.58-4.49)	**3.99** (3.00-5.29)	**4.79** (3.51-6.62)	**5.40** (3.88-7.61)	**6.03** (4.23-8.80)	**6.74** (4.50-10.1)	**7.73** (5.00-11.9)	**8.54** (5.41-13.5)
30-min	**1.55** (1.17-2.03)	**1.84** (1.40-2.42)	**2.32** (1.76-3.06)	**2.72** (2.05-3.61)	**3.27** (2.40-4.52)	**3.69** (2.65-5.20)	**4.12** (2.89-6.01)	**4.60** (3.08-6.87)	**5.29** (3.42-8.17)	**5.85** (3.70-9.21)
60-min	**0.978** (0.743-1.28)	**1.17** (0.884-1.53)	**1.47** (1.11-1.94)	**1.72** (1.30-2.29)	**2.07** (1.52-2.86)	**2.34** (1.68-3.29)	**2.61** (1.83-3.81)	**2.92** (1.95-4.36)	**3.36** (2.17-5.18)	**3.71** (2.35-5.84)
2-hr	**0.610** (0.465-0.796)	**0.736** (0.562-0.964)	**0.944** (0.718-1.24)	**1.12** (0.844-1.47)	**1.35** (0.998-1.87)	**1.53** (1.11-2.16)	**1.72** (1.22-2.52)	**1.94** (1.30-2.88)	**2.27** (1.47-3.49)	**2.55** (1.62-3.99)
3-hr	**0.464** (0.355-0.605)	**0.564** (0.431-0.736)	**0.727** (0.554-0.952)	**0.862** (0.654-1.14)	**1.05** (0.775-1.44)	**1.19** (0.863-1.67)	**1.34** (0.951-1.96)	**1.51** (1.02-2.24)	**1.78** (1.16-2.73)	**2.01** (1.28-3.13)
6-hr	**0.297** (0.228-0.385)	**0.361** (0.277-0.469)	**0.466** (0.357-0.608)	**0.553** (0.421-0.725)	**0.674** (0.500-0.924)	**0.763** (0.557-1.07)	**0.859** (0.614-1.25)	**0.975** (0.657-1.44)	**1.15** (0.749-1.75)	**1.30** (0.829-2.01)
12-hr	**0.188** (0.145-0.243)	**0.227** (0.175-0.294)	**0.292** (0.225-0.379)	**0.346** (0.265-0.452)	**0.421** (0.313-0.573)	**0.476** (0.349-0.663)	**0.535** (0.384-0.774)	**0.606** (0.410-0.886)	**0.712** (0.465-1.08)	**0.802** (0.513-1.23)
24-hr	**0.113** (0.087-0.145)	**0.137** (0.106-0.176)	**0.177** (0.136-0.228)	**0.210** (0.161-0.272)	**0.255** (0.191-0.346)	**0.289** (0.213-0.401)	**0.325** (0.234-0.469)	**0.369** (0.250-0.537)	**0.435** (0.285-0.653)	**0.491** (0.315-0.750)
2-day	**0.063** (0.049-0.081)	**0.078** (0.060-0.099)	**0.101** (0.078-0.130)	**0.121** (0.093-0.156)	**0.148** (0.111-0.200)	**0.168** (0.124-0.232)	**0.190** (0.138-0.273)	**0.216** (0.147-0.313)	**0.258** (0.169-0.384)	**0.293** (0.189-0.445)
3-day	**0.046** (0.036-0.058)	**0.056** (0.044-0.072)	**0.073** (0.057-0.094)	**0.087** (0.067-0.112)	**0.106** (0.080-0.144)	**0.121** (0.090-0.167)	**0.136** (0.099-0.196)	**0.156** (0.106-0.224)	**0.185** (0.122-0.276)	**0.211** (0.136-0.319)
4-day	**0.037** (0.029-0.047)	**0.045** (0.035-0.057)	**0.058** (0.045-0.074)	**0.069** (0.054-0.089)	**0.084** (0.064-0.114)	**0.096** (0.071-0.132)	**0.108** (0.079-0.154)	**0.123** (0.084-0.177)	**0.146** (0.096-0.216)	**0.166** (0.107-0.250)
7-day	**0.025** (0.020-0.032)	**0.030** (0.024-0.038)	**0.038** (0.030-0.049)	**0.045** (0.035-0.058)	**0.054** (0.041-0.073)	**0.061** (0.046-0.084)	**0.069** (0.050-0.097)	**0.078** (0.053-0.111)	**0.091** (0.060-0.134)	**0.103** (0.066-0.154)
10-day	**0.020** (0.016-0.026)	**0.024** (0.019-0.030)	**0.030** (0.023-0.038)	**0.035** (0.027-0.045)	**0.042** (0.032-0.056)	**0.047** (0.035-0.064)	**0.052** (0.038-0.073)	**0.059** (0.040-0.083)	**0.068** (0.045-0.099)	**0.075** (0.049-0.113)
20-day	**0.014** (0.011-0.018)	**0.016** (0.013-0.021)	**0.020** (0.015-0.025)	**0.022** (0.017-0.028)	**0.026** (0.020-0.034)	**0.029** (0.021-0.038)	**0.031** (0.023-0.043)	**0.034** (0.024-0.049)	**0.039** (0.026-0.056)	**0.042** (0.027-0.062)
30-day	**0.012** (0.009-0.015)	**0.013** (0.011-0.017)	**0.016** (0.012-0.020)	**0.017** (0.014-0.022)	**0.020** (0.015-0.026)	**0.022** (0.016-0.029)	**0.024** (0.017-0.032)	**0.026** (0.018-0.036)	**0.028** (0.019-0.041)	**0.030** (0.020-0.044)
45-day	**0.010** (0.008-0.012)	**0.011** (0.009-0.014)	**0.012** (0.010-0.016)	**0.014** (0.011-0.017)	**0.015** (0.012-0.020)	**0.017** (0.013-0.022)	**0.018** (0.013-0.025)	**0.019** (0.013-0.027)	**0.021** (0.014-0.030)	**0.022** (0.014-0.032)
60-day	**0.009** (0.007-0.011)	**0.009** (0.007-0.012)	**0.011** (0.008-0.013)	**0.012** (0.009-0.015)	**0.013** (0.010-0.017)	**0.014** (0.010-0.018)	**0.015** (0.011-0.020)	**0.016** (0.011-0.022)	**0.017** (0.011-0.024)	**0.018** (0.012-0.026)

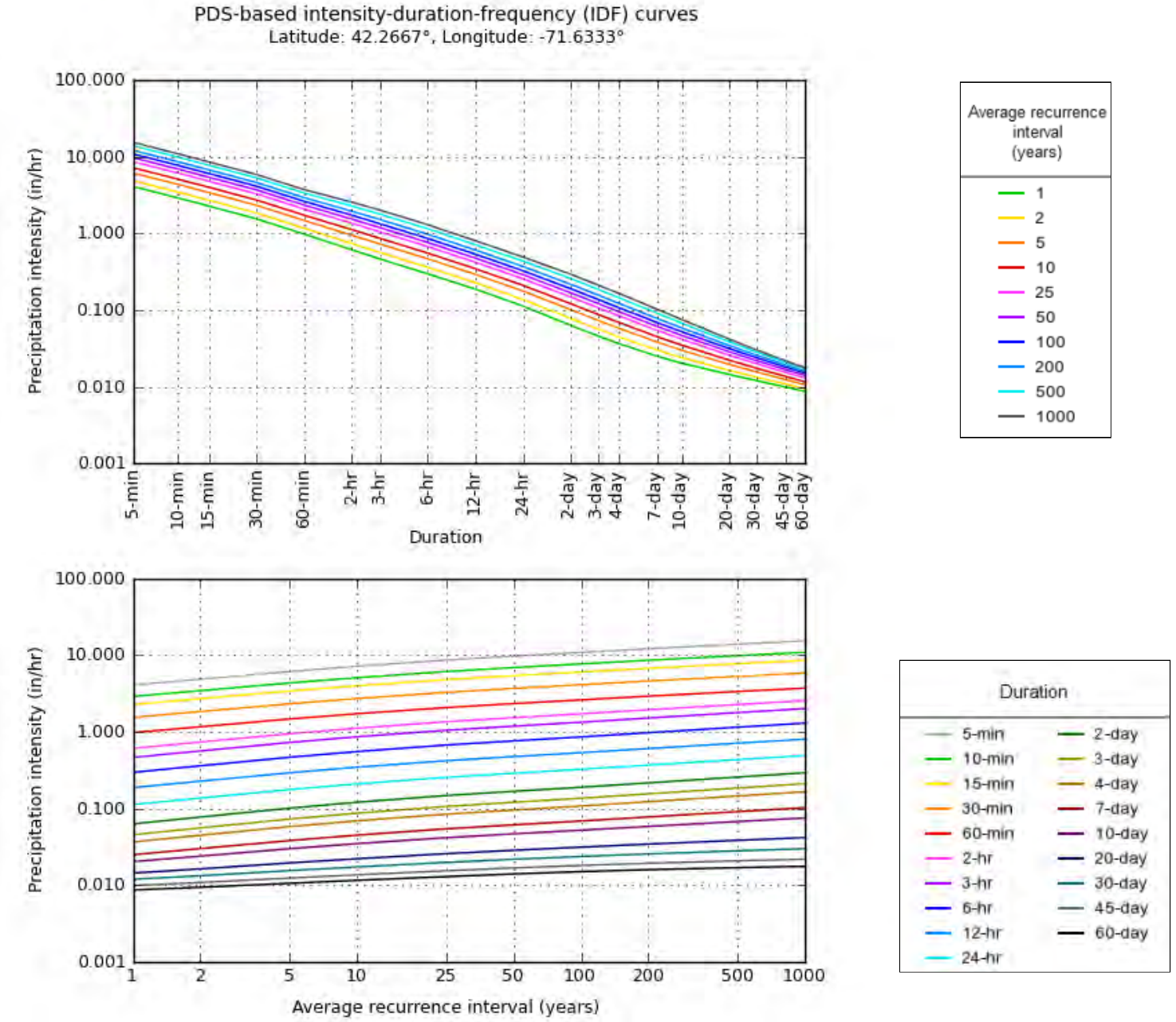
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



