HIGHPOINT

STORMWATER MANAGEMENT ANALYSIS

Dog Park | Memorial Drive | Ashland, MA

Project Address:	Memorial Drive Ashland, MA 01721
Date Prepared:	October 18, 2024
Project Number:	24018

COMMONWEALTH OF MASSACHUSETTS
DOUGLAS J. HARTNETT
CIVIL
No. 37796
REGISTERED PROFESSIONAL ENGINEER
10-18-2024

Prepared for:	Radner Design Associates, Inc. 3 Allied Drive, Suite 303 Dedham, MA 02026
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INTRODUCTION

This analysis summarizes pre- and post-development stormwater impacts associated with the construction of a dog park and associated site features (the Project) located at Memorial Drive (the Subject Property) in Ashland, Massachusetts. The Subject Property is shown on the Town of Ashland's Assessor's Map 19 as Parcel 13-138, along with other properties as listed on the Certified Abutter's List.

The Subject Property comprises approximately 122.5 ± acres of land area and is located within the Rail Transit District "C" and Rail Transit District "E". The Subject Property is bounded by Memorial Drive (MBTA Access Road) to the south and west, the Upper Charles Trail to the east, a wetland complex to the north and the Nyanza superfund cap site to the northwest. There is no access to the Subject Property currently.

The Subject Property is currently a wooded vacant lot part of larger parcel owned by the Town of Ashland. The Upper Charles Trail is located on the property which runs from Memorial Drive to Megunko Road.

Runoff from ground surfaces of the developed portion of the Subject Property flows over land in a predominantly northern direction.

Work associated with the Project includes:

- Construction of a dog park consisting of a large dog area and small dog area. The large dog area being 16,000 square feet consisting of a rice stone surface and the small dog area being 2,000 square feet consisting of a rice stone surface.
- Construction of a concrete pad including a dog receptacle, water bottle filler/bubbler, and benches.
- Construction of one paved access driveway servicing 20 parking spaces. The vehicular parking spaces consist of standard bituminous pavement.
- Construction of landscape and hardscape improvements, including a bituminous pavement sidewalk connecting a new crosswalk on Memorial Drive to the dog area entrance.
- Construction of a drainage basin that will provide treatment and detention for the pavement areas.
- Construction of a water line to service the water bottle filler/bubbler.

For detailed information regarding existing site conditions and proposed development, refer to the plans entitled, "Ashland Dog Park, Memorial Drive, Ashland, Massachusetts 01721," dated October 1, 2024 prepared by Radner Design Associates, Inc.

METHODOLOGY

The hydrologic analysis models the pre- and post-development stormwater characteristics for the Project and compares changes in peak rate of runoff and water quality associated with the proposed development. Where increases to peak rate of runoff or reductions in water quality are identified, Stormwater Best Management Practices (BMPs) and Low Impact Development (LID) techniques are considered. The analysis shall demonstrate that post-development hydrologic conditions generally mimic pre-development hydrologic conditions; that any potential impacts to downstream properties, infrastructure, or environmentally sensitive areas are mitigated; and that all local and state stormwater management standards are met.

The pre-development hydrologic model establishes the limits of the study area and down-gradient Points of Analysis (POAs), which are dependent on topographic and environmental conditions. The model quantifies sub-watershed stormwater runoff characteristics related to topography, land use/cover types and soil conditions, computing peak runoff rates for specific design storm frequencies under pre-development conditions at the POAs.

The post-development hydrologic model analyzes the same study area, and accounts for changes in sub-watershed area topography and land use/cover types associated with the proposed development. The model computes the changes to the peak runoff rates at the same POAs, and BMPs are implemented to mitigate stormwater impacts due to development. In addition, BMP's are also implemented to improve water quality and reduce Total Suspended Solid (TSS) pollutant concentrations to satisfy stormwater regulation requirements for the new construction.

For this analysis one (1) POA has been established including:

- POA A: The wetland complex in the northern part of the Site.

The hydrologic model, analysis, and proposed mitigation measures have been developed using the following resources:

- Hydrologic modeling techniques and methods established in NRCS - Technical Releases No. 20 and No. 55 (TR-20 and TR-55) using proprietary HydroCAD® stormwater modeling software.
- Massachusetts Department of Environmental Protection – Stormwater Handbook Volumes #1, #2, and #3 (as amended).
- NRCS "Engineering Field Handbook Part 650," Chapter 2 – Estimating Runoff and Peak Discharges.

RAINFALL DATA

Peak stormwater discharges have been determined for total rainfall estimated for the 2, 10, and 100-year storm event recurrence intervals. For this analysis, the values used for the 24-hour rainfall calculations were taken from the NOAA Atlas 14, Volume 10, Version 3 (see Appendix C for rainfall data table excerpt). The rainfall depths for all storm events for Ashland are outlined in Table 1.

Table 1. – Summary of Rainfall Data

Reference	Rainfall Recurrence Interval	24 Hour Rainfall Depth
NOAA Atlas 14, Volume 10, Version 3	2-Year Storm	3.35 inches
	10-Year Storm	5.24 inches
	100-Year Storm	8.22 inches

SOILS DATA

Based upon the USDA – NRCS Soil Conservation Service (SCS) Web Soil Survey for Middlesex County, soils underlying the Project site (excluding surface water bodies) are classified as follows:

Table 2. – Summary of USDA Soil Classification

Soil Classification	Hydrologic Soil Group (HSG)
Narragansett silt loam, 3 to 8 percent slopes	A

Subsurface investigations comprising three (3) hand dug test pits were conducted throughout the developed portion of the Subject Property by Highpoint Engineering, Inc. on May 31, 2024.

Groundwater was observed in one (1) of the test pits, and evidence of seasonal high water was observed at a depth of 17” below grade. The surface detention basin is designed to depths extending into the parent soils and are a minimum of 2’ above the estimated seasonal high groundwater elevation at all locations.

PRE-DEVELOPMENT CONDITIONS

The portions of the Subject Property subject to this analysis comprise of one (1) watershed area as described below and analyzed at one (1) POA described in the "Methodology" section in this report. Existing watershed areas include:

- E-1 – A 63,859 sf area comprising existing woodlands. Runoff from this watershed flows over land into the wetland complex.

Refer to the Pre-Development Watershed Plan under Figures for information and limits of the existing watershed areas.

For the pre-development watershed analysis, Table 3 presents a summary of the watershed areas, the weighted TR-55 runoff curve numbers (CN – based on ground cover types), and Times of Concentration (T_c) for the existing Watershed Areas:

Table 3. – Pre-Development Watershed Areas and Runoff Curve Numbers

	E-1
Area	63,859 ft²
CN	36
T_c	7.4 min

POST-DEVELOPMENT CONDITIONS

The project proposes to construct a dog park consisting of a large and small dog area along with associated site improvements, including the following:

- Construction of a concrete pad including a dog receptacle, water bottle filler/bubbler, and benches.
- Construction of one paved access driveway servicing 20 parking spaces. The vehicular parking spaces consist of standard bituminous pavement.
- Construction of landscape and hardscape improvements, including a bituminous pavement sidewalk connecting a new crosswalk on Memorial Drive to the dog area entrance.
- Construction of a drainage basin that will provide treatment and detention for the pavement areas.
- Construction of a water line to service the water bottle filler/bubbler.

New drainage and utility infrastructure will be constructed to service the Project; currently no stormwater management facilities or infrastructure exist on site. The total impervious land cover of the affected Project area under post-development conditions is 9,506 ft^2 as compared to none under existing conditions, thus resulting in a 9,506 ft^2 increase in impervious area. The 2, 10, and 100-year storm events will be mitigated for peak runoff through implementation of a surface stormwater detention/infiltration basin.

The Subject Property comprises three (3) proposed watershed areas.

- P-1 – A 14,318 ft^2 area comprising paved parking, lawn/landscape, and infiltration basin. Runoff from this watershed flows into a new stormwater BMP comprising one sediment forebay and an Infiltration Basin (SWM-1).
- P-2 – A 36,615 ft^2 area comprising existing woods, lawn/landscape, and a concrete walk. Runoff from this watershed flows overland into the wetland area (POA).
- P-3 – A 12,926 ft^2 area comprising of rice stone/gravel surface (SWM-2) and a concrete pad. Runoff from this watershed infiltrates into the rice stone and ultimately flows overland into the wetland area (POA).

Table 4 presents a comparison of watershed area, the weighted TR-55 runoff curve number (CN – based on ground cover types), and Time of Concentration (T_c) for the proposed watersheds:

Table 4. – Post-Development Watershed Areas and Runoff Curve Numbers

	P-1	P-2	P-3
Area	14,318 ft^2	36,615 ft^2	12,926 ft^2
CN	71	37	71
T_c	6.0 min	10.7 min	7.1 min

STORMWATER MITIGATION

The stormwater improvements were designed to meet the requirements of the Massachusetts Stormwater Handbook to provide the required water quality pretreatment of 0.5 inch of runoff for discharge to the various on-site vegetated wetland systems and Subject Property limits. All surface and subsurface detention/infiltration systems are designed to drain completely in less than 72 hours, are located outside lines of influence from proposed building foundations and are geometrically coordinated with proposed site features and utility infrastructure.

The Project will result in a 9,506 sf net increase in impervious site area. The stormwater management system and BMPs proposed for the Project are designed to mitigate water quantity and quality impacts prior to discharge to the adjacent vegetated wetland systems, and Subject Property limits. The Project results in either no changes or net decreases in peak runoff rates generated by all storm events at all POAs up to and including the 100-year storm. The proposed drainage collection system is designed to adequately collect and convey the 25-year storm event.

The following is a summary of the drainage infrastructure and BMPs selected for the Project:

- One (1) surface vegetated stormwater detention/infiltration basin with a vegetated sediment forebay to provide pre-treatment for parking lot runoff. The infiltration basin provides 1.07 feet of freeboard.

The increase in impervious area is mitigated via the implementation of surface detention/infiltration systems. Table 5 summarizes the pre- and post-development peak rates of runoff at the POAs for the Project after implementation of the selected stormwater BMPs for the NRCS rainfall events.

Table 5. – Summary of Pre- and Post-Development Peak Rates of Runoff

Design Storm	POA A (Wetland - West)		
	Pre-Dev	**Post-Dev**	**Change**
2 Year	0.00 cfs	0.00 cfs	0.00 cfs
10 Year	0.01 cfs	0.01 cfs	0.00 cfs
100 Year	1.07 cfs	0.65 cfs	-0.42 cfs

Refer to Appendix C for TSS removal rates for each treatment train. The proposed TSS removal rates meet the Massachusetts Stormwater Policy Guidelines' minimum removal rate of 80% prior to surface or groundwater discharge.

Construction-Phase and Long-Term Stormwater Operation and Maintenance Plans (O&M Plans) have been included in Appendix D of this report and include information on the responsible party for the O&M plan implementation, a project overview, and the structural and non-structural BMPs to be utilized on site.

CONCLUSION

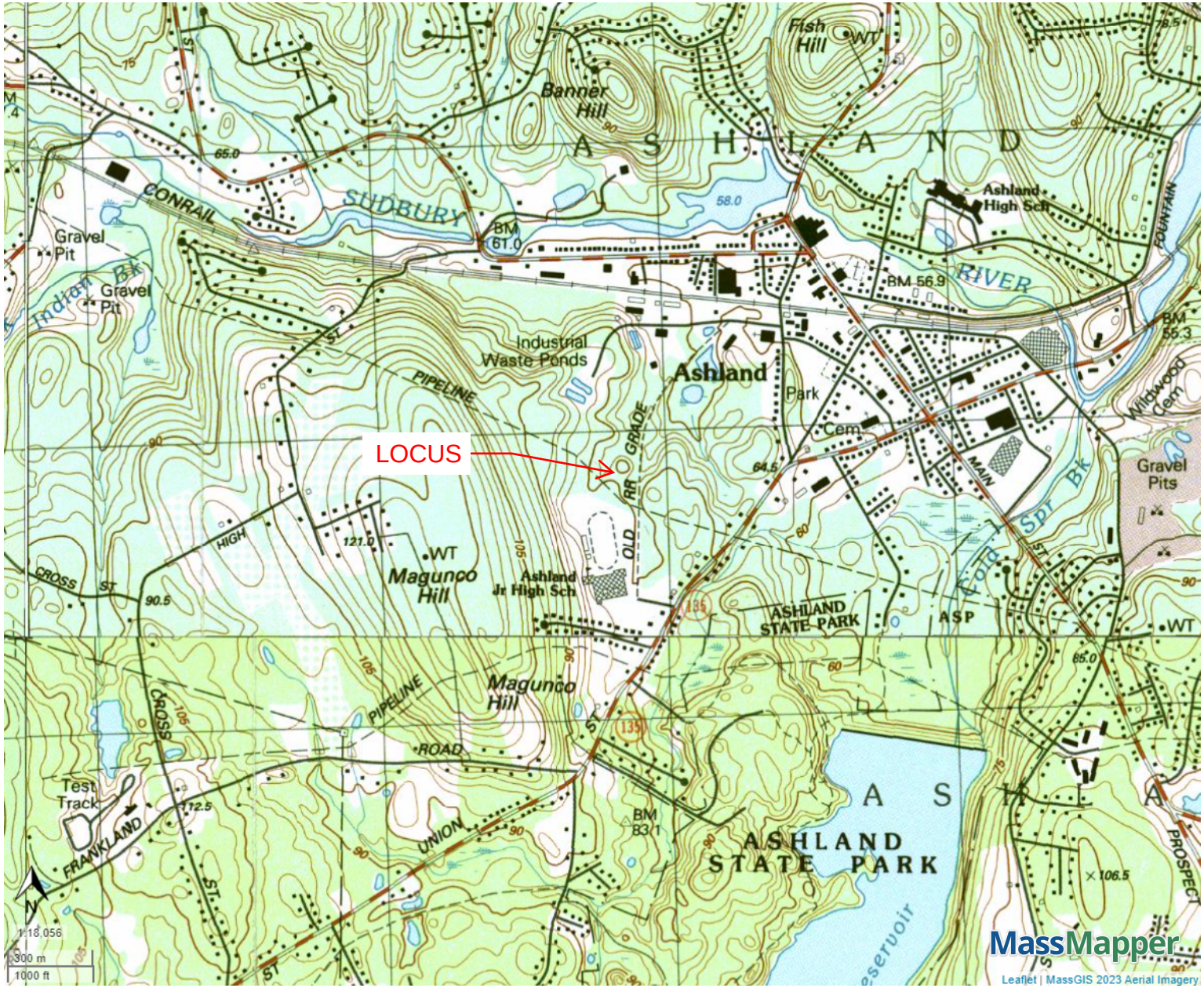
The Project will improve existing runoff patterns and off-site discharge locations of the Subject Property and will improve discharge conditions through implementation of stormwater infiltration BMPs and reduction of the volume of uncontrolled and untreated off-site runoff. The Project will also implement water quality treatment measures, and those measures will be maintained under a long-term stormwater operation and maintenance plan. Potential stormwater impacts associated with the development will be mitigated as required by State and Municipal Regulations.