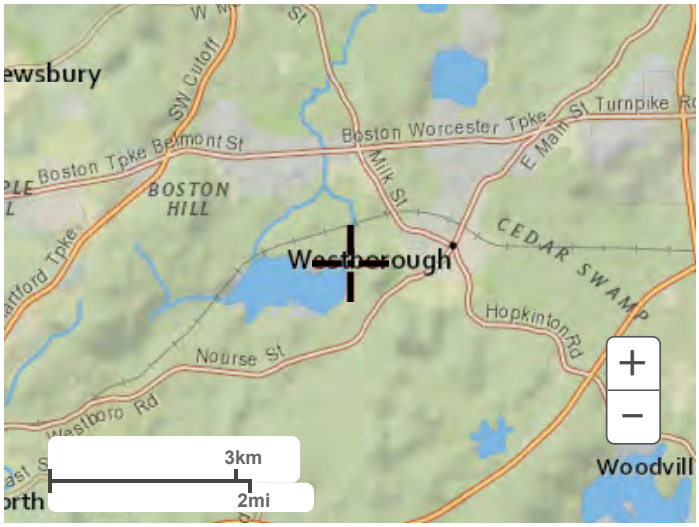
NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Thu Nov 12 16:06:19 2020

Back to Top

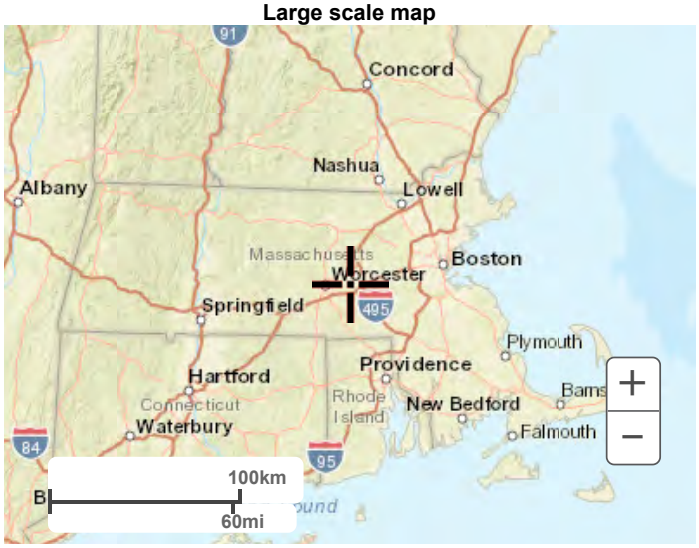
Maps & aerials

Small scale terrain

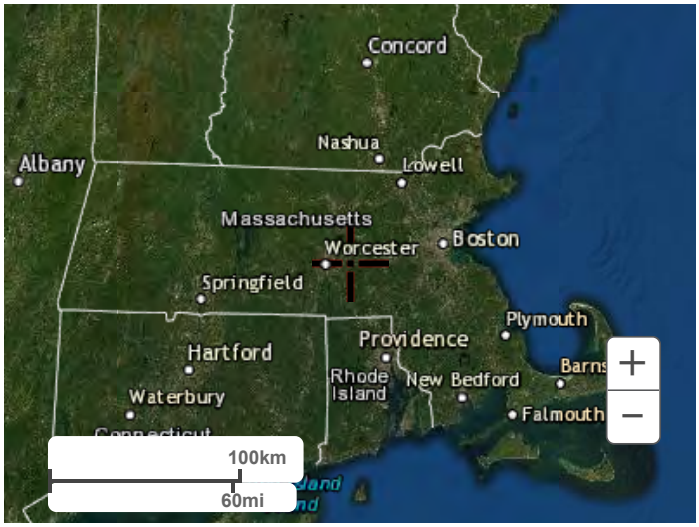


Large scale terrain

Large scale map



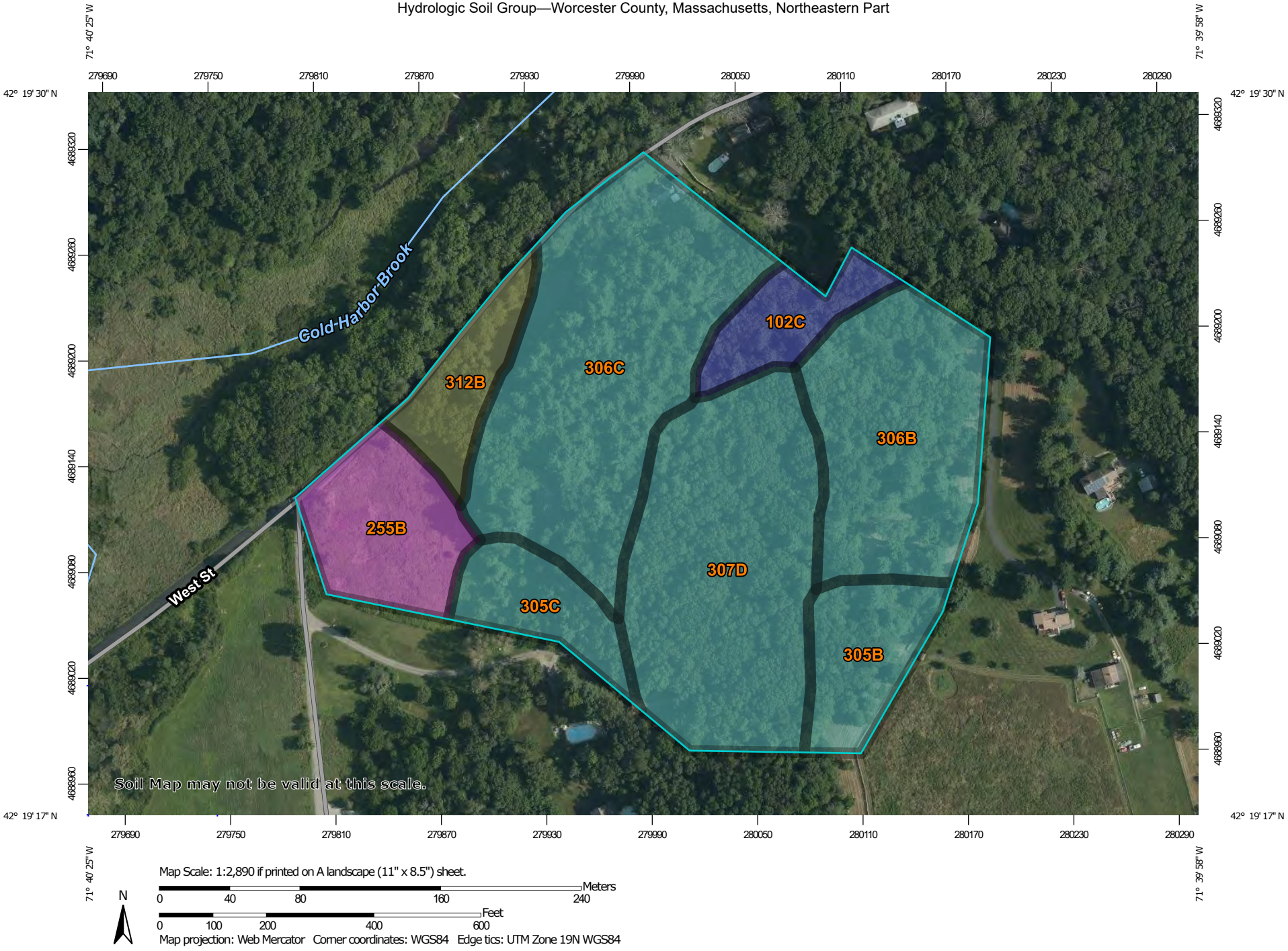
Large scale aerial



Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer



Map Scale: 1:2,890 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 40 80 160 240

Feet: 0 100 200 400 600

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 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Worcester County, Massachusetts, Northeastern Part
Survey Area Data: Version 15, Jun 10, 2020

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

Date(s) aerial images were photographed: Jul 26, 2019—Oct 5, 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
102C	Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes	B	1.0	4.9%
255B	Windsor loamy sand, 3 to 8 percent slopes	A	1.8	8.7%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	C	1.4	6.6%
305C	Paxton fine sandy loam, 8 to 15 percent slopes	C	1.1	5.4%
306B	Paxton fine sandy loam, 0 to 8 percent slopes, very stony	C	3.6	17.2%
306C	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	C	5.7	27.5%
307D	Paxton fine sandy loam, 15 to 25 percent slopes, extremely stony	C	5.1	24.3%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	C/D	1.1	5.3%
Totals for Area of Interest			**20.9**	**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

TEST HOLE LOG

85 WEST STREET
NORTHBOROUGH, MA

Date: 1/13/21
Soil Evaluator: Gerald Buzanoski
Excavator: Neil Stowe

TEST HOLE TP-BSN

Depth	Horizon	Texture	Color
0-12”	Ap	Fine Sandy Loam	10YR2/2
12”-28”	Bw	Fine Sandy Loam	10YR4/6
28”-87”	C	Loam-FSL	10YR4/4

Comments: Redox features observed at 16”, seepage at 20”

TEST HOLE DR-103

Depth	Horizon	Texture	Color
0-16”	Ap	Fine Sandy Loam	10YR3/4
16”-38”	Bw	Fine Sandy Loam	10YR4/6
38”-76”	C	Loamy Sand	10YR5/4

Comments: Seepage at 48”

TEST HOLE DR-104

Depth	Horizon	Texture	Color
0-16”	Ap	Fine Sandy Loam	10YR3/2
16”-36”	Bw	Fine Sandy Loam	10YR5/6
36”-66”	C	Medium Sand	10YR4/4

Comments: Redox observed at 24”, groundwater at 43”

TEST HOLE 3-1A

Depth	Horizon	Texture	Color
0-6”	A	Fine Sandy Loam	10YR3/2
6”-50”	Bw	Fine Sandy Loam	10YR4/4
50”-68”	Cd	Loamy Sand	10YR5/3

Comments: Redox observed at 30”; groundwater at 62”

TEST HOLE 3-1B

Depth	Horizon	Texture	Color
0-8”	A	Fine Sandy Loam	10YR3/2
8”-24”	Bw	Fine Sandy Loam	10YR4/4
24”-38”	B/C	Loamy Sand	10YR4/4-4/6
38”-103”	Cd	Loamy Sand	10YR5/3

Comments: Redox observed at 32”; seepage at 68”

TEST HOLE 4-1A

Depth	Horizon	Texture	Color
0-6”	A	Fine Sandy Loam	10YR3/2
6”-38”	Bw	Fine Sandy Loam	10YR4/4
38”-106”	Cd	Fine Sandy Loam	10YR5/4

Comments: Redox observed at 29”; no groundwater observed

TEST HOLE 4-1B

Depth	Horizon	Texture	Color
0-6”	A	Fine Sandy Loam	10YR3/2
6”-46”	Bw	Fine Sandy Loam	10YR4/6
38”-100”	Cd	Fine Sandy Loam	10YR5/2-5/3

Comments: Redox observed at 24”; no groundwater observed

TEST HOLE 5-1A

Depth	Horizon	Texture	Color
0-6”	A	Fine Sandy Loam	10YR3/2
6”-52”	Bw	Fine Sandy Loam	10YR4/4
52”-104”	Cd	Fine Sandy Loam	10YR5/3

Comments: Redox observed at 42”; no groundwater observed

TEST HOLE 5-1B

Depth	Horizon	Texture	Color
0-6”	A	Fine Sandy Loam	10YR3/2
6”-48”	Bw	Fine Sandy Loam	10YR4/4
48”-96”	Cd	Fine Sandy Loam	10YR5/2-5/3

Comments: Redox observed at 30”; no groundwater observed

TEST HOLE 5-1C

Depth	Horizon	Texture	Color
0-6”	A	Fine Sandy Loam	10YR3/2
6”-50”	Bw	Fine Sandy Loam	10YR4/4
50”-88”	Cd	Fine Sandy Loam	10YR5/2-5/3

Comments: Redox observed at 32”; no groundwater observed

PERCOLATION TEST DATA

85 WEST STREET
NORTHBOROUGH, MA

Date: 1/13/21
Soil Evaluator: Gerald Buzanoski
Excavator: Neil Stowe

PERC 3

Depth:	55”
Soak:	1:32
12”:	1:47
9”:	2:25
6”:	discontinued
Rate:	40 mpi (estimate)

Comments: 7.5” at 3:03; estimated rate = 40 mpi

PERC 4

Depth:	50”
Soak:	10:46
12”:	11:01
9”:	11:35
6”:	12:30
Rate:	19 mpi

PERC 5

Depth:	50”
Soak:	12:20
12”:	12:35
9”:	1:08
6”:	1:56
Rate:	16 mpi

TEST HOLE LOG

8 West Street
NORTHBOROUGH, MA

Date: 2/3/21
Soil Evaluator: Gerald Buzanoski
Excavator: Neal Stowe, Stowe Excavating

TEST HOLE DR-105

Depth	Horizon	Texture	Color
0-6”	A	Fine Sandy Loam	10yr3/3
6”-32”	Bw	Fine Sandy Loam	10YR5/6
32”-50”	Cd	Fine Sandy Loam	10YR5/3

Comments: Redox features observed at 37”; no groundwater observed.

TEST HOLE DR-106

Depth	Horizon	Texture	Color
0-6”	A	Fine Sandy Loam	10yr3/3
6”-32”	Bw	Fine Sandy Loam	10YR5/6
32”-80”	Cd	Fine Sandy Loam	10YR5/3

Comments: Faint redox features observed at 70”; no groundwater observed.

TEST HOLE DR-200

Depth	Horizon	Texture	Color
0-6”	A	Fine Sandy Loam	10yr3/2
6”-24”	Bw	Fine Sandy Loam	10YR5/6
24”-72”	C1	Loamy Sand	10YR4/6
48”-72”	C2	Silty Fine Sand	10YR4/4

Comments: Distinct redox features observed at 36”; groundwater observed at 60”.

85 West Street Test Hole Data (continued)

TEST HOLE TP-5D

Depth	Horizon	Texture	Color
0-6”	A	Fine Sandy Loam	10yr3/2
6”-30”	Bw	Fine Sandy Loam	10YR4/4
30”-85”	Cd	Fine Sandy Loam	10YR5/3

Comments: Few faint redox features observed at 42”; no groundwater observed.

Double-Ring Infiltrometer (ASTM D3385-09)

Yankee Engineering & Testing, Inc.
10 Mason Street
Worcester, MA 01609
508-831-7404

Client:	WDA Design Group
Project:	85 West St, Northborough, MA
Project No.:	2021-1A
Date:	1/14/2021
Technician:	Mr. Joel Morin
Weather:	Cloudy 32-37F, light snow
Site Contact:	Mr. Neil Stow
Test No.:	DR-103 - see location map

Test Elevation	1.6	feet bgs
GW Elevation:	n/a	feet bgs
Ground Temp:	1.7	˚C

	Area (cm^2)	Depth of Liquid (cm)	Liquid No.	Container vol/ΔH (cm^3/mark)	
Inner Ring	726	7.6	1	51.13	Small Mariotte
Annular Space	2166	7.6	2	161.02	Big Mariotte

			Inner Ring		Annular Space					
Trial		Time (min)	Reading	Water Volume (cm^3)	Reading	Water Volume (cm^3)	Liquid Temp (˚C)	Inner Infiltration Rate (cm/hr)	Annular Infiltration Rate (cm/hr)	Remarks
1	Test	15	55.00	1150.425	57.50	3639.052	12.2	6.34	6.72	Soil Sample L29511
	Total	15	32.50		34.90					
2	Test	15	32.50	1140.199	34.90	2930.564	12.2	6.28	5.41	
	Total	30	10.20		16.70					
3	Test	15	30.20	1094.182	51.20	2833.952	12.2	6.03	5.23	
	Total	45	8.80		33.60					
4	Test	15	50.70	562.43	51.00	3429.726	12.2	3.10	6.33	
	Total	60	39.70		29.70					
5	Test	15	39.70	485.735	40.00	3542.44	12.2	2.68	6.54	
	Total	75	30.20		18.00					
6	Test	15	55.00	490.848	57.00	2962.768	12.2	2.70	5.47	
	Total	90	45.40		38.60					
7	Test	15	45.40	132.938	49.00	3043.278	12.2	0.73	5.62	
	Total	105	42.80		30.10					
8	Test	15	42.80	127.825	41.00	2978.87	12.2	0.70	5.50	
	Total	120	40.30		22.50					

bgs = below ground surface

Double-Ring Infiltrometer (ASTM D3385-09)

Yankee Engineering & Testing, Inc.
10 Mason Street
Worcester, MA 01609
508-831-7404

Client:	WDA Design Group
Project:	85 West St, Northborough, MA
Project No.:	2021-1A
Date (s):	1/14/2021
Technician:	Mr. Joel Morin
Weather:	Cloudy 32-37F, light snow
Site Contact:	Mr. Neil Stow
Test No.:	DR-103 - see location map

Type of liquid used: Hose water pH: 6.4

Area of Rings:

	Area (cm^2)
Inner Ring	726
Annular Space	2166

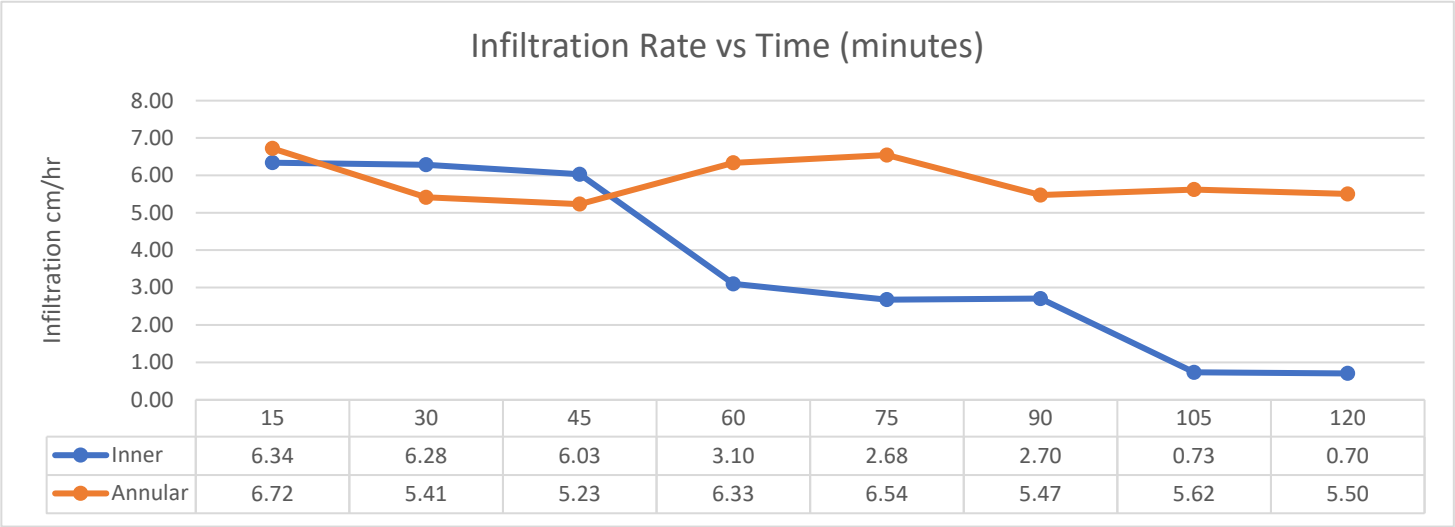
Containers Used: Mariotte Tubes

Flow Constants:			
	51.13	cm^3	Small Mariotte
	161.02	cm^3	Big Mariotte

Depth of Liquid in Rings

Inner Ring	13.4	cm
Annular Space	13.4	cm

Depth to Groundwater Table: n/a



	15	30	45	60	75	90	105	120
Inner	6.34	6.28	6.03	3.10	2.68	2.70	0.73	0.70
Annular	6.72	5.41	5.23	6.33	6.54	5.47	5.62	5.50

At the time of termination, the flow was measured stable at 0.70 cm/hr or **4.6 x 10^{-3} in/min**.

Double-Ring Infiltrometer (ASTM D3385-09)

Yankee Engineering & Testing, Inc.
10 Mason Street
Worcester, MA 01609
508-831-7404

Client:	WDA Design Group
Project:	85 West St, Northborough, MA
Project No.:	2021-1A
Date:	1/14/2021
Technician:	Mr. Joel Morin
Weather:	Cloudy 32-37F, light snow
Site Contact:	Mr. Neil Stow
Test No.:	DR-104 - see location map

Test Elevation	1.5	feet bgs
GW Elevation:	n/a	feet bgs
Ground Temp:	1.7	˚C

	Area (cm^2)	Depth of Liquid (cm)	Liquid No.	Container vol/ΔH (cm^3/mark)	
Inner Ring	726	7.6	1	51.13	Small Mariotte
Annular Space	2166	7.6	2	161.02	Big Mariotte

			Inner Ring		Annular Space					
Trial		Time (min)	Reading	Water Volume (cm^3)	Reading	Water Volume (cm^3)	Liquid Temp (˚C)	Inner Infiltration Rate (cm/hr)	Annular Infiltration Rate (cm/hr)	Remarks
1	Test	15	57.00	1666.838	58.10	5442.476	12.2	9.18	10.05	Soil Sample L29512
	Total	15	24.40		24.30					
2	Test	15	52.90	1406.075	43.50	5667.904	12.2	7.75	10.47	
	Total	30	25.40		8.30					
3	Test	15	55.10	1124.86	58.10	4267.03	12.2	6.20	7.88	
	Total	45	33.10		31.60					
4	Test	15	56.10	1232.233	50.90	4234.826	12.2	6.79	7.82	
	Total	60	32.00		24.60					

bgs = below ground surface

Double-Ring Infiltrometer (ASTM D3385-09)

Yankee Engineering & Testing, Inc.
10 Mason Street
Worcester, MA 01609
508-831-7404

Client:	WDA Design Group
Project:	85 West St, Northborough, MA
Project No.:	2021-1A
Date (s):	1/14/2021
Technician:	Mr. Joel Morin
Weather:	Cloudy 32-37F, light snow
Site Contact:	Mr. Neil Stow
Test No.:	DR-104 - see location map

Type of liquid used: Hose water pH: 6.4

Area of Rings:

	Area (cm^2)
Inner Ring	726
Annular Space	2166

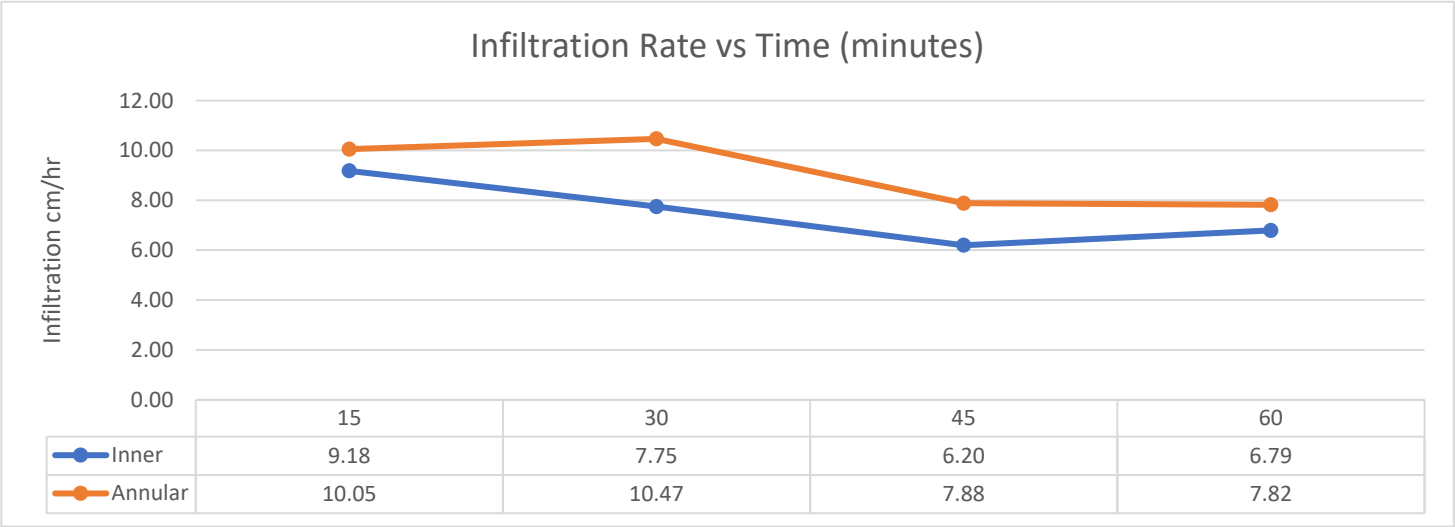
Containers Used: Mariotte Tubes

Flow Constants:			
	51.13	cm^3	Small Mariotte
	161.02	cm^3	Big Mariotte

Depth of Liquid in Rings

Inner Ring	13.4	cm
Annular Space	13.4	cm

Depth to Groundwater Table: n/a



	15	30	45	60
Inner	9.18	7.75	6.20	6.79
Annular	10.05	10.47	7.88	7.82

At the time of termination, the flow was measured stable at 7.8 cm/hr or **5.12 x 10^{-2} in/min**.

Yankee Engineering & Testing, Inc.

HYDRAULIC CONDUCTIVITY BY GUELPH PERMEAMETER

Project No.:	2021-1A	Date:	January 20, 2021
Project Name:	85 West Double Rings	Project Address:	85 West Street, Northborough, MA
Client Name:	WDA Design Group	Client Address:	31 East Main Street, Westborough, MA 01581