The Project will comply with Standards outlined in the Massachusetts Stormwater Management Handbook as follows:

STANDARD **1**	No New Untreated Discharges	Water quality mitigation is proposed to treat discharge impacts at all new discharge points throughout the Project.
STANDARD **2**	Peak Rate Attenuation	Calculations are provided showing post-development peak discharge rates do not exceed pre-development rates for the 2-, 10-, and 100-year 24-hour storm events at all POAs.
STANDARD **3**	Recharge	The required recharge volume for A soils is provided below the outlet elevations of the proposed surface detention/infiltration basins.
STANDARD **4**	Water Quality	Sediment forebays and surface and subsurface infiltration BMPs have been sized to treat 0.5 inch of water quality volume and achieve a minimum 80% TSS removal rate prior to infiltration.
STANDARD **5**	Land Uses with Higher Potential Pollutant Loads	The proposed project is not a listed activity associated with a LUHPPL as defined in the Handbook.
STANDARD **6**	Critical Areas	The Project Site is not located within a critical area.
STANDARD **7**	Redevelopments and Other Projects Subject to the Standards only to the Maximum Extent Practicable	The proposed project is considered a New Development. Stormwater management facilities and BMP designs are completed in full compliance with DEP guidance for New Development projects.
STANDARD **8**	Construction Period Pollution Prevention and Erosion and Sedimentation Control	The project may be required to obtain an EPA - NPDES Construction General Permit (CGP) prior to construction. A Stormwater Pollution Prevention Plan (SWPPP) will be prepared and filed with the EPA.
STANDARD **9**	Operation & Maintenance Plan	Construction Phase and Long-Term Operation and Maintenance (O&M) Plans are included in Appendix D.
STANDARD **10**	Prohibition of Illicit Discharges	A No Illicit Discharge Compliance Statement will be submitted by the Owner prior to the discharge of any stormwater to post-construction BMP's.

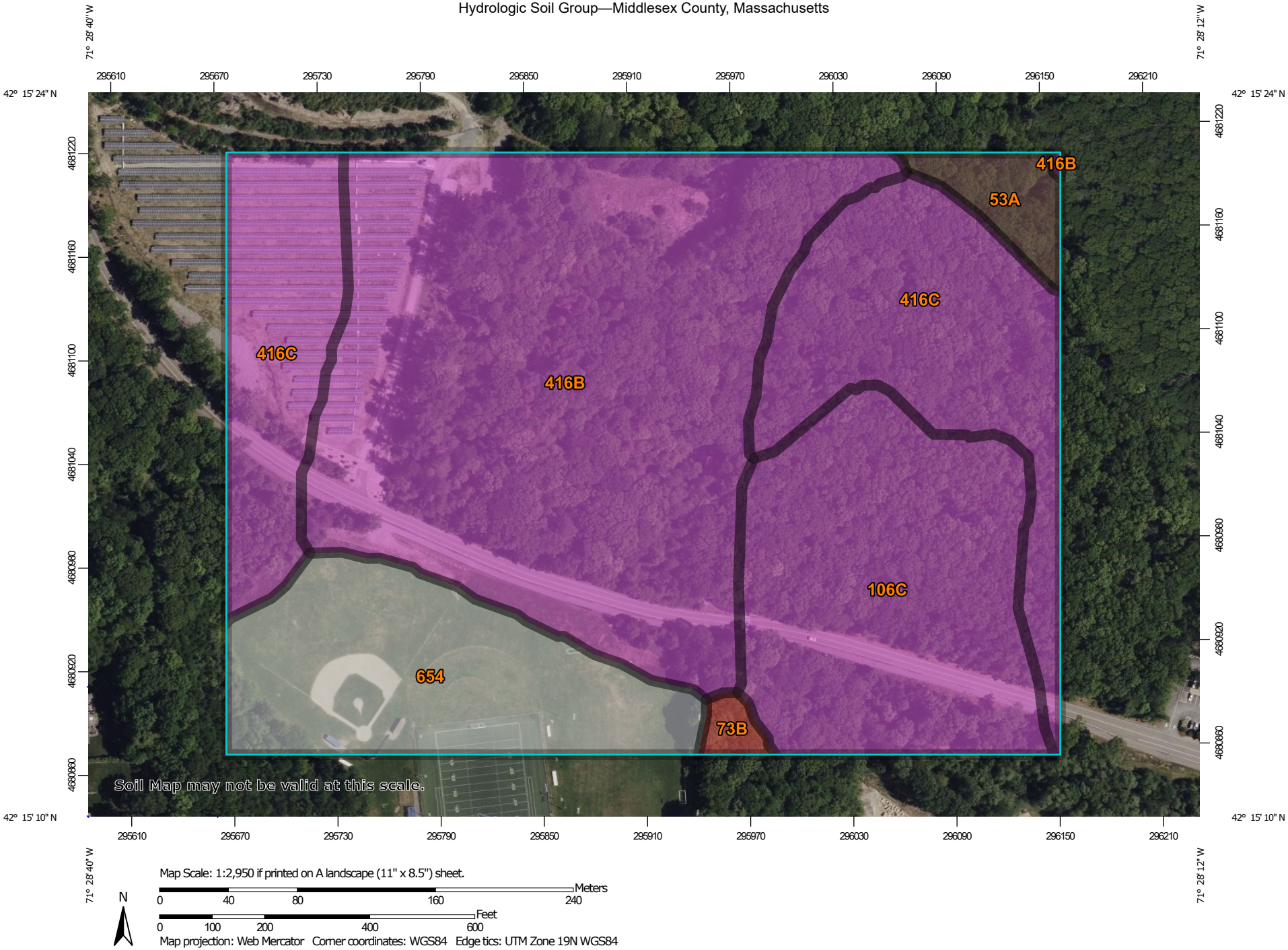
FIGURES

USGS - Ashland



USGS Topographic Maps

Property Tax Parcels



Map Scale: 1:2,950 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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
53A	Freetown muck, ponded, 0 to 1 percent slopes	B/D	0.9	2.2%
73B	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D	0.3	0.7%
106C	Narragansett-Hollis-Rock outcrop complex, 3 to 15 percent slopes	A	7.9	18.8%
416B	Narragansett silt loam, 3 to 8 percent slopes, very stony	A	17.7	42.1%
416C	Narragansett silt loam, 8 to 15 percent slopes, very stony	A	9.5	22.6%
654	Udorthents, loamy		5.7	13.6%
Totals for Area of Interest			**42.0**	**100.0%**

LEGEND

234	SURFACE CONTOUR	208.8 WFA2	LIMIT OF BORDERING VEGETATED WETLAND WITH FLAG NUMBER AND ELEVATION
	STONE WALL		LIMIT OF 100-FOOT WETLAND BUFFER ZONE
	METAL GUARDRAIL		EDGE OF GRAVEL ROAD
	EDGE OF PAVEMENT	× 232.6	SPOT ELEVATION
	WIRE FENCE		LIGHT POLE
	EDGE OF WOODED AREA		BOLLARD
8"D	SEWERLINE & MANHOLE WITH PIPE SIZE, MATERIAL & FLOW DIRECTION		SIGN
12"RCP	DRAINLINE WITH PIPE SIZE, MATERIAL & FLOW DIRECTION, CATCHBASIN, MANHOLE & ROUND CATCHBASIN	BM	BENCHMARK
W 6"CI	WATER MANHOLE, WATER MAIN WITH SIZE, TEE, GATE VALVE & FIRE HYDRANT	CB	CATCH BASIN
G 10"DI	GAS MAIN WITH SIZE & GATE VALVE	SMH	SEWER MANHOLE
#181 OHW	EXISTING UTILITY POLE WITH DESIGNATION OVERHEAD WIRES AND GUY POLE	BB	BITUMINOUS BERM
		BIT.	BITUMINOUS
		CI	CAST IRON
		CMP	CORRUGATED METAL PIPE
		CONC.	CONCRETE
		HH	HAND HOLE

PVC	POLYVINYL CHLORIDE
(R)	RECORD
(R/H)	RECORD AND HELD
RCP	REINFORCED CONCRETE PIPE
GC	VERTICAL GRANITE CURB
○○○	LINE OF WOODEN POSTS

NAD27

MBTA ACCESS ROAD
aka MEMORIAL DRIVE
50' WIDE PUBLIC 2000 LAYOUT

NOW OR FORMERLY
TOWN OF ASHLAND
DEED BOOK 72181, PAGE 234

NOW OR FORMERLY
APPLE RIDGE REALTY TRUST
DEED BOOK 22694, PAGE 263

NOW OR FORMERLY
TOWN OF ASHLAND
DEED BOOK 10313, PAGE 202

SHELL OIL COMPANY, INC. (150' WIDE) EASEMENT
RAIL TRANSIT DISTRICT "E"
EASEMENT PARCEL A-25

25' NO DISTURB BUFFER
100' WETLAND BUFFER

TP#3
FG=239.0
BOT.=237.0
GW=237.58 (17")

TP#2
FG=241.8
BOT.=239.5
GW=NONE OBSERVED

TP#1
FG=244.2
BOT.=242.0
GW=NONE OBSERVED

27'-0"
67'-0"
75'-0"
44'-2"

DENSE TREES
WOODED

NOTES:

1. WETLAND SERIES WF A-200 THROUGH WF A-223 SHOWN HEREON WERE DELINEATED IN JULY OF 2022 AND FIELD LOCATED BY THIS OFFICE. PORTION OF GREYSCALED WETLANDS SHOWN HEREON (NORTH OF CURRENT SURVEYED WETLANDS FLAGS) WERE DELINEATED BY WETLANDS PRESERVATION INC. AND LOCATED BY FIELD SURVEY IN NOVEMBER 2006 AND 2016. ADDITIONAL WETLANDS SHOWN HEREON AS 'APPROXIMATE WETLAND BOUNDARY' WERE FIELD LOCATED DURING PRIOR SURVEY.
2. AERIAL TOPOGRAPHY PROVIDED BY COL-EAST, INC. (DATE OF PHOTOGRAMMETRY: NOVEMBER 29, 2000) AND WAS UTILIZED FOR THE 2' INTERVAL TOPOGRAPHY NORTHERLY OF THE NORTH LIMITS OF THE ROADWAY AND SHOWN HEREON SHOWN IN GREY-SCALE.
3. THE PROJECT SOURCE BENCHMARK IS A MONEL RIVET SET ON A BASE STONE IN A STONE WALL LOCATED ON THE NORTHERLY SIDE OF THE SUDBURY RIVER AND DENOTED NUMBER 68E-12B BY THE MASS HIGHWAY DEPT. (LOCATED AT N 460282 E 607032)
4. VERTICAL DATUM: NGVD OF 1929.
5. HORIZONTAL DATUM: NAD27, MASS MAINLAND ZONE
6. UNDERGROUND UTILITIES SHOWN HEREON ARE COMPILED FROM FIELD LOCATIONS OF STRUCTURES AND FROM AVAILABLE RECORD INFORMATION ON FILE AT THE TOWN ENGINEERING OFFICES, TOWN D.P.W., MASS HIGHWAY DEPT. AND UTILITY COMPANIES. OTHER UNDERGROUND UTILITIES MAY EXIST. IT SHALL BE THE RESPONSIBILITY OF THE DESIGN ENGINEER AND THE CONTRACTOR TO VERIFY THE LOCATION, SIZE & ELEVATION OF ALL UTILITIES WITHIN THE AREA OF PROPOSED WORK AND TO CONTACT "DIG-SAFE" AT 811 AT LEAST 72 HOURS PRIOR TO ANY EXCAVATION, DEMOLITION OR CONSTRUCTION.
7. SEE PLAN NO. 966 OF 2006 RECORDED AT THE SOUTHERN DISTRICT OF THE MIDDLESEX COUNTY REGISTRY OF DEEDS FOR COMPLETE BOUNDARY MATHEMATICS.
8. THE PURPOSE OF THIS PLAN IS TO BRING IN NEWLY FLAGGED BORDERING VEGETATIVE WETLAND FLAGS INTO AERIAL TOPOGRAPHY (2' INTERVAL FROM 2000) BETWEEN THE FLAGS AND THE NORTH SIDE OF THE ROAD. ADDITIONALLY, NEW TOPOGRAPHY (1' CONTOUR INTERVAL) WAS FIELD SURVEYED FROM THE NORTH SIDE OF THE ROAD UP TO THE NEW LOCATION OF THE FENCE TO THE BASEBALL FIELD.
9. AS OF THE REVISION DATE OF THIS PLAN THE ASHLAND WATER DEPARTMENT HAS ONLY SUPPLIED A VERBAL LOCATION OF THE WATER LINE. WATER LINE SHOWN IS APPROXIMATE ONLY AND SHOULD BE VERIFIED.

REFERENCES:

DEED BOOK 72181 PAGE 234
DEED BOOK 10313 PAGE 202
DEED BOOK 22694 PAGE 263

PLAN 1911 OF 1986
PLAN 165 OF 1981
PLAN 984 OF 1996
PLAN 258 OF 1983
PLAN 153 OF 1997
PLAN 1107 OF 1979
PLAN 548 OF 1978
PLAN 464 OF 1977
PLAN 1464 OF 1978

L.C.C. #66541
L.C.C. #6654J
L.C.C. #6654G

A PLAN ENTITLED: "PLAN OF LAND, ASHLAND, MASS.", PREPARED FOR DEPARTMENT OF THE ARMY NEW ENGLAND CORPS OF ENGINEERS, PREPARED BY: FUSS & O'NEILL, INC., MANCHESTER,

PLAN 162 OF 1981
PLAN 1139 OF 2000
PLAN 966 OF 2006

DWG: 26256-ASHLAND-BARK-PARK-TO-2022-09-15-WB(2).dwg

SCALE: 1" = 20'
0 20 40 80

SITE ADDRESS:

MEMORIAL DRIVE
(aka MBTA ACCESS RD.)
ASHLAND, MA 01721

PREPARED FOR:

TOWN OF ASHLAND
100 MAIN STREET
ASHLAND, MA 01721

HANCOCK ASSOCIATES

Civil Engineers

Land Surveyors

Environmental Consultants

315 Elm Street, Marlborough, MA 01752
Voice (508) 460-1111, Fax (508) 460-1121
www.hancockassociates.com

NO.	BY	APP	DATE	ISSUE/REVISION DESCRIPTION
2	CMC	JDB	9/15/22	GENERAL REVISIONS
1	CMC	JDB	8/8/22	REVISE PLAN SCALE

DATE: 7/25/22 DRAWN BY: CMC
SCALE: 1" = 20' CHECK BY: JDB

LIMITED TOPOGRAPHIC PLAN

TEST PIT LOCATION PLAN

PLOT PATH: - Dog

LAYOUT: EC
SHEET: 1 OF 1

TO

PROJECT NO.: 26256

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

TBD
Owner Name

MBTA Access Road
Street Address

Map/Lot #

Ashland
City

MA
State

01721
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade

2. Soil Survey — USDA Soil Survey Website (Source); 416B (Soil Map Unit); Narragansett Silt Loam - 3-8% slopes (Soil Series)

Ground moraines back/side slopes
Landform

Well-drained
Soil Limitations

Friable loamy/silty eolian deposits over loose & sandy glaciofluvial deposits and/or friable sandy basal till
Soil Parent material

3. Surficial Geological Report — 2018 - USGS (Year Published/Source); Gravel & Swamp (Map Unit)

East side of the site is predominantly sandy loam. The west side of the site is indicated as swamp area.
Description of Geologic Map Unit:

4. Flood Rate Insurance Map — Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☒ Yes ☐ No — If yes, MassGIS Wetland Data Layer: Wooded Marsh (Wetland Type)

7. Current Water Resource Conditions (USGS): June 3, 2024 (Month/Day/ Year) Range: ☐ Above Normal ☐ Normal ☒ Below Normal

8. Other references reviewed:
(Zone II, IWPA, Zone A, EEA Data Portal, etc.)

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-1 (Hole #) | 5/29/2024 (Date) | 12:00 PM (Time) | Sunny - 75° (Weather) | (Latitude) | (Longitude)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Dense trees & underbrush (Vegetation) | (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-10% (Slope (%))

Description of Location: Lot is currently undeveloped and has no access.

2. Soil Parent Material: Friable loamy/silty eolian deposits over loose & sandy glaciofluvial deposits and/or friable sandy basal till | Ground moraines (Landform) | (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body N/A feet | Drainage Way N/A feet | Wetlands 25' feet
Property Line 40' (+/-) feet | Drinking Water Well N/A feet | Other N/A feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 4"	A	Sandy Loam	10YR 2/2		Cnc : Dpl:		None	None	Massive	Friable	
4 - 13"	B	Sandy Loam	10YR 4/6		Cnc : Dpl:		None	None	Massive	Friable	
13 - 27"	C1	Sandy Loam	2.5YR 5/8		Cnc : Dpl:		None	None	Massive	Friable	
REFUSAL AT 27" - TILL ENCOUNTERED					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes: No evidence of groundwater mottling noted.

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP#2 (Hole #) | 5/31/2024 (Date) | 12:40 PM (Time) | Sunny - 75° (Weather) | _____ (Latitude) | _____ (Longitude)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Dense trees & underbrush (Vegetation) | (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-10% (Slope (%))

   Description of Location: Lot is currently undeveloped and has no access.

2. Soil Parent Material: Friable loamy/silty eolian deposits over loose & sandy glaciofluvial deposits and/or friable sandy basal till | Ground moraines (Landform) | (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body N/A feet | Drainage Way N/A feet | Wetlands N/A feet | Property Line 40' (+/-) feet | Drinking Water Well N/A feet | Other N/A feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 8"	A	Sandy Loam	10YR 2/2		Cnc : Dpl:						
8 - 18"	Bw	Sandy Loam	10YR 4/6		Cnc : Dpl:						
18 - 28"	C1	Sandy Loam	2.5YR 5/7		Cnc : Dpl:						
REFUSAL AT 28" - TILL ENCOUNTERED					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes: No evidence of groundwater mottling noted.

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one): Obs. Hole # TP-1 Obs. Hole # TP-2

☐ Depth to soil redoximorphic features	_____ inches	_____ inches
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

Index Well Number _____ Reading Date _____

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

      ☐ Yes ☐ No

   b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator	June 4, 2024 Date
Steven J. Lee SE #13936 Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License
N/A Name of Approving Authority Witness	Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

TBD
Owner Name

MBTA Access Road
Street Address

Map/Lot #

Ashland
City

MA
State

01721
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade

2. Soil Survey — USDA Soil Survey Website (Source); 416B (Soil Map Unit); Narragansett Silt Loam - 3-8% slopes (Soil Series)

Ground moraines back/side slopes
Landform

Well-drained
Soil Limitations

Friable loamy/silty eolian deposits over loose & sandy glaciofluvial deposits and/or friable sandy basal till
Soil Parent material

3. Surficial Geological Report — 2018 - USGS (Year Published/Source); Gravel & Swamp (Map Unit)

East side of the site is predominantly sandy loam. The west side of the site is indicated as swamp area.
Description of Geologic Map Unit:

4. Flood Rate Insurance Map — Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☒ Yes ☐ No — If yes, MassGIS Wetland Data Layer: Wooded Marsh (Wetland Type)

7. Current Water Resource Conditions (USGS): June 3, 2024 (Month/Day/ Year) Range: ☐ Above Normal ☐ Normal ☒ Below Normal

8. Other references reviewed:
(Zone II, IWPA, Zone A, EEA Data Portal, etc.)

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-3 (Hole #) | 5/29/2024 (Date) | 1:25 PM (Time) | Sunny - 75° (Weather) | (Latitude) | (Longitude)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Dense trees & underbrush (Vegetation) | (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3-10% (Slope (%))

Description of Location: Lot is currently undeveloped and has no access.

2. Soil Parent Material: Friable loamy/silty eolian deposits over loose & sandy glaciofluvial deposits and/or friable sandy basal till | Ground moraines (Landform) | (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body N/A feet | Drainage Way N/A feet | Wetlands 25' feet | Property Line 40' (+/-) feet | Drinking Water Well N/A feet | Other N/A feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
+2" - 0	O	N/A	N/A		Cnc : Dpl:						
0 - 6"	A	Sandy Loam	10YR 5/6		Cnc : Dpl:		None	None	Massive	Friable	
6 - 19"	Bw	Silt Loam	10YR 6/8	17"	Cnc : Dpl:	7.5YR 8/2	None	None	Massive	Friable	
19-26"	C1	Silt Loam	2.5Y 8/4		Cnc : Dpl:		None	None	Massive	Friable	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:
Evidence of ESHGWT found at 17" where soil seemed saturated for a large part of the year - showing signs of anaerobic conditions.

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

	Obs. Hole # TP-3	Obs. Hole # _____
☒ Depth to soil redoximorphic features	17" inches	_____ inches
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number

_____ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

      ☐ Yes ☐ No

   b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

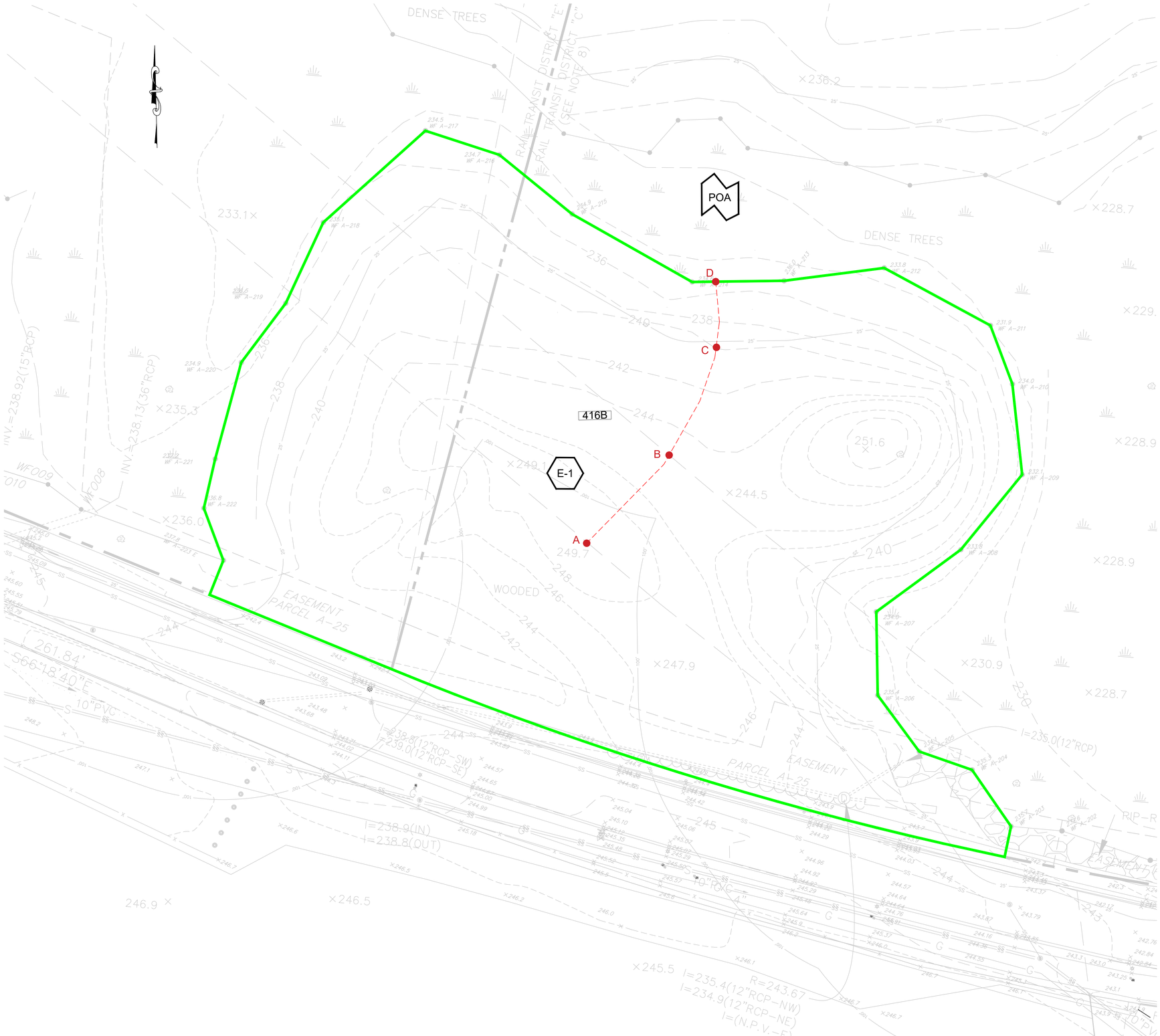
I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator	June 4, 2024 Date
Steven J. Lee SE #13936 Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License
N/A Name of Approving Authority Witness	Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:

APPENDIX A: HYDROLOGIC CALCULATIONS



SYMBOL LEGEND

WATERSHED BOUNDARY

SOIL BOUNDARY

PRE-DEV WATERSHED AREAS

E-1 — WATERSHED E-1 = 63,859 SF
WOODS, FAIR (A) = 63,859 SF
Tc = 7.4 | CN = 36

POINT OF ANALYSIS SUMMARY

POA — POA
WETLAND

SOIL SUMMARY

416B NARRAGANSETT SILT LOAM, 3 TO 8 PERCENT SLOPES, VERY STONY

GRAPHIC SCALE 20 0 10 20 40 80 — 1 inch = 20 ft.

HIGHPOINT ENGINEERING, INC.
LAND PLANNING
PERMIT EXPEDITING
CIVIL ENGINEERING
CONSULTING
DEDHAM EXECUTIVE CENTER
980 WASHINGTON ST., SUITE 216
DEDHAM, MA 02026
www.HighpointEng.com

CLIENT:

CONSULTANT:

SEAL

ASHLAND DOG PARK

MEMORIAL DRIVE
ASHLAND, MA

OWNER/APPLICANT: TOWN OF ASHLAND

REV	DATE	DESCRIPTION

ISSUE TYPE: PERMIT
ISSUE DATE: 2024-09-12
PROJECT NUMBER: 24018

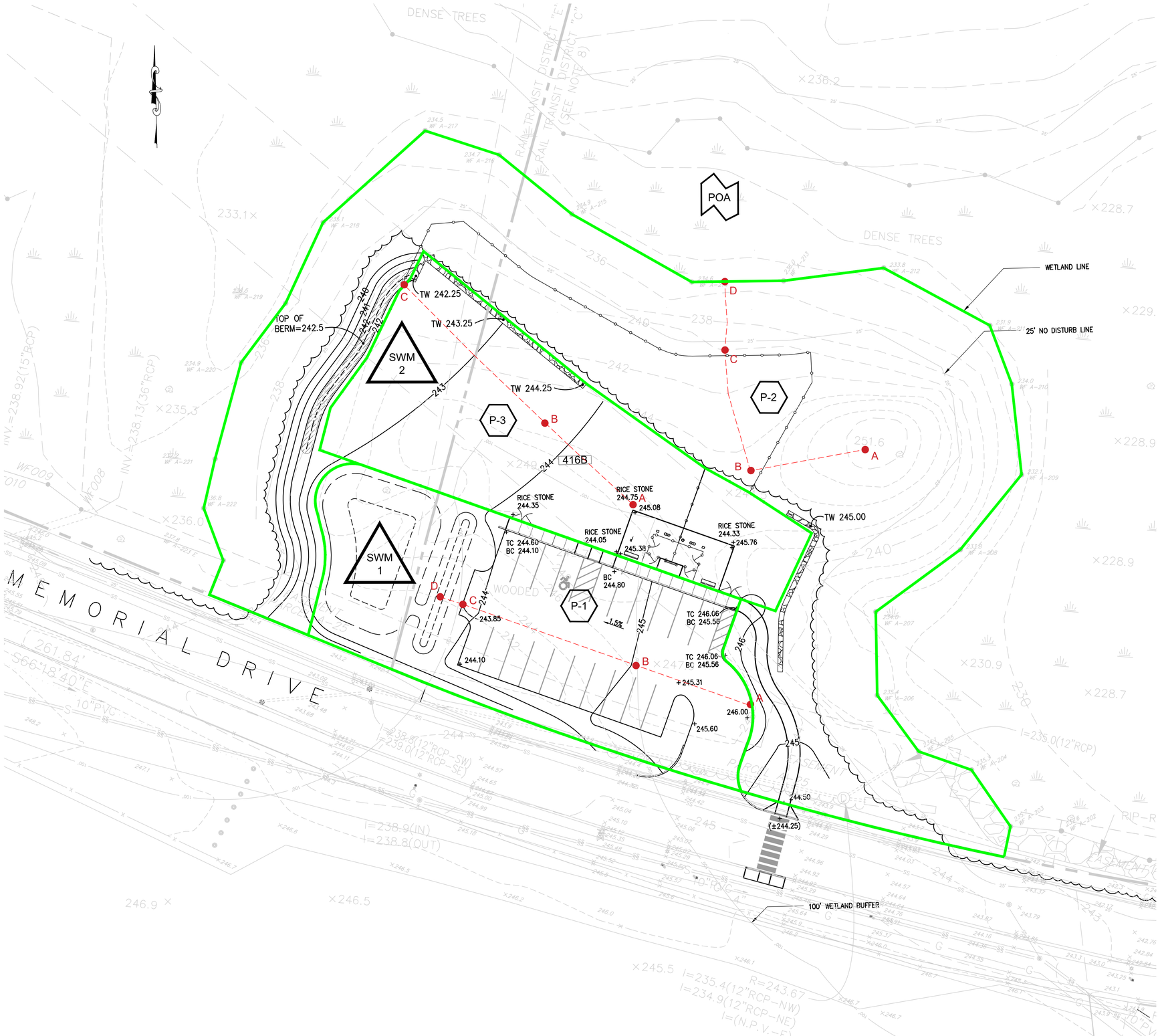
DRAWN BY: NCK
CHECKED BY: DJH

SHEET TITLE:
PRE DEVELOPMENT WATERSHED MAP

SHEET NUMBER:

ISSUED FOR : PERMIT

P:\Radner Design\24018 (Ashland Dog Park)\04_Design\Dwg\@Hyd\24018_Pre-dev.dwg



SYMBOL LEGEND

- WATERSHED BOUNDARY
- SOIL BOUNDARY

POST-DEV WATERSHED AREAS

P-1 — WATERSHED P-1 = 14,318 SF
PAVEMENT (A) = 7,706 SF
GRASS, GOOD (A) = 6,612 SF
Tc = 6.0 | CN = 71

P-2 — WATERSHED P-2 = 36,615 SF
WOODS, FAIR (A) = 29,987 SF
GRASS, GOOD (A) = 6,178 SF
UNCONNECTED PAVEMENT (A) = 450 SF
Tc = 10.7 | CN = 37

P-3 — WATERSHED P-3 = 12,926 SF
GRASS, POOR (A) = 11,576 SF
UNCONNECTED PAVEMENT (A) = 1,350 SF
Tc = 7.1 | CN = 71

POINT OF ANALYSIS SUMMARY

POA — POA
WETLAND

SOIL SUMMARY

416B NARRAGANSETT SILT LOAM, 3 TO 8 PERCENT SLOPES, VERY STONY

GRAPHIC SCALE 20 0 10 20 40 80 — 1 inch = 20 ft.