Purpose: To conduct infiltration testing by Guelph Permeameter per ASTM D5126-10

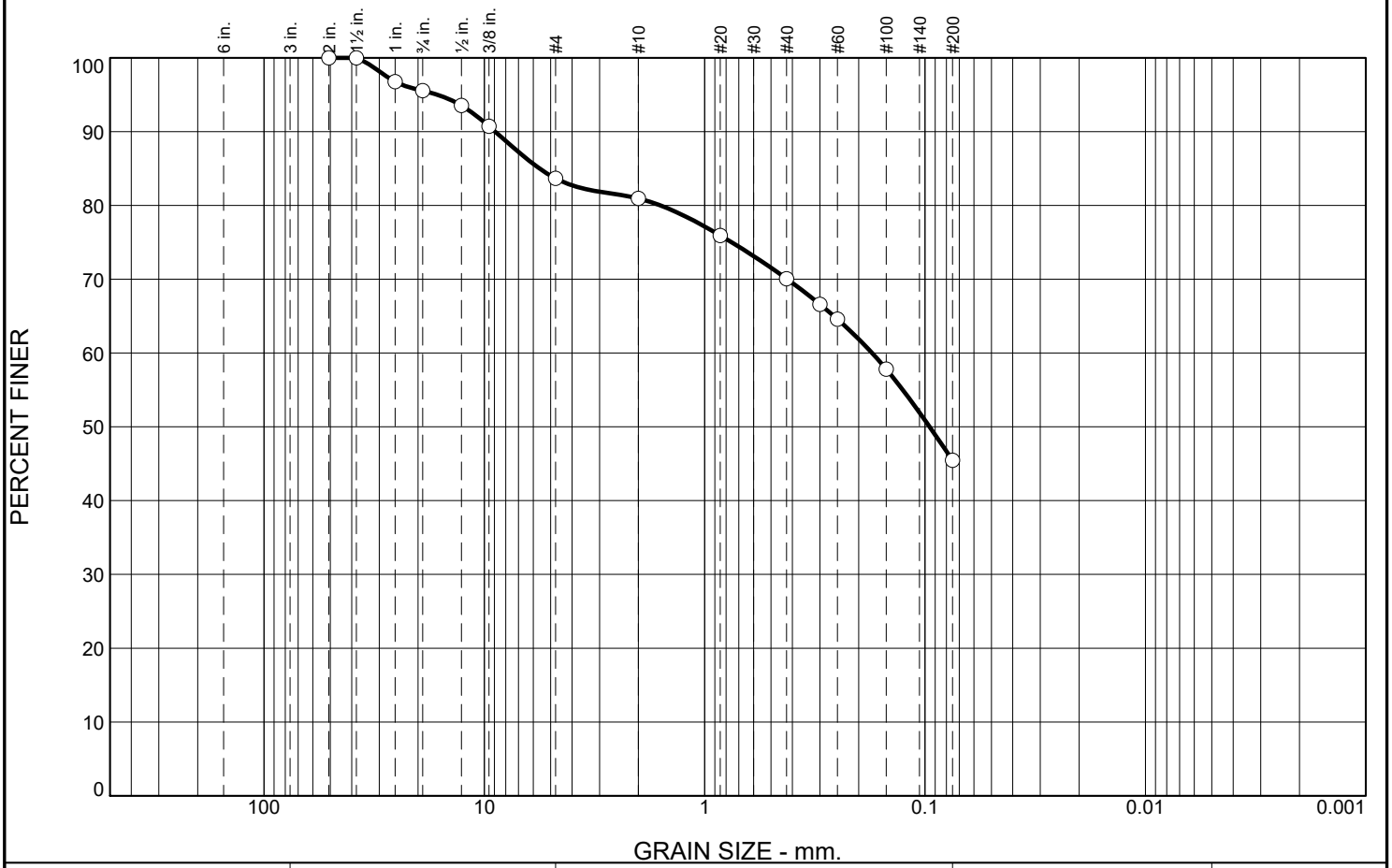
Date Tested	Location	Depth Below Surface Grade (in)	Approx. Test Elevation (ft)	K_{fsat} (in/min)
1/15/21	DR-200 (see location map)	18	336	$3.77x10^{-2}$
1/15/21	DR-106 (see location map)	18	356	$2.93x10^{-2}$
1/15/21	DR-105 (see location map)	18	346	$2.14x10^{-2}$

Data/worksheets available upon request.

Report by: Mr. Joel Morin

10 Mason Street Worcester Massachusetts 01609
Tel (508) 831-7404 Fax (508) 831-7388
CONSTRUCTION INSPECTION & MATERIALS TESTING
www.yankeeengineering.com

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	16.3	38.2	45.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1-1/2"	100.0		
1"	96.8		
3/4"	95.6		
1/2"	93.5		
3/8"	90.7		
#4	83.7		
#10	81.0		
#20	75.9		
#40	70.1		
#50	66.6		
#60	64.6		
#100	57.8		
#200	45.5		

* (no specification provided)

Material Description

Brown 1.5" max sand silt little gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 5.6098 D_{60}= 0.1740 D_{50}= 0.0954
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Sampled by Joel Morin 1/15/20
See infiltration reports for additional information

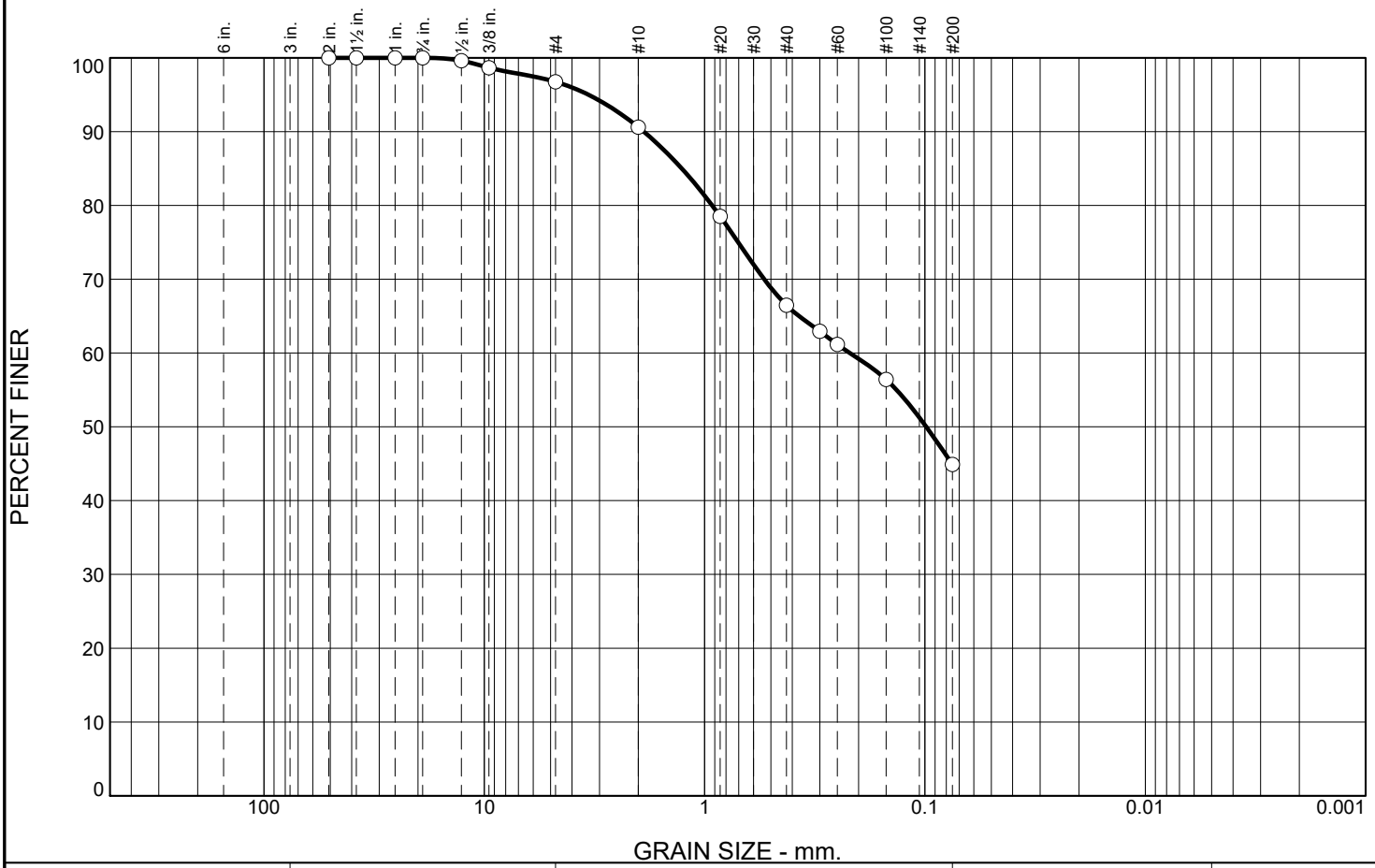
Sample No.: L29511 **Source of Sample:** 85 West Double Rings - Northboro **Date:** 1/20/21
Location: DR-103 **Elev./Depth:** 18" BSG

YANKEE ENGINEERING & TESTING, INC.

Client: WDA Design Group
Project: WDA Design Group
Various Projects/Sites
Project No: 2020.5

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	3.2	51.9	44.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1-1/2"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	99.6		
3/8"	98.7		
#4	96.8		
#10	90.6		
#20	78.5		
#40	66.5		
#50	62.9		
#60	61.2		
#100	56.4		
#200	44.9		

* (no specification provided)

Material Description

Light brown silty sand trace gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 1.2693 D_{60}= 0.2195 D_{50}= 0.0986
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Sampled by Joel Morin 1/15/20
See infiltration reports for additional information