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ASHLAND, MA

OWNER/APPLICANT: TOWN OF ASHLAND

REV	DATE	DESCRIPTION

ISSUE TYPE: PERMIT
ISSUE DATE: 2024-09-12
PROJECT NUMBER: 24018

DRAWN BY: NCK
CHECKED BY: DJH

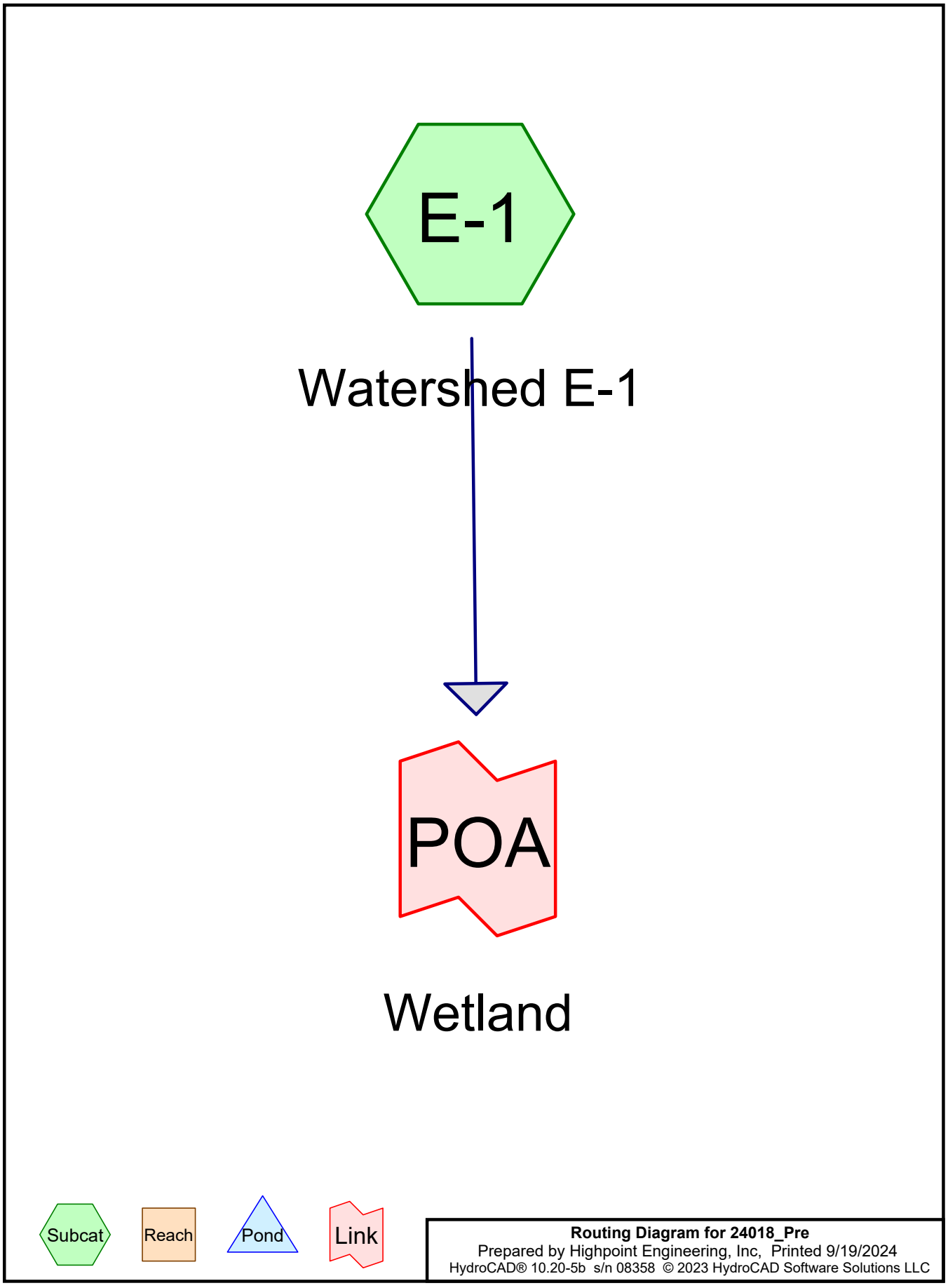
SHEET TITLE:
POST DEVELOPMENT WATERSHED MAP

SHEET NUMBER:

ISSUED FOR : PERMIT

P:\Radner Design\24018 (Ashland Dog Park)\04_Design\Dwg\@Hyd\24018_Post-dev.dwg

APPENDIX B: HYDRAULIC CALCULATIONS



Routing Diagram for 24018_Pre
Prepared by Highpoint Engineering, Inc, Printed 9/19/2024

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
63,859	36	Woods, Fair, HSG A (E-1)
63,859	**36**	**TOTAL AREA**

Summary for Subcatchment E-1: Watershed E-1

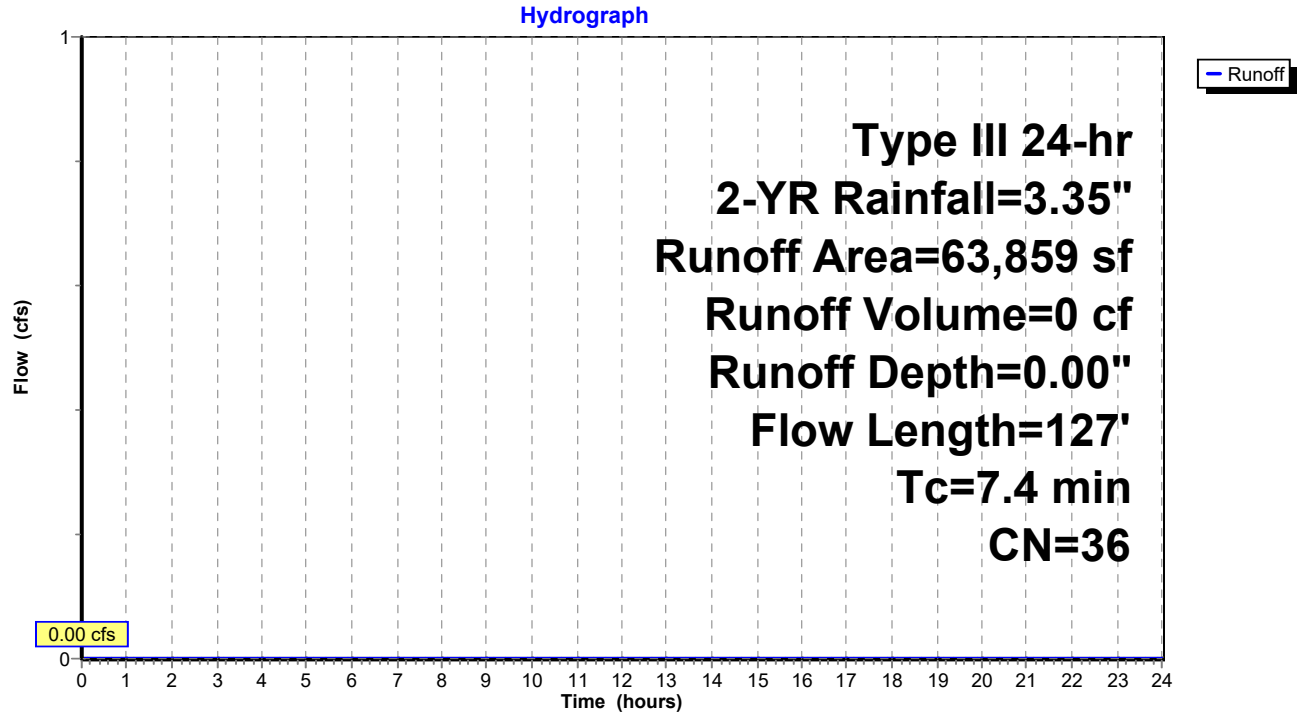
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Link POA : Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.35"

Area (sf)	CN	Description
63,859	36	Woods, Fair, HSG A
63,859		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.0940	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.16"
0.5	50	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	27	0.2000	2.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.4	127	Total			

Subcatchment E-1: Watershed E-1

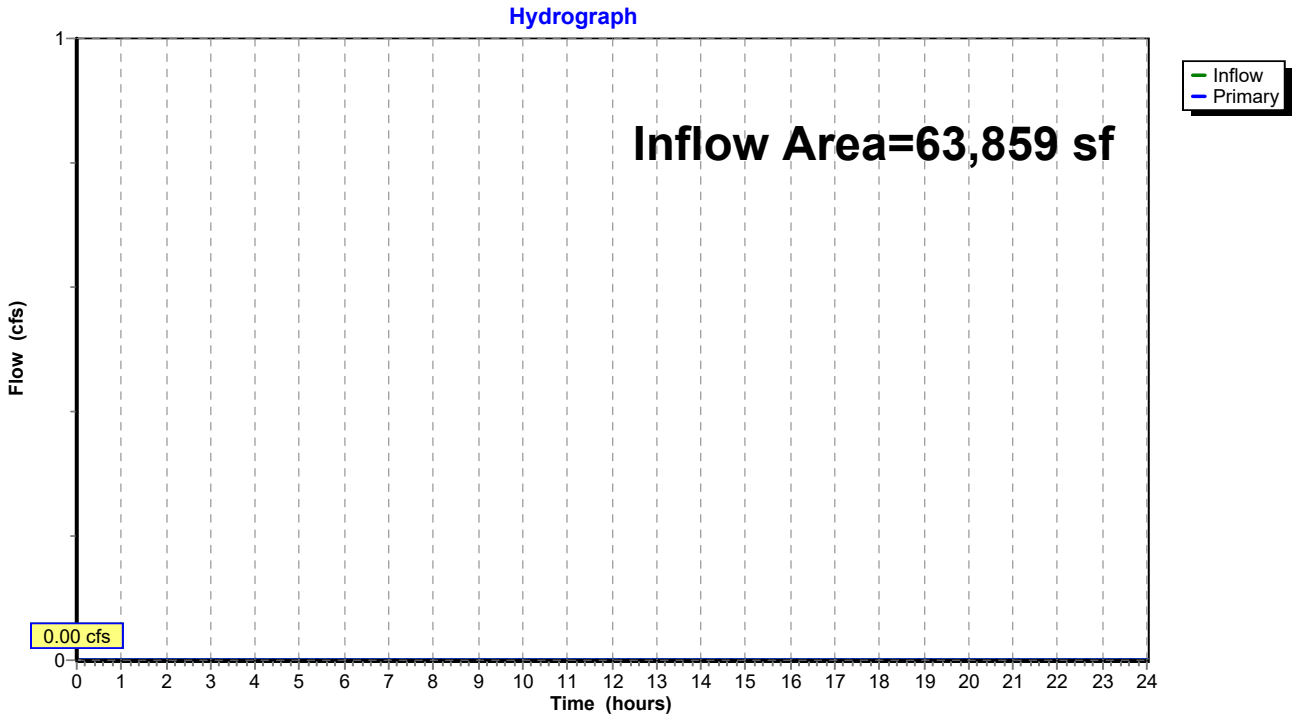


Summary for Link POA: Wetland

Inflow Area = 63,859 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-YR event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link POA: Wetland



Summary for Subcatchment E-1: Watershed E-1

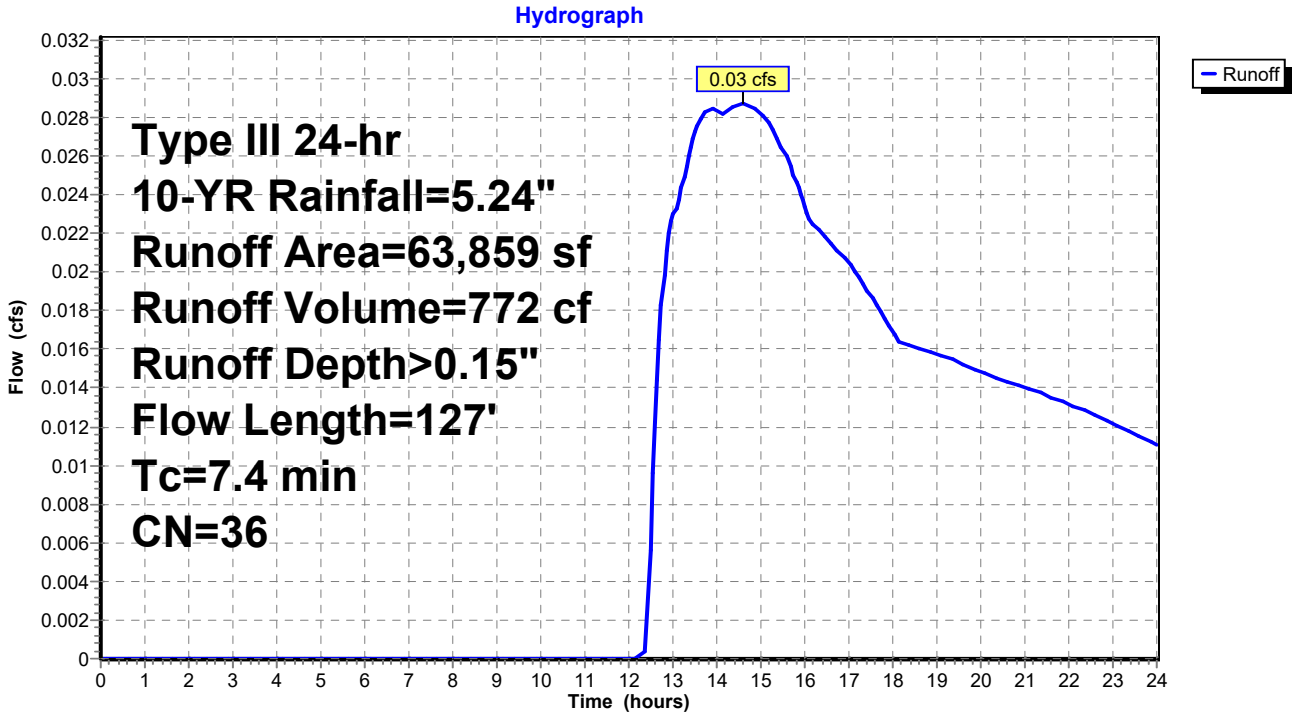
Runoff = 0.03 cfs @ 14.59 hrs, Volume= 772 cf, Depth> 0.15"
Routed to Link POA : Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.24"

Area (sf)	CN	Description
63,859	36	Woods, Fair, HSG A
63,859		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.0940	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.16"
0.5	50	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	27	0.2000	2.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.4	127	Total			

Subcatchment E-1: Watershed E-1

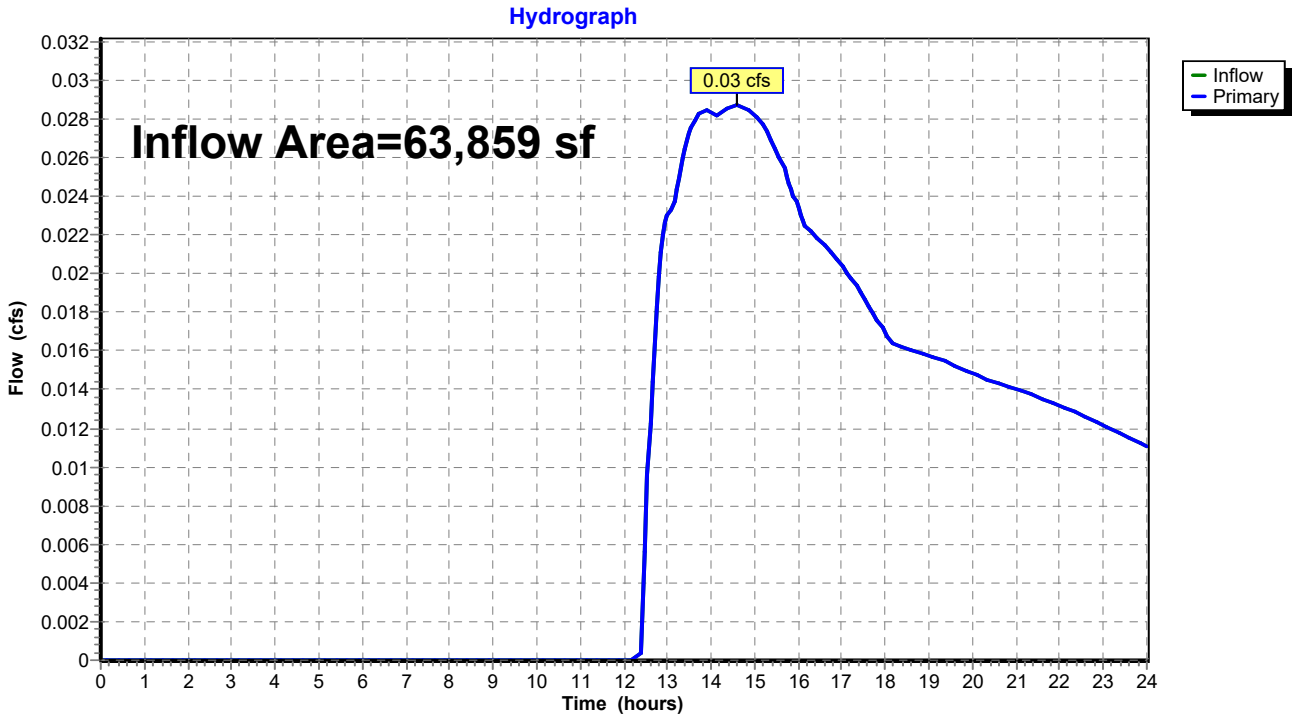


Summary for Link POA: Wetland

Inflow Area = 63,859 sf, 0.00% Impervious, Inflow Depth > 0.15" for 10-YR event
Inflow = 0.03 cfs @ 14.59 hrs, Volume= 772 cf
Primary = 0.03 cfs @ 14.59 hrs, Volume= 772 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link POA: Wetland



Summary for Subcatchment E-1: Watershed E-1

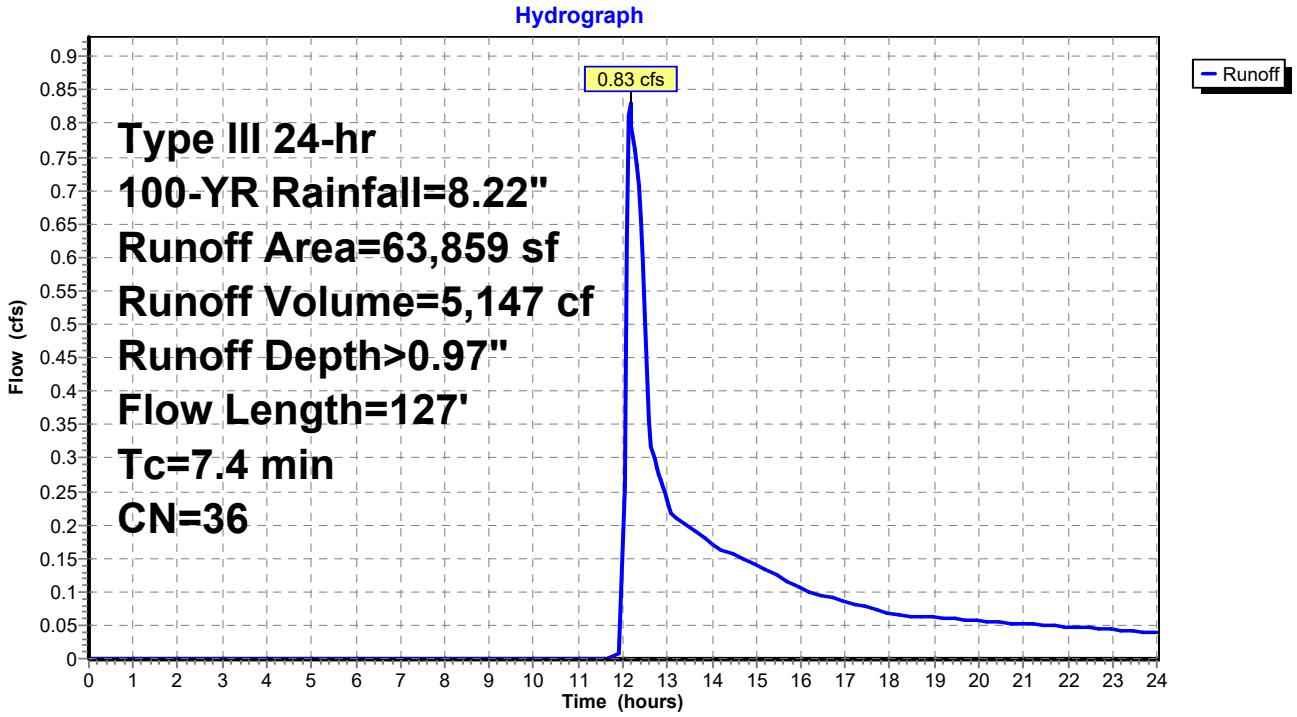
Runoff = 0.83 cfs @ 12.17 hrs, Volume= 5,147 cf, Depth> 0.97"
Routed to Link POA : Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=8.22"

Area (sf)	CN	Description
63,859	36	Woods, Fair, HSG A
63,859		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.0940	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.16"
0.5	50	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	27	0.2000	2.24		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.4	127	Total			

Subcatchment E-1: Watershed E-1

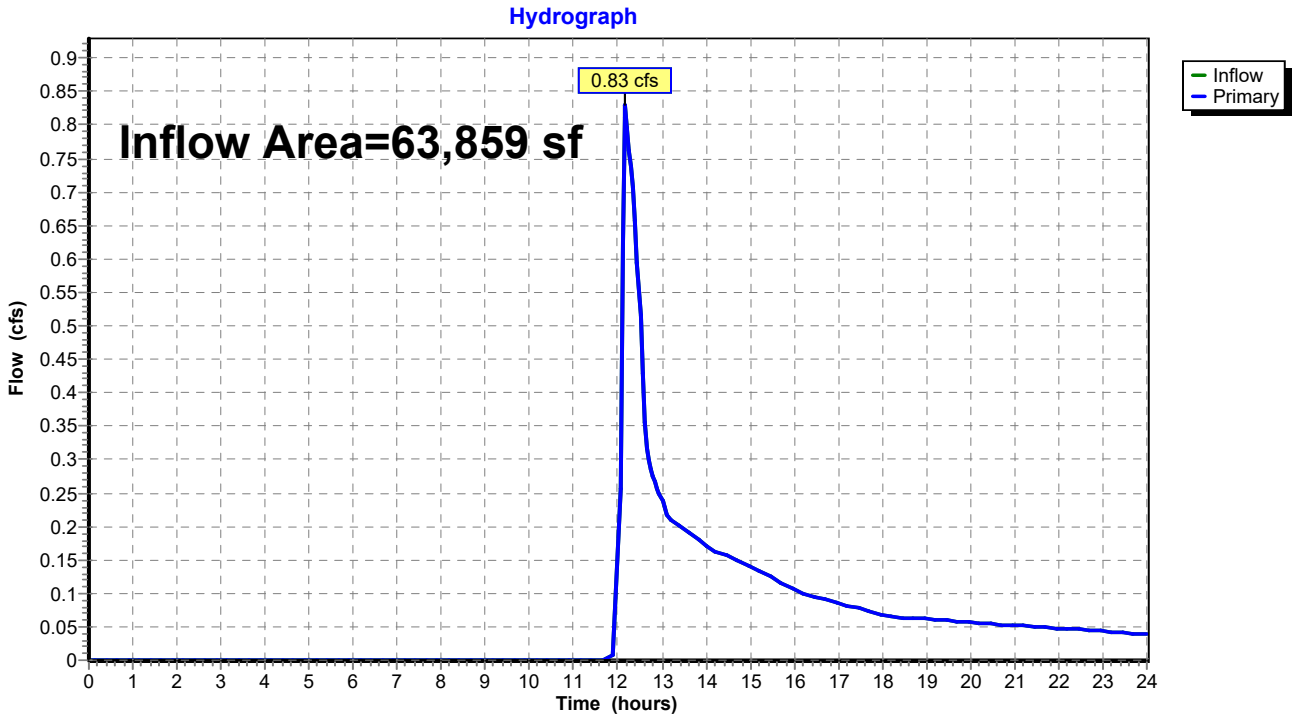


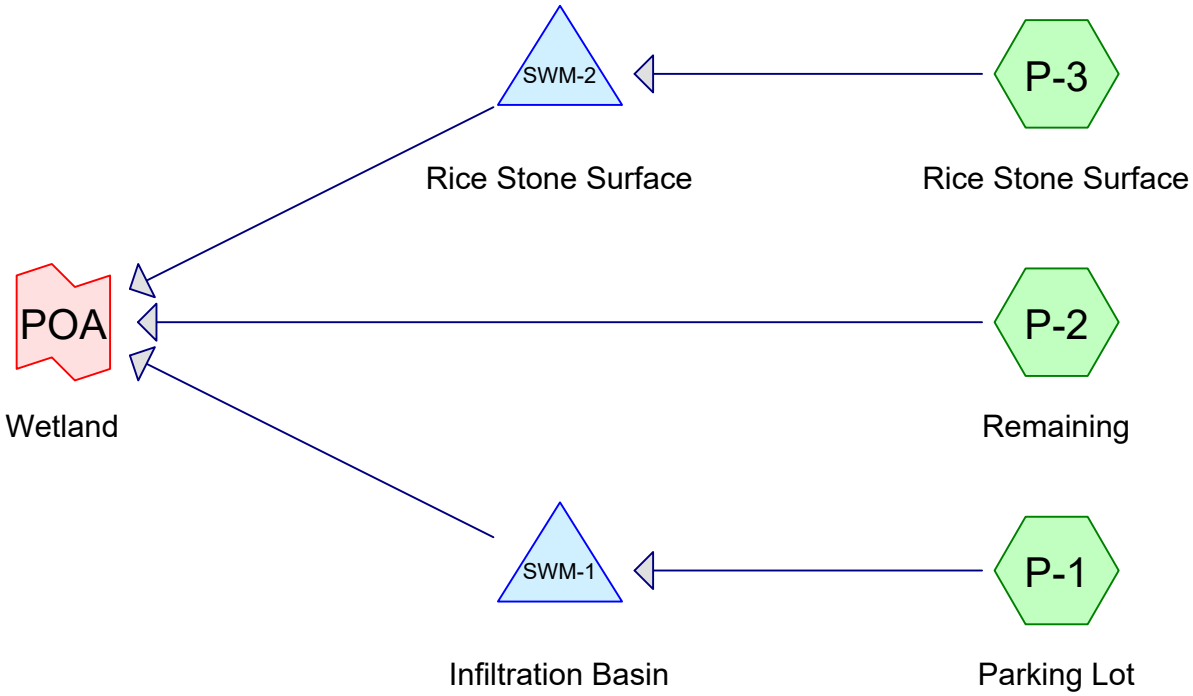
Summary for Link POA: Wetland

Inflow Area = 63,859 sf, 0.00% Impervious, Inflow Depth > 0.97" for 100-YR event
Inflow = 0.83 cfs @ 12.17 hrs, Volume= 5,147 cf
Primary = 0.83 cfs @ 12.17 hrs, Volume= 5,147 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link POA: Wetland





Subcat Reach Pond Link

Routing Diagram for 24018_Post
Prepared by Highpoint Engineering, Inc, Printed 9/19/2024

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
11,576	68	<50% Grass cover, Poor, HSG A (P-3)
12,790	39	>75% Grass cover, Good, HSG A (P-1, P-2)
7,706	98	Paved parking, HSG A (P-1)
1,800	98	Unconnected pavement, HSG A (P-2, P-3)
29,987	36	Woods, Fair, HSG A (P-2)
63,859	**52**	**TOTAL AREA**

Summary for Subcatchment P-1: Parking Lot

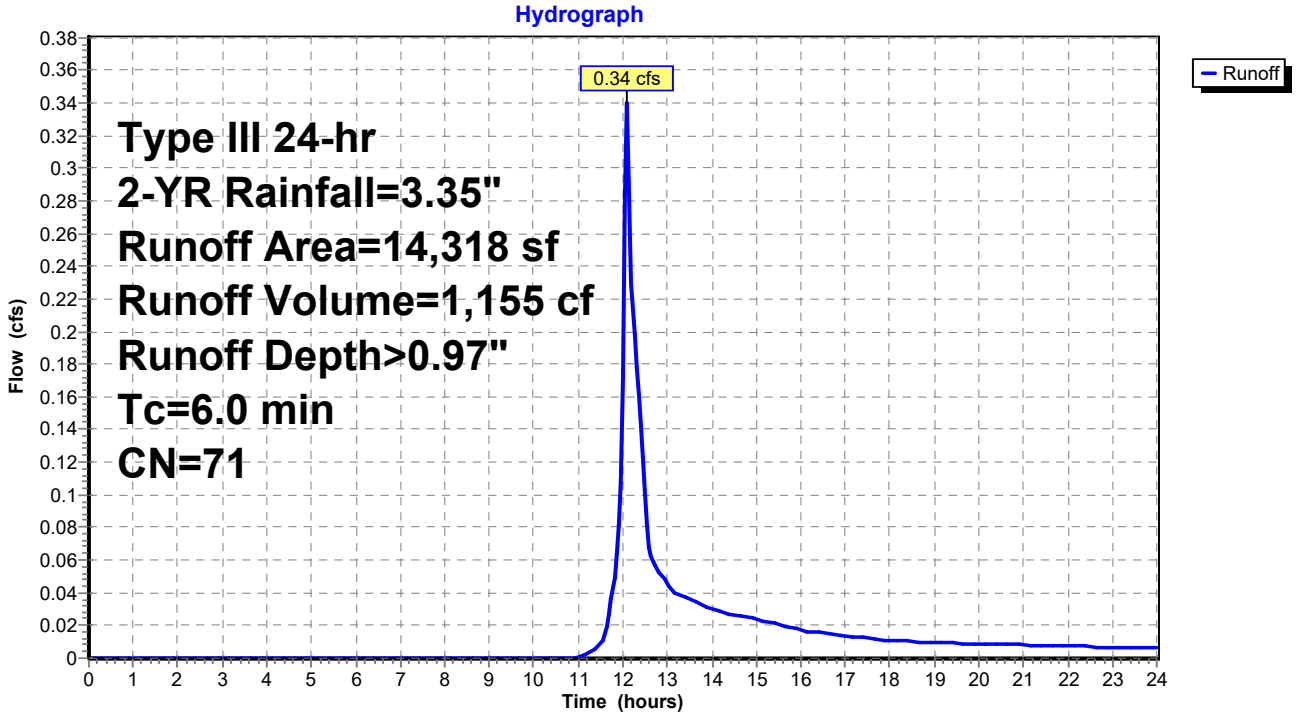
Runoff = 0.34 cfs @ 12.10 hrs, Volume= 1,155 cf, Depth> 0.97"
Routed to Pond SWM-1 : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.35"

Area (sf)	CN	Description
7,706	98	Paved parking, HSG A
6,612	39	>75% Grass cover, Good, HSG A
14,318	71	Weighted Average
6,612		46.18% Pervious Area
7,706		53.82% Impervious Area