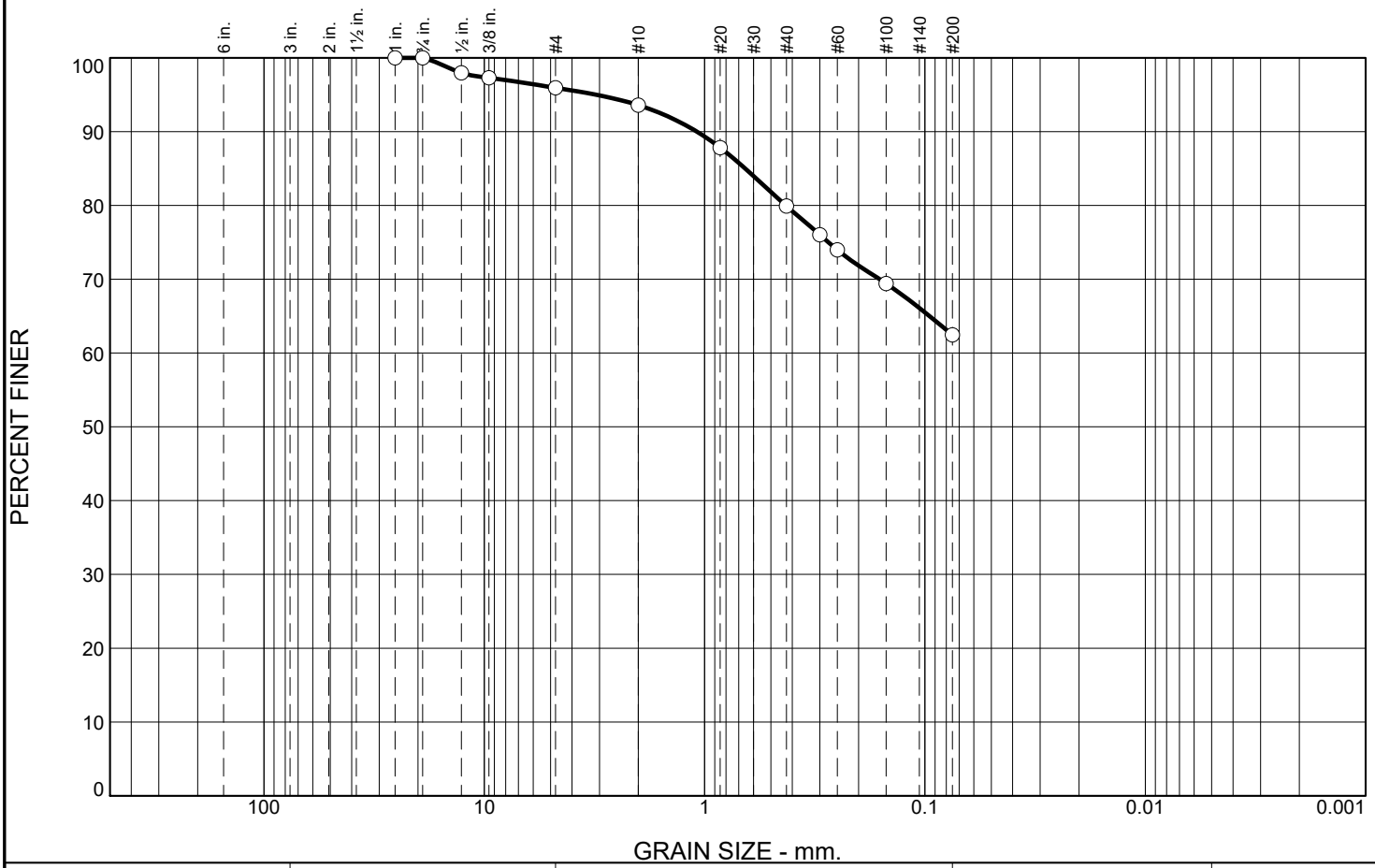
Sample No.: L29512 **Source of Sample:** 85 West Double Rings - Northboro **Date:** 1/20/21
Location: DR-104 **Elev./Depth:** 18" BSG

YANKEE ENGINEERING & TESTING, INC.

Client: WDA Design Group
Project: WDA Design Group
Various Projects/Sites
Project No: 2020.5

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	4.1	33.4	62.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	100.0		
1/2"	98.0		
3/8"	97.3		
#4	95.9		
#10	93.6		
#20	87.8		
#40	79.9		
#50	76.0		
#60	74.0		
#100	69.4		
#200	62.5		

* (no specification provided)

Material Description

Light brown sandy silty trace gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 0.6542 D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Sampled by Joel Morin 1/15/20
See infiltration reports for additional information

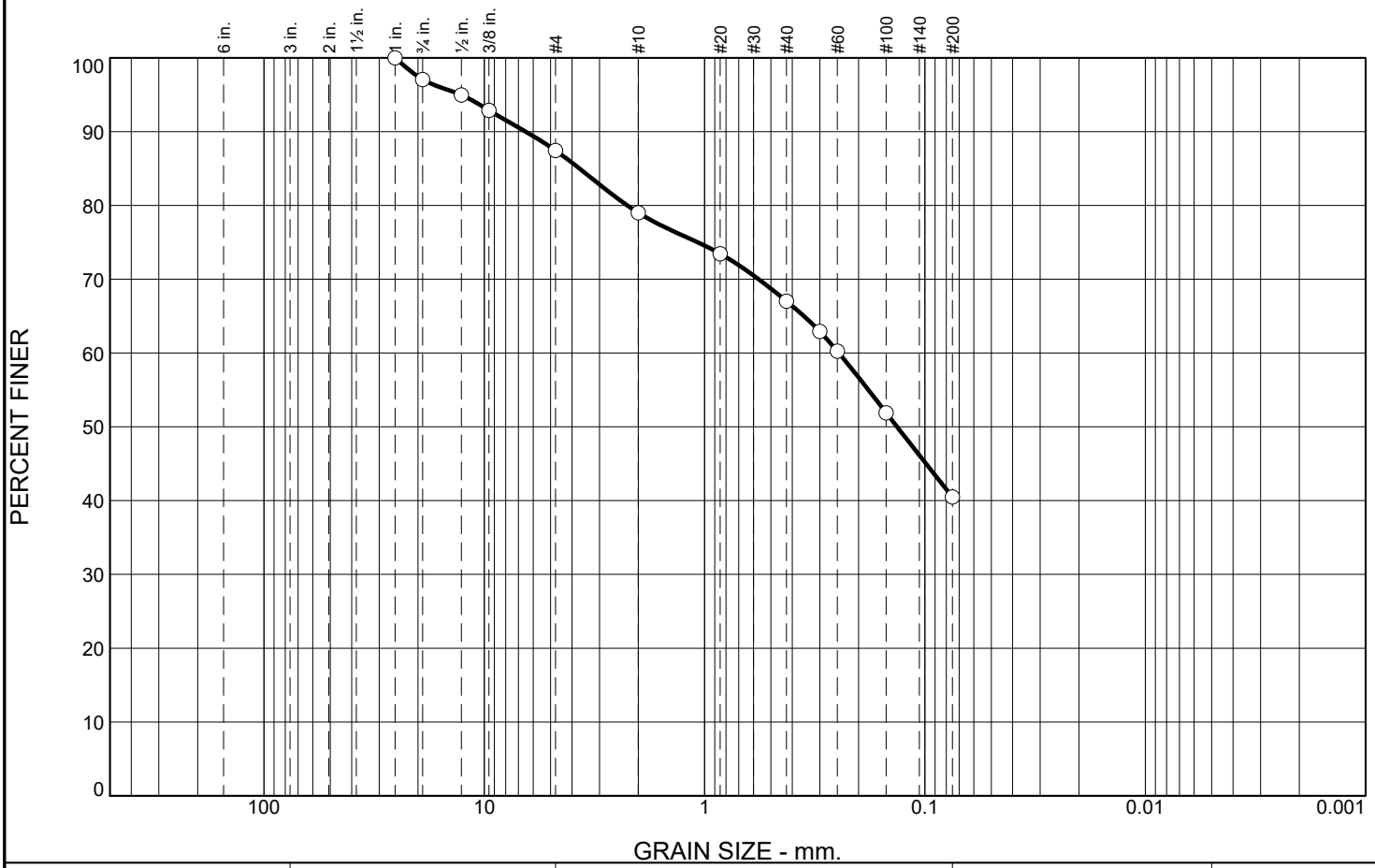
Sample No.: L29513 **Source of Sample:** 85 West Double Rings - Northboro **Date:** 1/20/21
Location: DR-105 **Elev./Depth:** 18" BSG

YANKEE ENGINEERING & TESTING, INC.

Client: WDA Design Group
Project: WDA Design Group
Various Projects/Sites
Project No: 2020.5

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	12.6	46.9	40.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	97.1		
1/2"	95.0		
3/8"	92.9		
#4	87.4		
#10	79.0		
#20	73.5		
#40	67.0		
#50	62.9		
#60	60.3		
#100	51.9		
#200	40.5		

* (no specification provided)

Material Description

Brown silty sand little gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 3.6953 D_{60}= 0.2460 D_{50}= 0.1338
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Sampled by Joel Morin 1/15/20
See infiltration reports for additional information