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

Subcatchment P-1: Parking Lot



Summary for Subcatchment P-2: Remaining

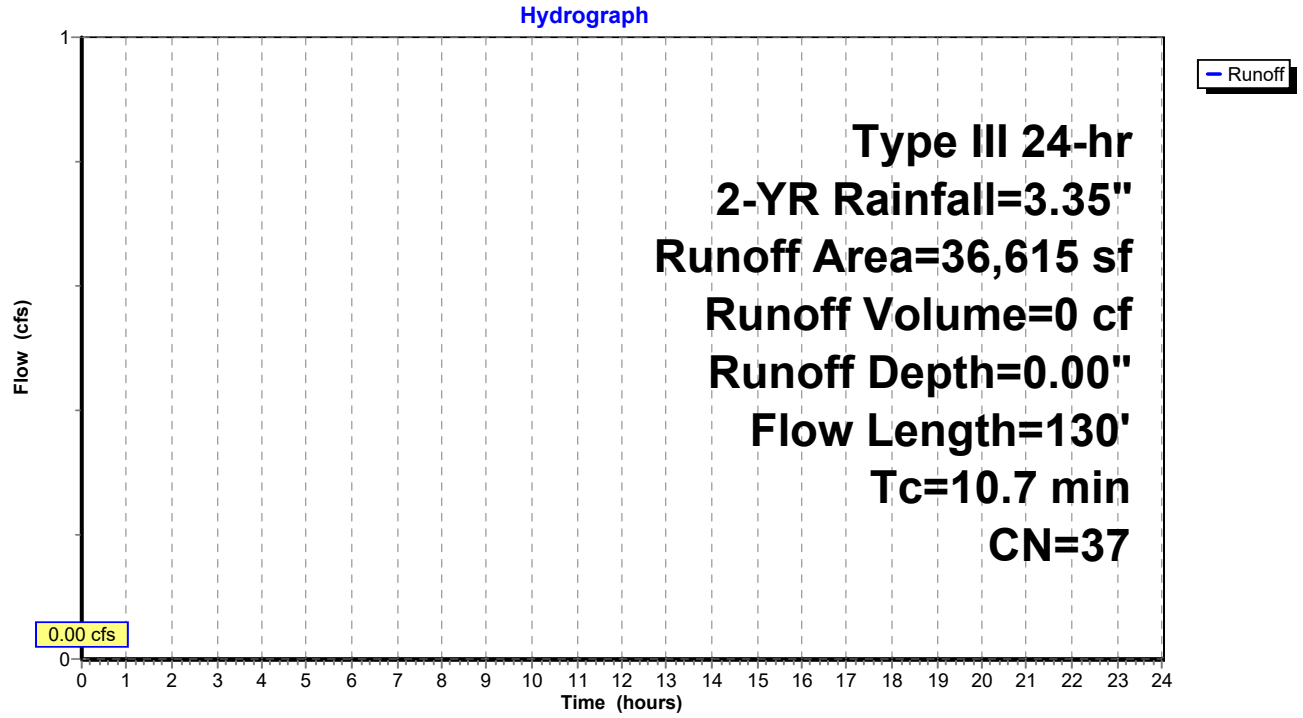
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Link POA : Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.35"

Area (sf)	CN	Description
29,987	36	Woods, Fair, HSG A
6,178	39	>75% Grass cover, Good, HSG A
450	98	Unconnected pavement, HSG A
36,615	37	Weighted Average
36,165		98.77% Pervious Area
450		1.23% Impervious Area
450		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	50	0.1400	0.08		**Sheet Flow, A-B** Woods: Dense underbrush n= 0.800 P2= 3.16"
0.6	52	0.0900	1.50		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.2	28	0.1800	2.12		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
10.7	130	Total			

Subcatchment P-2: Remaining



Summary for Subcatchment P-3: Rice Stone Surface

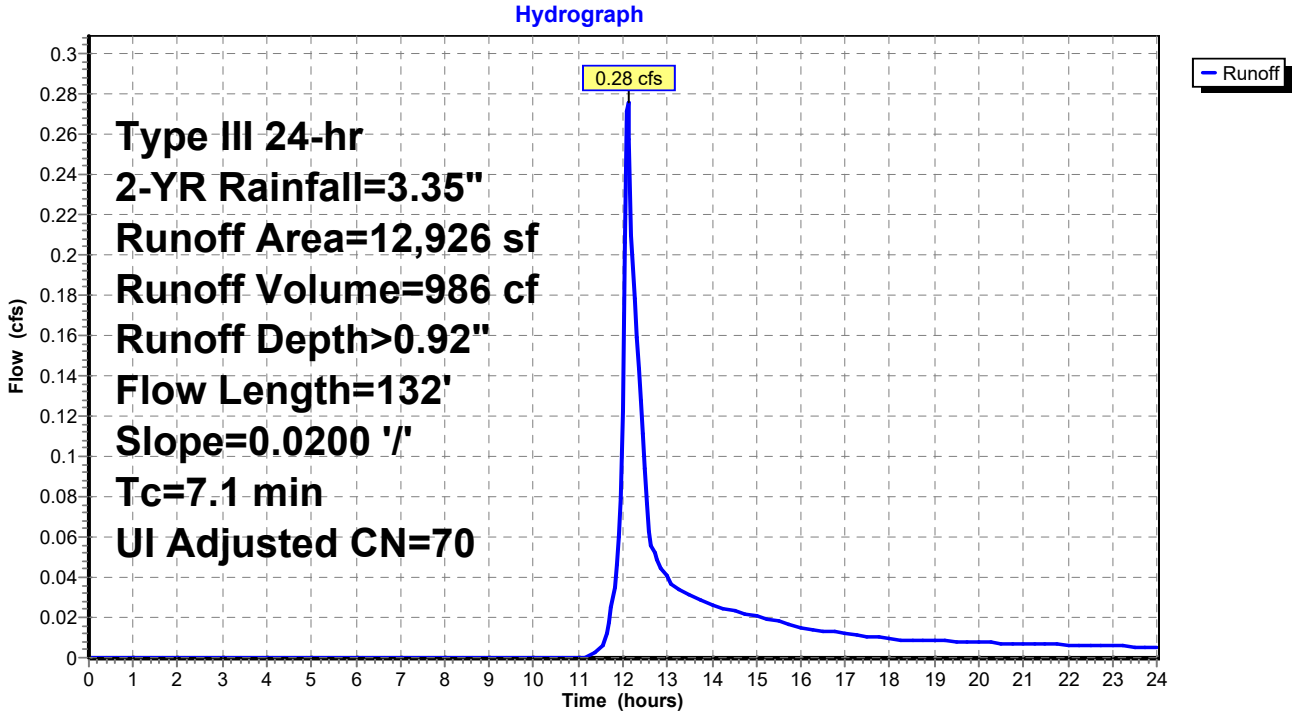
Runoff = 0.28 cfs @ 12.12 hrs, Volume= 986 cf, Depth> 0.92"
Routed to Pond SWM-2 : Rice Stone Surface

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.35"

Area (sf)	CN	Adj	Description
11,576	68		<50% Grass cover, Poor, HSG A
1,350	98		Unconnected pavement, HSG A
12,926	71	70	Weighted Average, UI Adjusted
11,576			89.56% Pervious Area
1,350			10.44% Impervious Area
1,350			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.16"
1.4	82	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.1	132	Total			

Subcatchment P-3: Rice Stone Surface



Summary for Pond SWM-1: Infiltration Basin

Inflow Area = 14,318 sf, 53.82% Impervious, Inflow Depth > 0.97" for 2-YR event
Inflow = 0.34 cfs @ 12.10 hrs, Volume= 1,155 cf
Outflow = 0.03 cfs @ 14.78 hrs, Volume= 1,046 cf, Atten= 93%, Lag= 160.9 min
Discarded = 0.03 cfs @ 14.78 hrs, Volume= 1,046 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link POA : Wetland

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 240.55' @ 14.78 hrs Surf.Area= 1,062 sf Storage= 519 cf

Plug-Flow detention time= 241.7 min calculated for 1,044 cf (90% of inflow)
Center-of-Mass det. time= 195.6 min (1,063.9 - 868.3)

Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	5,727 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

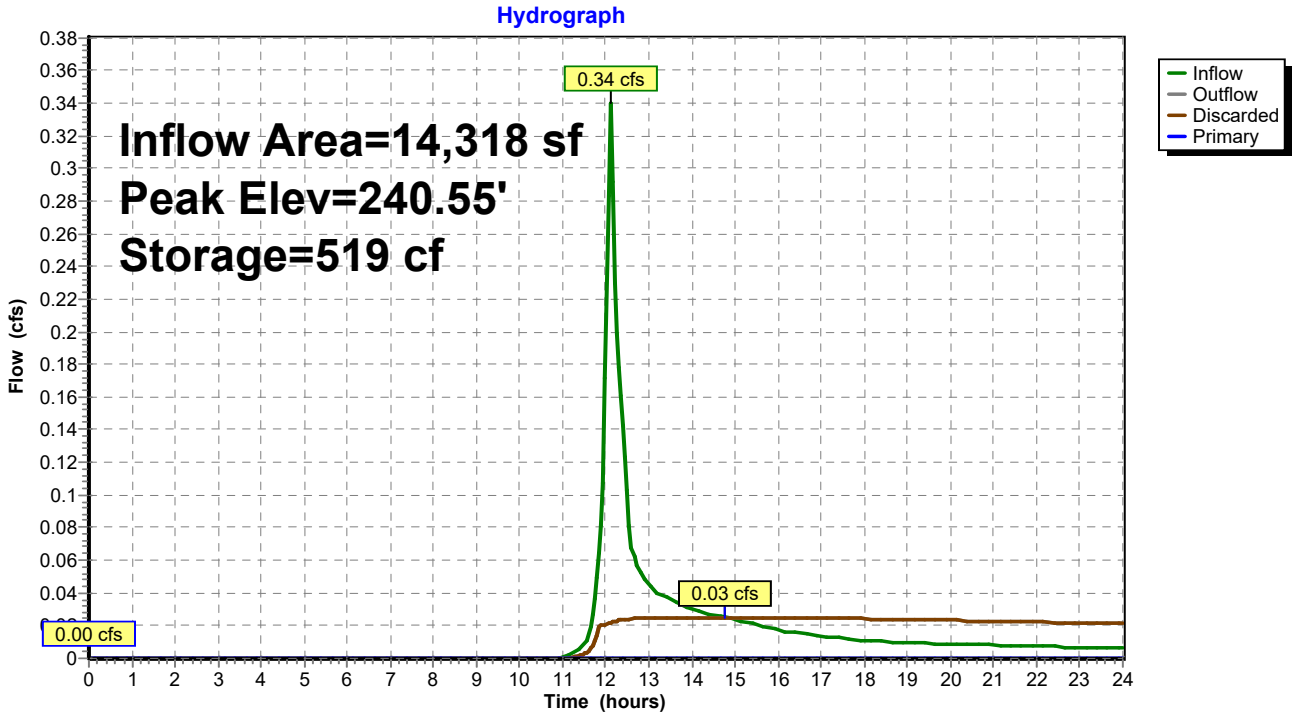
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
240.00	846	128.0	0	0	846
241.00	1,260	147.0	1,046	1,046	1,284
242.00	1,732	166.0	1,490	2,536	1,782
243.00	2,260	185.0	1,990	4,526	2,341
243.50	2,545	194.0	1,201	5,727	2,629

Device	Routing	Invert	Outlet Devices
#1	Discarded	240.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Device 3	242.30'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	240.00'	**12.0" Round Culvert** L= 22.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.00' / 239.75' S= 0.0114 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.03 cfs @ 14.78 hrs HW=240.55' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=240.00' (Free Discharge)
↑—**3=Culvert** (Controls 0.00 cfs)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond SWM-1: Infiltration Basin



Stage-Discharge for Pond SWM-1: Infiltration Basin

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
240.00	0.00	0.00	0.00
240.05	0.02	0.02	0.00
240.10	0.02	0.02	0.00
240.15	0.02	0.02	0.00
240.20	0.02	0.02	0.00
240.25	0.02	0.02	0.00
240.30	0.02	0.02	0.00
240.35	0.02	0.02	0.00
240.40	0.02	0.02	0.00
240.45	0.02	0.02	0.00
240.50	0.02	0.02	0.00
240.55	0.03	0.03	0.00
240.60	0.03	0.03	0.00
240.65	0.03	0.03	0.00
240.70	0.03	0.03	0.00
240.75	0.03	0.03	0.00
240.80	0.03	0.03	0.00
240.85	0.03	0.03	0.00
240.90	0.03	0.03	0.00
240.95	0.03	0.03	0.00
241.00	0.03	0.03	0.00
241.05	0.03	0.03	0.00
241.10	0.03	0.03	0.00
241.15	0.03	0.03	0.00
241.20	0.03	0.03	0.00
241.25	0.03	0.03	0.00
241.30	0.03	0.03	0.00
241.35	0.03	0.03	0.00
241.40	0.03	0.03	0.00
241.45	0.03	0.03	0.00
241.50	0.04	0.04	0.00
241.55	0.04	0.04	0.00
241.60	0.04	0.04	0.00
241.65	0.04	0.04	0.00
241.70	0.04	0.04	0.00
241.75	0.04	0.04	0.00
241.80	0.04	0.04	0.00
241.85	0.04	0.04	0.00
241.90	0.04	0.04	0.00
241.95	0.04	0.04	0.00
242.00	0.04	0.04	0.00
242.05	0.04	0.04	0.00
242.10	0.04	0.04	0.00
242.15	0.04	0.04	0.00
242.20	0.04	0.04	0.00
242.25	0.04	0.04	0.00
242.30	0.04	0.04	0.00
242.35	0.06	0.05	0.01
242.40	0.09	0.05	0.04
242.45	0.14	0.05	0.10
242.50	0.22	0.05	0.17
242.55	0.31	0.05	0.26
242.60	0.42	0.05	0.37
242.65	0.54	0.05	0.49
242.70	0.68	0.05	0.63
242.75	0.83	0.05	0.78
242.80	1.00	0.05	0.95
242.85	1.17	0.05	1.12
242.90	1.35	0.05	1.30
242.95	1.54	0.05	1.48
243.00	1.73	0.05	1.67
243.05	1.92	0.05	1.86
243.10	2.11	0.05	2.05
243.15	2.29	0.06	2.23
243.20	2.46	0.06	2.40
243.25	2.61	0.06	2.56
243.30	2.73	0.06	2.67
243.35	2.86	0.06	2.80
243.40	2.99	0.06	2.93
243.45	3.11	0.06	3.05
243.50	**3.22**	**0.06**	**3.16**

Summary for Pond SWM-2: Rice Stone Surface

Inflow Area = 12,926 sf, 10.44% Impervious, Inflow Depth > 0.92" for 2-YR event
Inflow = 0.28 cfs @ 12.12 hrs, Volume= 986 cf
Outflow = 0.26 cfs @ 12.14 hrs, Volume= 986 cf, Atten= 5%, Lag= 1.4 min
Discarded = 0.26 cfs @ 12.14 hrs, Volume= 986 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 240.01' @ 12.14 hrs Surf.Area= 11,090 sf Storage= 17 cf

Plug-Flow detention time= 1.1 min calculated for 986 cf (100% of inflow)
Center-of-Mass det. time= 0.9 min (873.3 - 872.5)

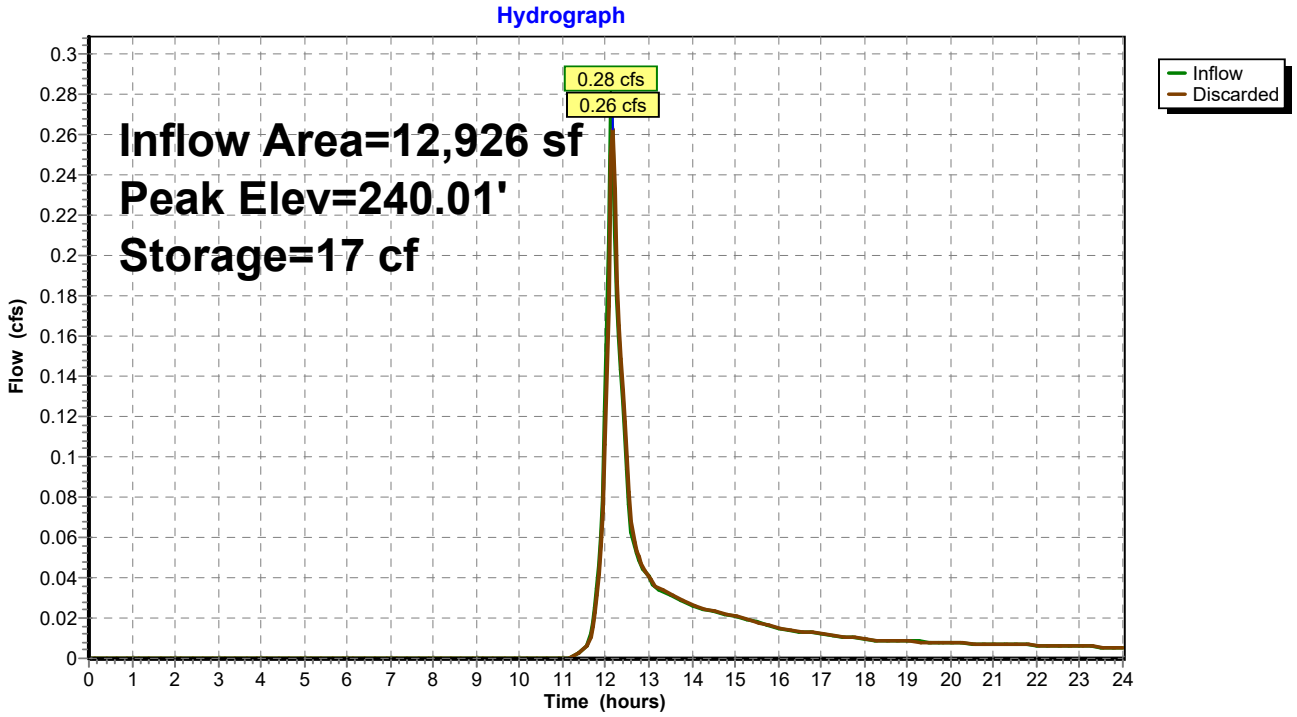
Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	1,664 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 5,545 cf Overall x 30.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
240.00	11,090	0	0
240.50	11,090	5,545	5,545

Device	Routing	Invert	Outlet Devices
#1	Discarded	240.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.26 cfs @ 12.14 hrs HW=240.01' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.26 cfs)

Pond SWM-2: Rice Stone Surface



Stage-Discharge for Pond SWM-2: Rice Stone Surface

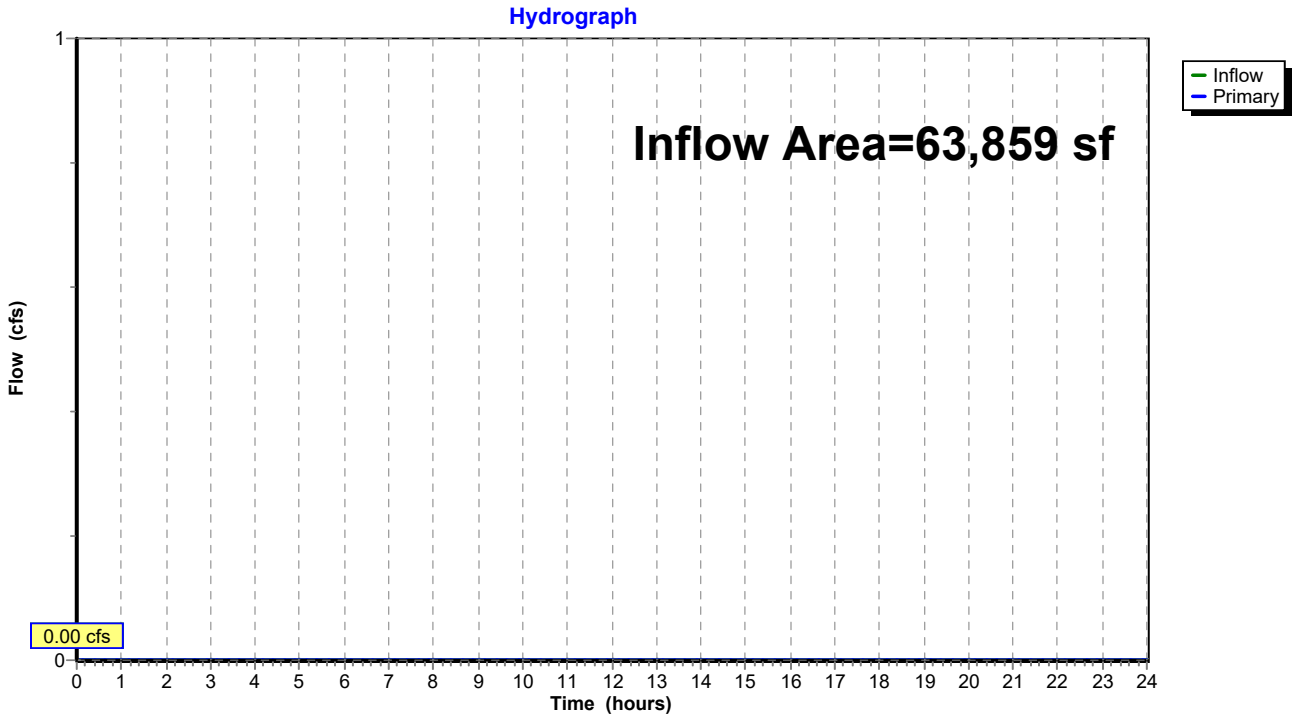
Elevation (feet)	Discarded (cfs)
240.00	0.00
240.01	**0.26**
240.02	0.26
240.03	0.26
240.04	0.26
240.05	0.26
240.06	0.26
240.07	0.26
240.08	0.26
240.09	0.26
240.10	0.26
240.11	0.26
240.12	0.26
240.13	0.26
240.14	0.26
240.15	0.26
240.16	0.26
240.17	0.26
240.18	0.26
240.19	0.26
240.20	0.26
240.21	0.26
240.22	0.26
240.23	0.26
240.24	0.26
240.25	0.26
240.26	0.26
240.27	0.26
240.28	0.26
240.29	0.26
240.30	0.26
240.31	0.26
240.32	0.26
240.33	0.26
240.34	0.26
240.35	0.26
240.36	0.26
240.37	0.26
240.38	0.26
240.39	0.26
240.40	0.26
240.41	0.26
240.42	0.26
240.43	0.26
240.44	0.26
240.45	0.26
240.46	0.26
240.47	0.26
240.48	0.26
240.49	0.26
240.50	0.26

Summary for Link POA: Wetland

Inflow Area = 63,859 sf, 14.89% Impervious, Inflow Depth = 0.00" for 2-YR event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link POA: Wetland



Summary for Subcatchment P-1: Parking Lot

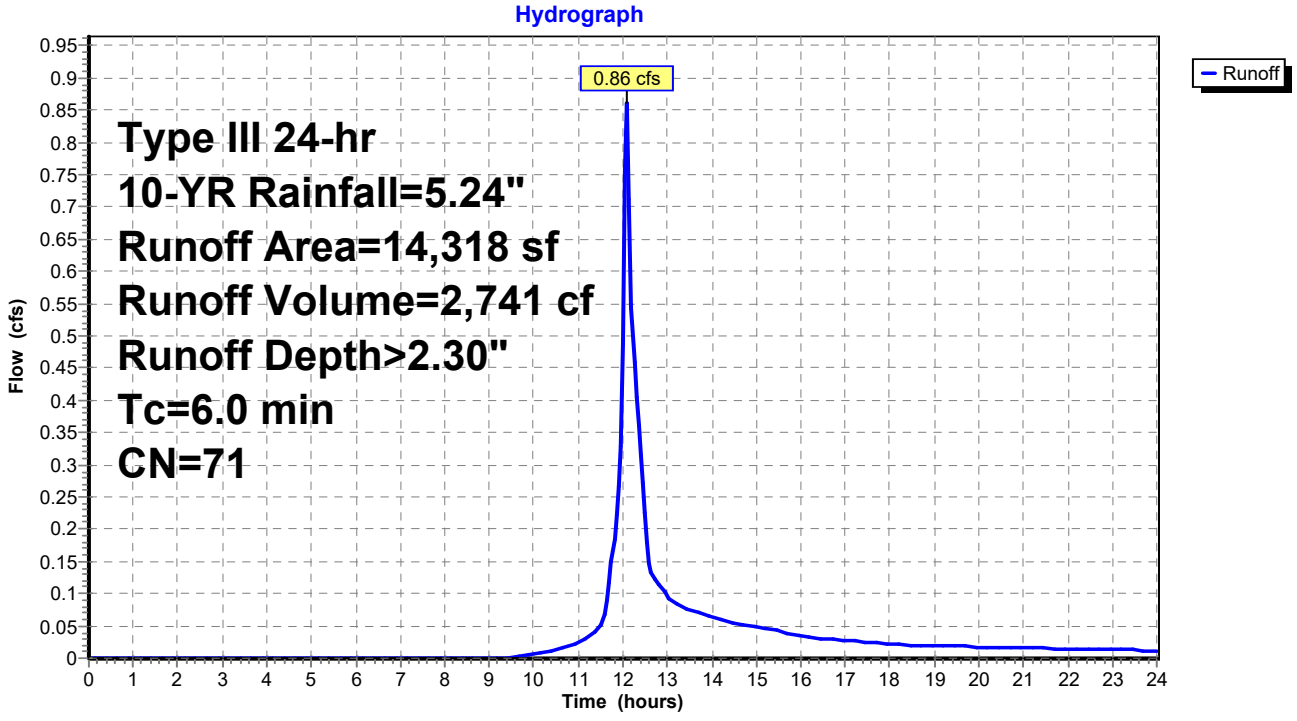
Runoff = 0.86 cfs @ 12.10 hrs, Volume= 2,741 cf, Depth> 2.30"
Routed to Pond SWM-1 : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.24"

Area (sf)	CN	Description
7,706	98	Paved parking, HSG A
6,612	39	>75% Grass cover, Good, HSG A
14,318	71	Weighted Average
6,612		46.18% Pervious Area
7,706		53.82% Impervious Area

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

Subcatchment P-1: Parking Lot



Summary for Subcatchment P-2: Remaining

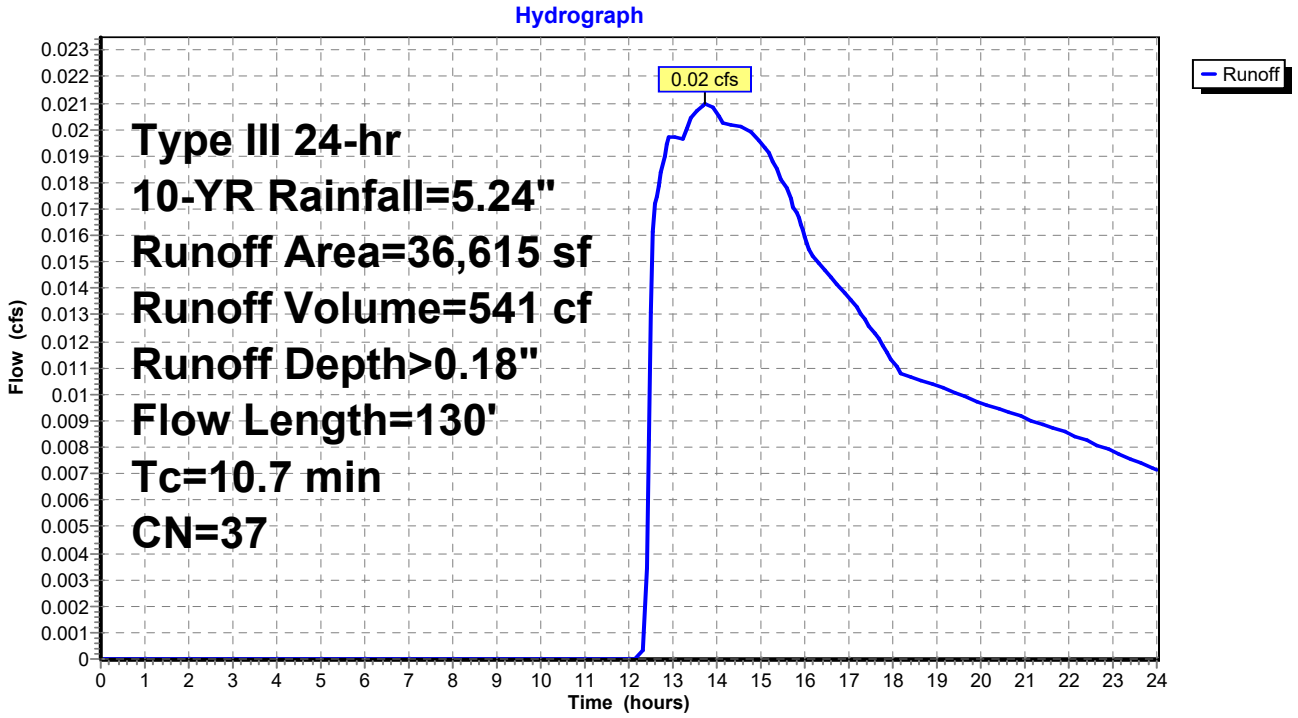
Runoff = 0.02 cfs @ 13.74 hrs, Volume= 541 cf, Depth> 0.18"
Routed to Link POA : Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.24"

Area (sf)	CN	Description
29,987	36	Woods, Fair, HSG A
6,178	39	>75% Grass cover, Good, HSG A
450	98	Unconnected pavement, HSG A
36,615	37	Weighted Average
36,165		98.77% Pervious Area
450		1.23% Impervious Area
450		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	50	0.1400	0.08		**Sheet Flow, A-B** Woods: Dense underbrush n= 0.800 P2= 3.16"
0.6	52	0.0900	1.50		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.2	28	0.1800	2.12		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
10.7	130	Total			

Subcatchment P-2: Remaining



Summary for Subcatchment P-3: Rice Stone Surface

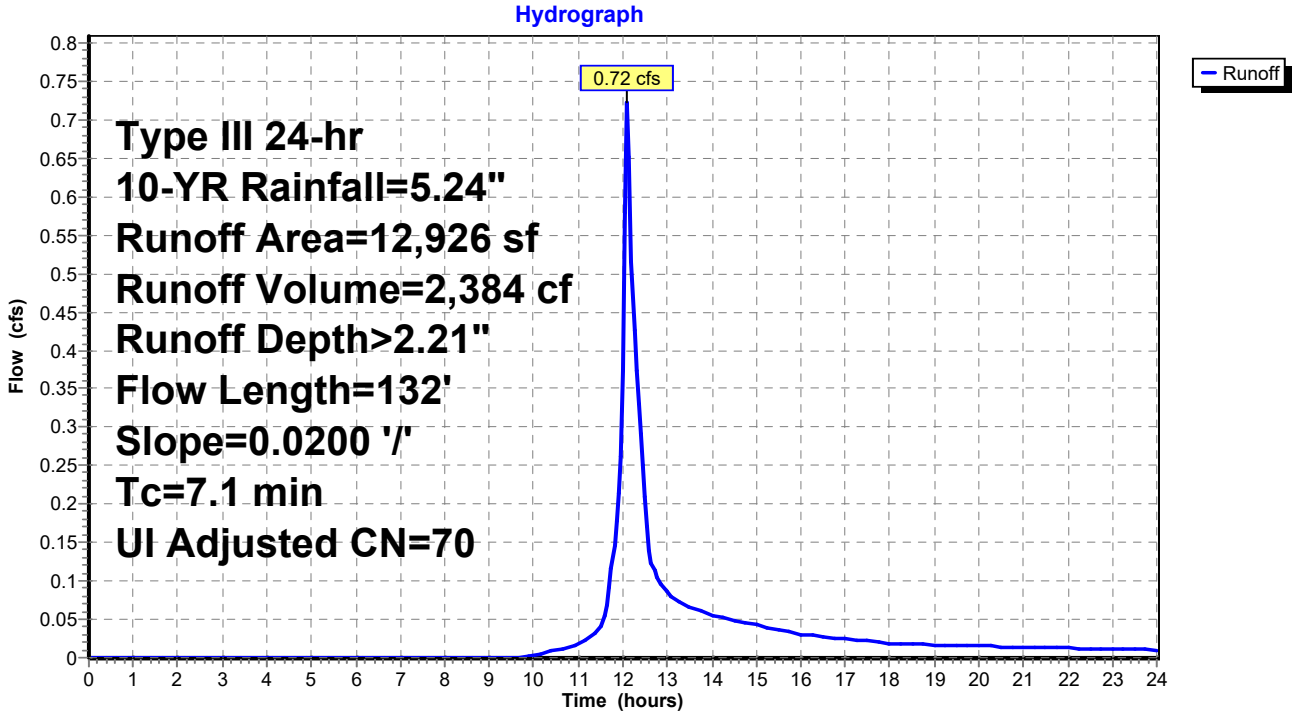
Runoff = 0.72 cfs @ 12.11 hrs, Volume= 2,384 cf, Depth> 2.21"
Routed to Pond SWM-2 : Rice Stone Surface