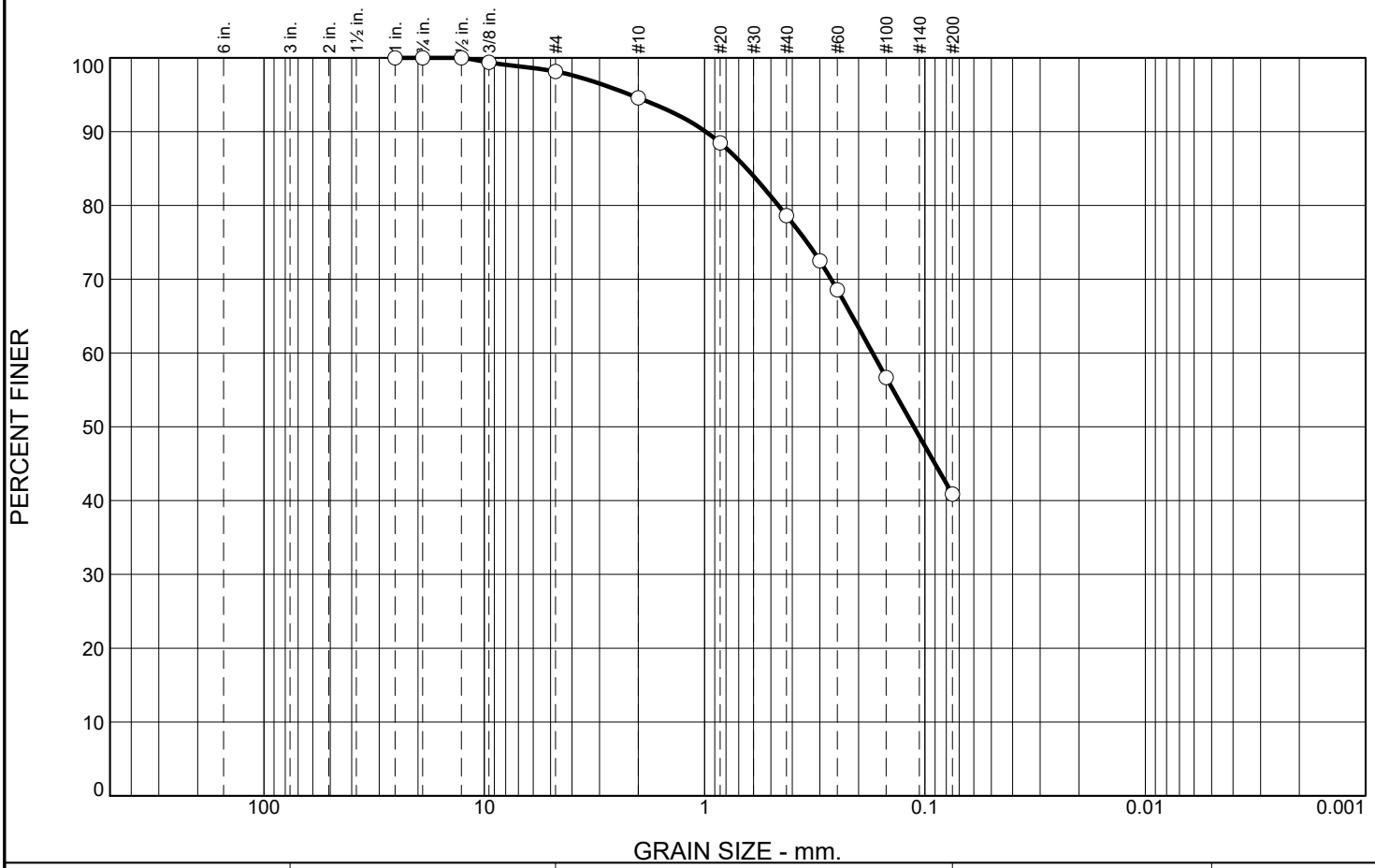
Sample No.: L29514 **Source of Sample:** 85 West Double Rings - Northboro **Date:** 1/20/21
Location: DR-106 **Elev./Depth:** 18" BSG

YANKEE ENGINEERING & TESTING, INC.

Client: WDA Design Group
Project: WDA Design Group
Various Projects/Sites
Project No: 2020.5

Tested By: AK **Checked By:** SMM

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	1.8	57.3	40.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	99.4		
#4	98.2		
#10	94.6		
#20	88.5		
#40	78.6		
#50	72.5		
#60	68.6		
#100	56.7		
#200	40.9		

* (no specification provided)

Material Description

Brown silty sand trace gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{85}= 0.6441 D_{60}= 0.1728 D_{50}= 0.1122
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Sampled by Joel Morin 1/15/20
See infiltration reports for additional information

Sample No.: L29516 **Source of Sample:** 85 West Double Rings - Northboro **Date:** 1/20/21
Location: DR-200 **Elev./Depth:** 18" BSG

YANKEE ENGINEERING & TESTING, INC.

Client: WDA Design Group
Project: WDA Design Group
Various Projects/Sites
Project No: 2020.5

Tested By: AK **Checked By:** SMM

DRAWING KEY

C2.01 | C3.00 | C3.02

BASIS OF BEARINGS: MASSACHUSETTS STATE PLANE COORDINATE SYSTEM, MAINLAND ZONE

LOCUS MAP
N.T.S.

INTERSTATE ROUTE 290 · CHURCH STREET · CRAWFORD STREET · WEST STREET · LOCUS

REV.	DATE	DESCRIPTION	INIT.
B	12/14/20	CON. COM. COMMENTS	GBS
A		INITIAL ISSUE	GBS

COMMONWEALTH OF MASSACHUSETTS · GREGORY BRIAN SCOTCHIE · CIVIL · No. 52510 · REGISTERED PROFESSIONAL ENGINEER

12/14/20

PREPARED BY:

WDA DESIGN GROUP
31 EAST MAIN STREET WESTBOROUGH, MA
508.366.6552
WDA-DG.COM

OWNER:
Brant L. Viner & Margaret Harling
P.O Box 295
Ellsworth, ME 04605

PREPARED FOR:
Brant L. Viner & Margaret Harling
P.O Box 295
Ellsworth, ME 04605

TITLE:
GRADING, DRAINAGE, & UTILITY PLAN

85 & 98 COMMON DRIVEWAY
85 & 95 West Street
Northborough, MA 01532
(Worcester County)

NOTICE OF INTENT

0 50 100 Feet

JOB NO.:	1207.03	DATE:	11/20/20
DWN. BY:	GBS	SHEET:	C3.00
CHK'D. BY:	BPW/JRW		

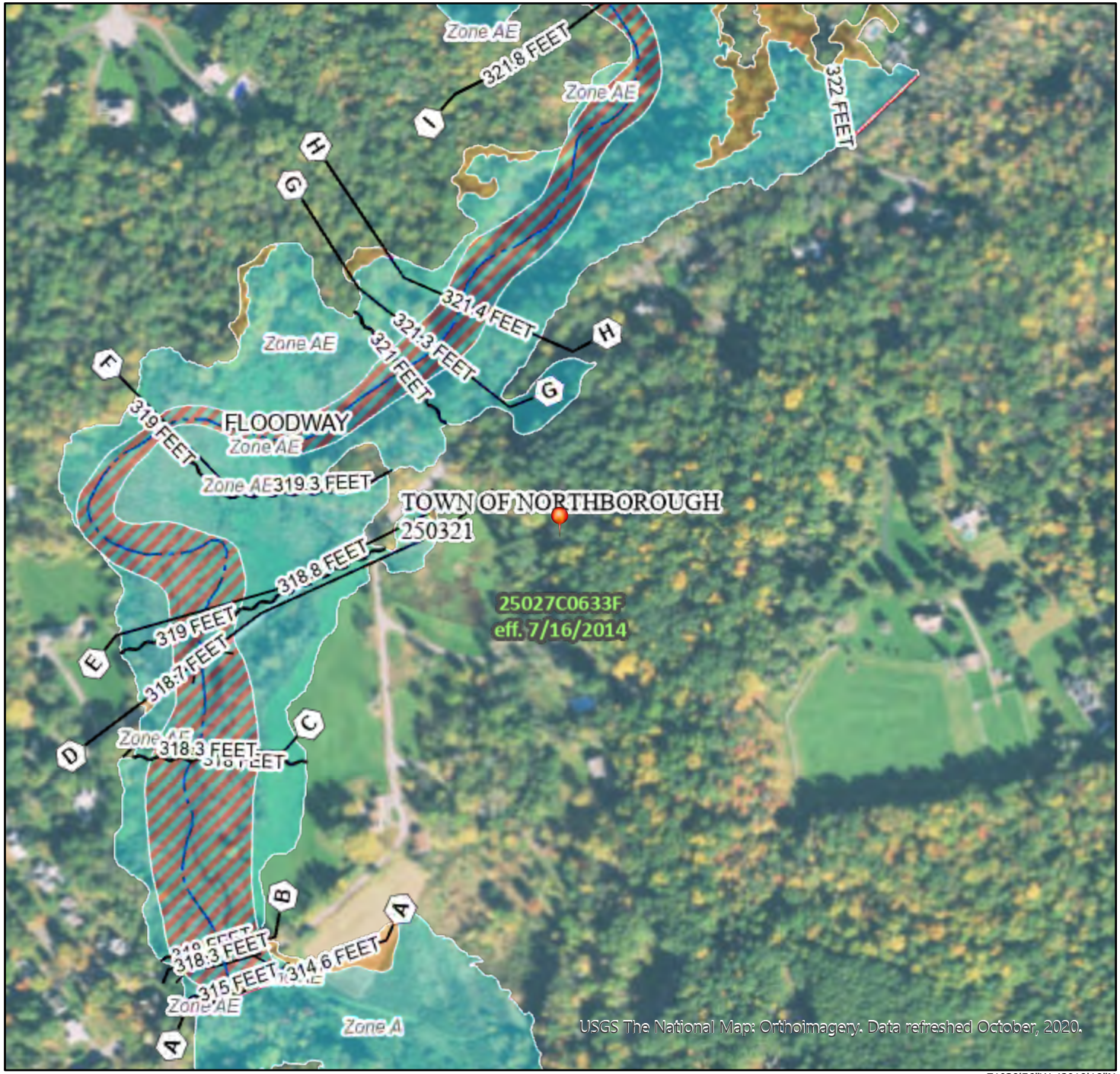
C3.00.dwg

* = PERMEABILITY TEST (5)
A = DEEP TEST HOLE
● = PERC TEST

National Flood Hazard Layer FIRMette

FEMA

71°40'33"W 42°19'37"N



71°39'56"W 42°19'10"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

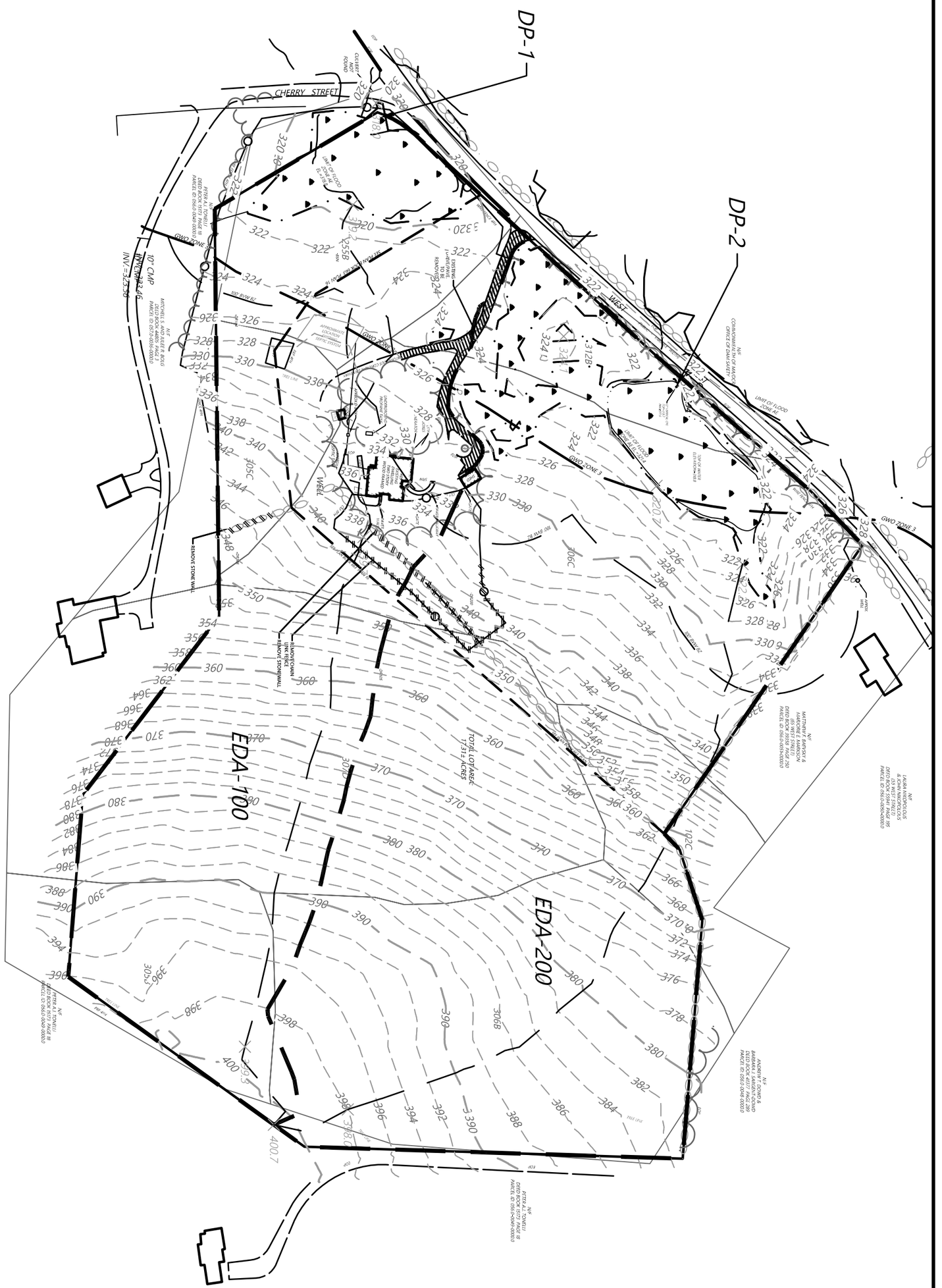
N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/13/2020 at 10:14 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



PREPARED BY:

WDA DESIGN GROUP

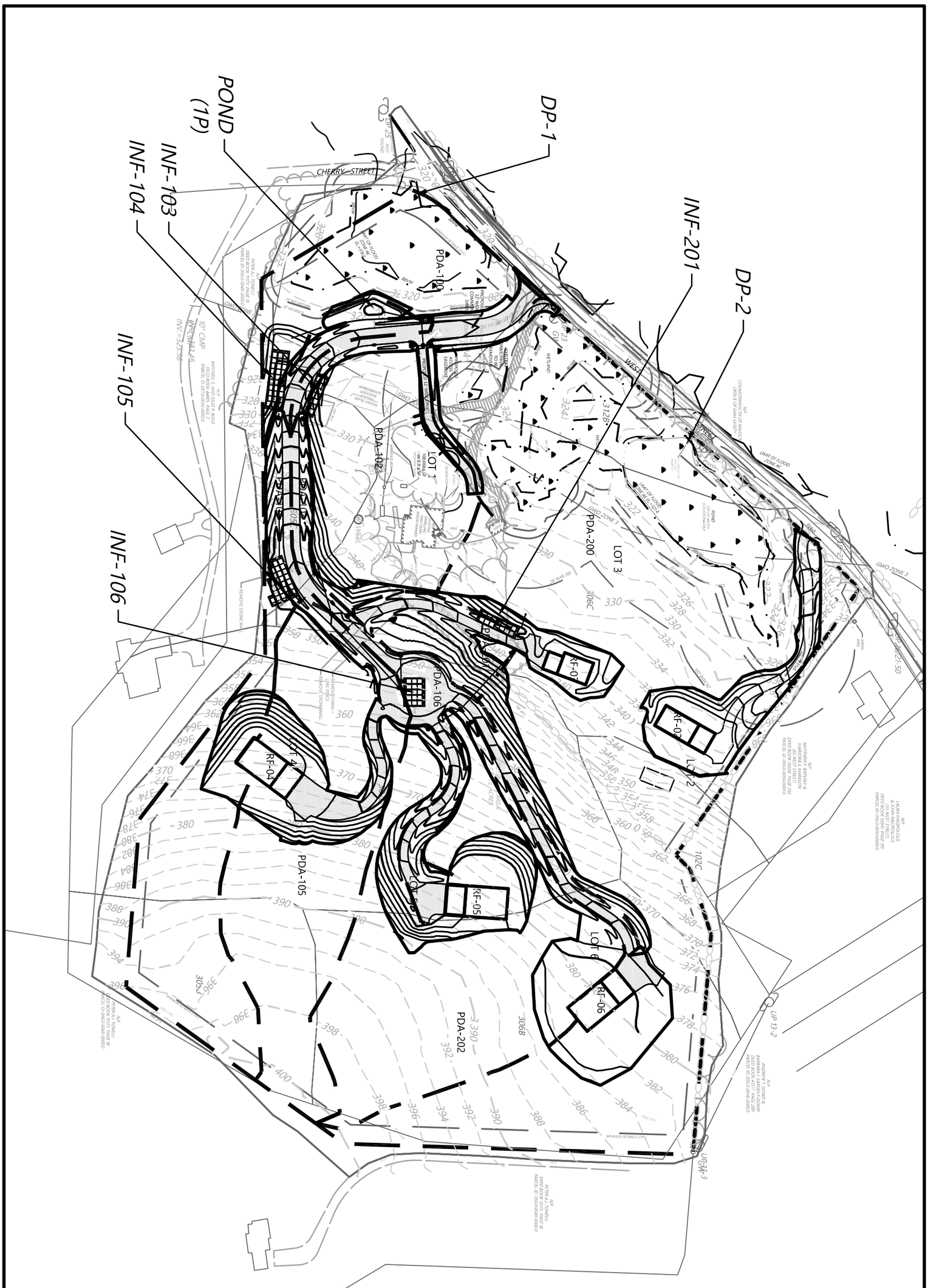
31 EAST MAIN STREET WESTBOROUGH, MA | 508.366.6552
7 CENTRAL STREET PROVIDENCE, RI | 401.274.1360
WDA-DG.COM

TITLE:	EXISTING HYDROLOGY 85 & 95 West Street Northborough, MA 01532
OWNER:	Brant L. Viner & Margaret Harling P.O Box 295 Ellsworth, ME 04605
PREPARED FOR:	Brant L. Viner & Margaret Harling P.O Box 295 Ellsworth, ME 04605

DATE: 11/13/2020 JOB NO.: 1207.03 REV. NO.: _____-_
DRAWN BY: ___ FILE NO.: 1207350-Existing HydroCAD.dwg REV. DATE: __/__/__

0 120 240 360

1207350 - Existing HydroCAD.dwg



PREPARED BY:

WDA DESIGN GROUP

31 EAST MAIN STREET WESTBOROUGH, MA | 508.366.6552
7 CENTRAL STREET PROVIDENCE, RI | 401.274.1360
WDA-DG.COM

TITLE:	PROPOSED HYDROLOGY 85 & 95 West Street Northborough, MA 01532
OWNER:	Brant L. Viner & Margaret Harling P.O Box 295 Ellsworth, ME 04605
PREPARED FOR:	Brant L. Viner & Margaret Harling P.O Box 295 Ellsworth, ME 04605
DATE: ----	JOB NO.: 1207.03 REV. NO.: ____-__
DRAWN BY: __	FILE NO.: 1207350-Existing HydroCAD.dwg REV. DATE: __/__/__

0 120 240 360

1207350 - Proposed HydroCAD.dwg