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.24"

Area (sf)	CN	Adj	Description
11,576	68		<50% Grass cover, Poor, HSG A
1,350	98		Unconnected pavement, HSG A
12,926	71	70	Weighted Average, UI Adjusted
11,576			89.56% Pervious Area
1,350			10.44% Impervious Area
1,350			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.16"
1.4	82	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.1	132	Total			

Subcatchment P-3: Rice Stone Surface



Summary for Pond SWM-1: Infiltration Basin

Inflow Area = 14,318 sf, 53.82% Impervious, Inflow Depth > 2.30" for 10-YR event
Inflow = 0.86 cfs @ 12.10 hrs, Volume= 2,741 cf
Outflow = 0.03 cfs @ 16.01 hrs, Volume= 1,529 cf, Atten= 96%, Lag= 235.0 min
Discarded = 0.03 cfs @ 16.01 hrs, Volume= 1,529 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link POA : Wetland

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 241.42' @ 16.01 hrs Surf.Area= 1,451 sf Storage= 1,620 cf

Plug-Flow detention time= 326.2 min calculated for 1,526 cf (56% of inflow)
Center-of-Mass det. time= 209.9 min (1,051.9 - 842.0)

Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	5,727 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

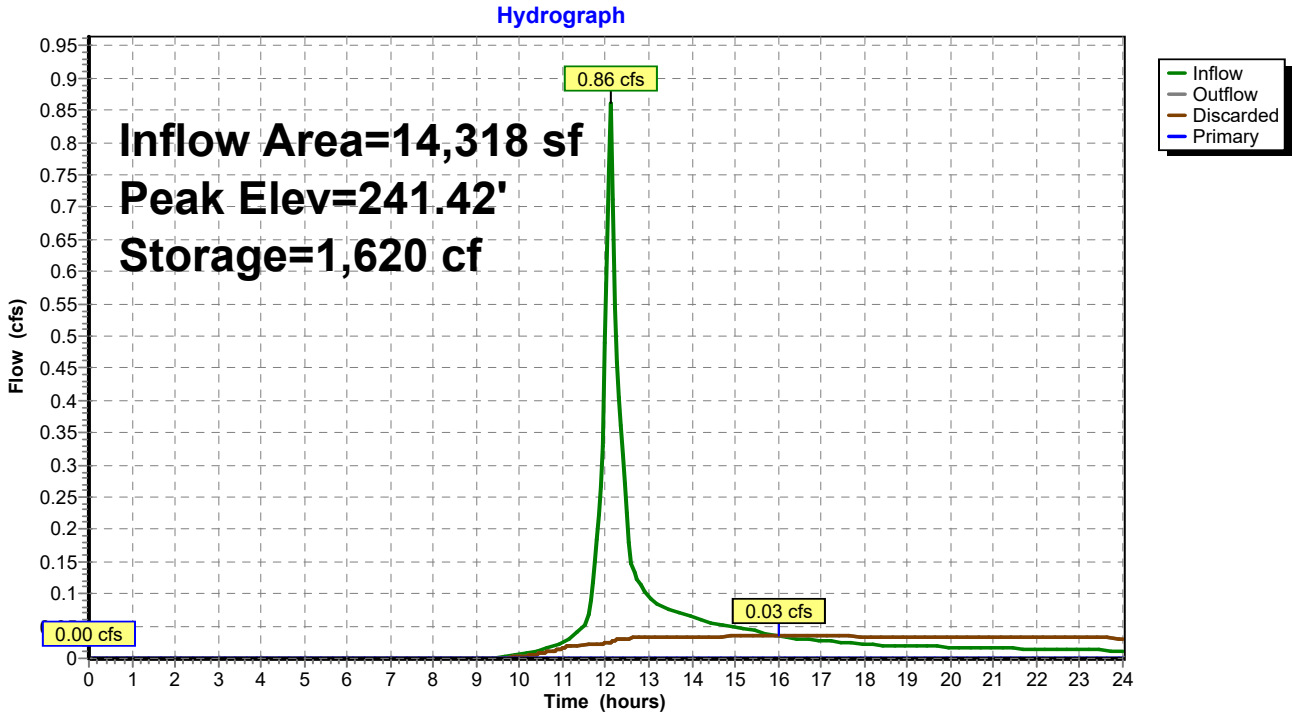
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
240.00	846	128.0	0	0	846
241.00	1,260	147.0	1,046	1,046	1,284
242.00	1,732	166.0	1,490	2,536	1,782
243.00	2,260	185.0	1,990	4,526	2,341
243.50	2,545	194.0	1,201	5,727	2,629

Device	Routing	Invert	Outlet Devices
#1	Discarded	240.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Device 3	242.30'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	240.00'	**12.0" Round Culvert** L= 22.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.00' / 239.75' S= 0.0114 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.03 cfs @ 16.01 hrs HW=241.42' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=240.00' (Free Discharge)
↑—**3=Culvert** (Controls 0.00 cfs)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond SWM-1: Infiltration Basin



Stage-Discharge for Pond SWM-1: Infiltration Basin

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
240.00	0.00	0.00	0.00
240.05	0.02	0.02	0.00
240.10	0.02	0.02	0.00
240.15	0.02	0.02	0.00
240.20	0.02	0.02	0.00
240.25	0.02	0.02	0.00
240.30	0.02	0.02	0.00
240.35	0.02	0.02	0.00
240.40	0.02	0.02	0.00
240.45	0.02	0.02	0.00
240.50	0.02	0.02	0.00
240.55	0.03	0.03	0.00
240.60	0.03	0.03	0.00
240.65	0.03	0.03	0.00
240.70	0.03	0.03	0.00
240.75	0.03	0.03	0.00
240.80	0.03	0.03	0.00
240.85	0.03	0.03	0.00
240.90	0.03	0.03	0.00
240.95	0.03	0.03	0.00
241.00	0.03	0.03	0.00
241.05	0.03	0.03	0.00
241.10	0.03	0.03	0.00
241.15	0.03	0.03	0.00
241.20	0.03	0.03	0.00
241.25	0.03	0.03	0.00
241.30	0.03	0.03	0.00
241.35	0.03	0.03	0.00
241.40	0.03	0.03	0.00
241.45	0.03	0.03	0.00
241.50	0.04	0.04	0.00
241.55	0.04	0.04	0.00
241.60	0.04	0.04	0.00
241.65	0.04	0.04	0.00
241.70	0.04	0.04	0.00
241.75	0.04	0.04	0.00
241.80	0.04	0.04	0.00
241.85	0.04	0.04	0.00
241.90	0.04	0.04	0.00
241.95	0.04	0.04	0.00
242.00	0.04	0.04	0.00
242.05	0.04	0.04	0.00
242.10	0.04	0.04	0.00
242.15	0.04	0.04	0.00
242.20	0.04	0.04	0.00
242.25	0.04	0.04	0.00
242.30	0.04	0.04	0.00
242.35	0.06	0.05	0.01
242.40	0.09	0.05	0.04
242.45	0.14	0.05	0.10
242.50	0.22	0.05	0.17
242.55	0.31	0.05	0.26
242.60	0.42	0.05	0.37
242.65	0.54	0.05	0.49
242.70	0.68	0.05	0.63
242.75	0.83	0.05	0.78
242.80	1.00	0.05	0.95
242.85	1.17	0.05	1.12
242.90	1.35	0.05	1.30
242.95	1.54	0.05	1.48
243.00	1.73	0.05	1.67
243.05	1.92	0.05	1.86
243.10	2.11	0.05	2.05
243.15	2.29	0.06	2.23
243.20	2.46	0.06	2.40
243.25	2.61	0.06	2.56
243.30	2.73	0.06	2.67
243.35	2.86	0.06	2.80
243.40	2.99	0.06	2.93
243.45	3.11	0.06	3.05
243.50	**3.22**	**0.06**	**3.16**

Summary for Pond SWM-2: Rice Stone Surface

Inflow Area = 12,926 sf, 10.44% Impervious, Inflow Depth > 2.21" for 10-YR event
Inflow = 0.72 cfs @ 12.11 hrs, Volume= 2,384 cf
Outflow = 0.26 cfs @ 12.00 hrs, Volume= 2,383 cf, Atten= 64%, Lag= 0.0 min
Discarded = 0.26 cfs @ 12.00 hrs, Volume= 2,383 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 240.11' @ 12.44 hrs Surf.Area= 11,090 sf Storage= 359 cf

Plug-Flow detention time= 7.0 min calculated for 2,378 cf (100% of inflow)
Center-of-Mass det. time= 6.9 min (852.3 - 845.4)

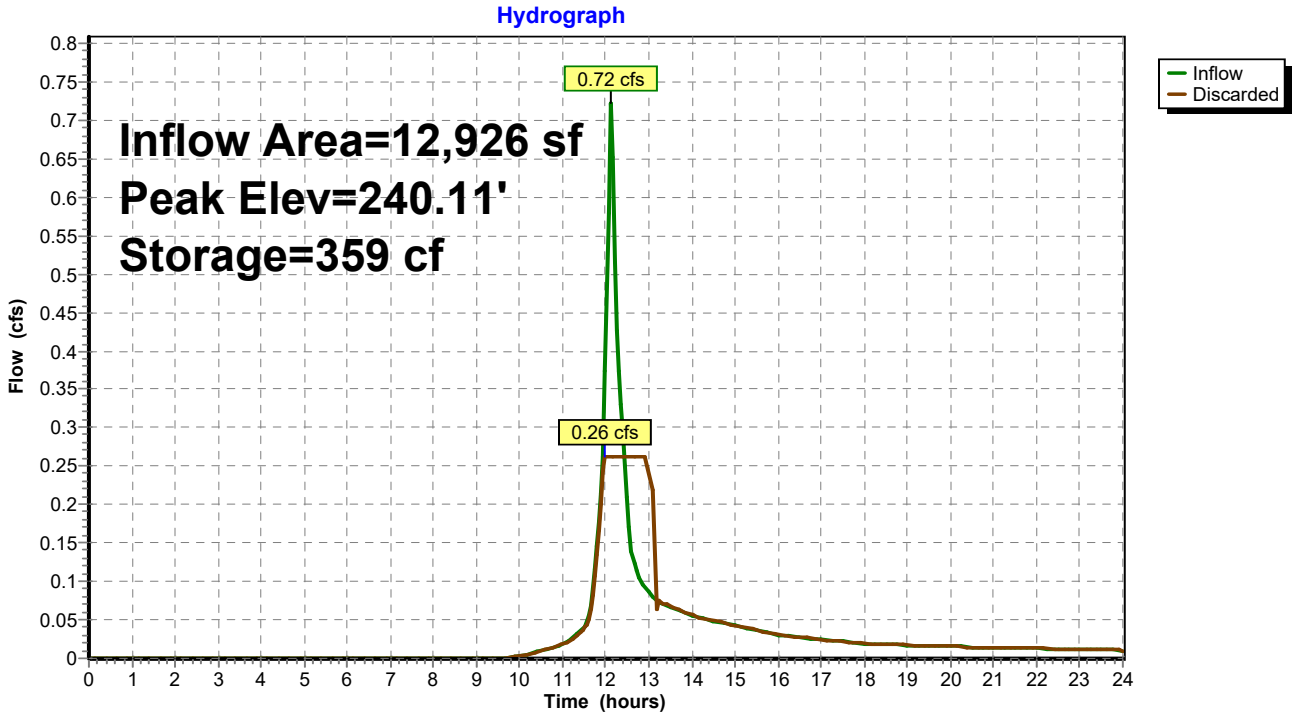
Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	1,664 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 5,545 cf Overall x 30.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
240.00	11,090	0	0
240.50	11,090	5,545	5,545

Device	Routing	Invert	Outlet Devices
#1	Discarded	240.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.26 cfs @ 12.00 hrs HW=240.01' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.26 cfs)

Pond SWM-2: Rice Stone Surface



Stage-Discharge for Pond SWM-2: Rice Stone Surface

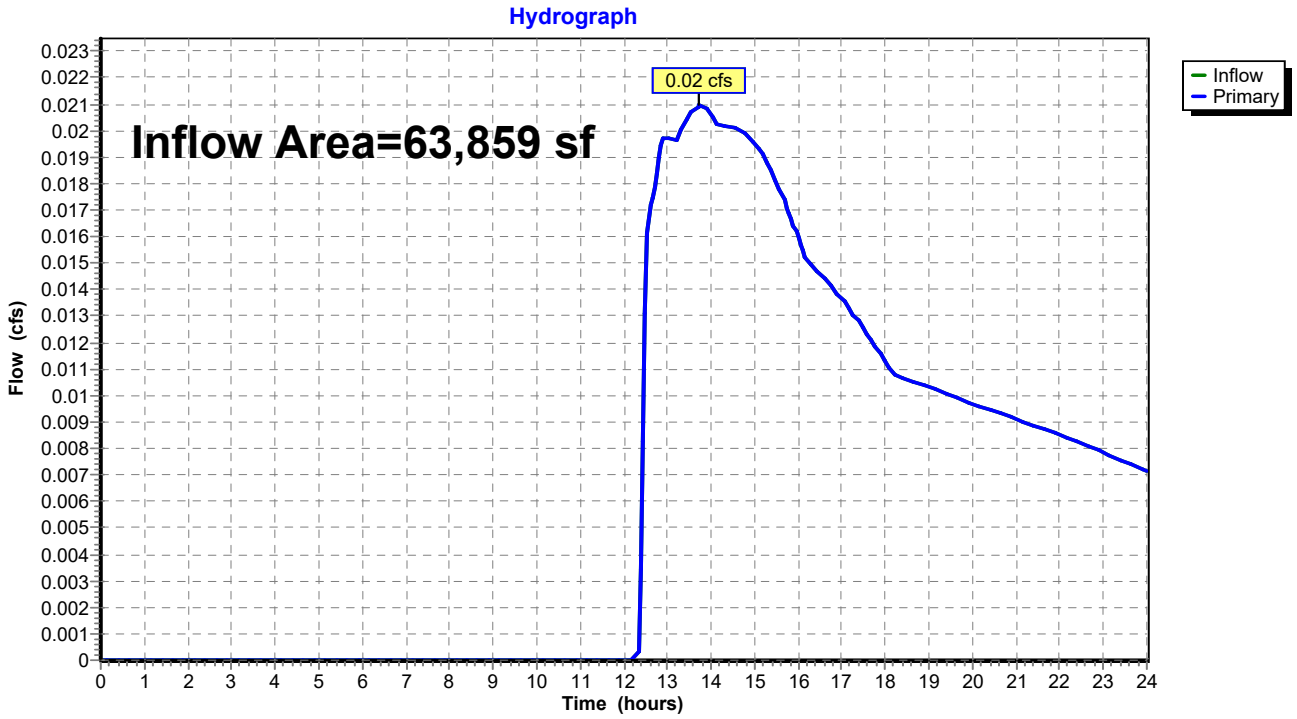
Elevation (feet)	Discarded (cfs)
240.00	0.00
240.01	**0.26**
240.02	0.26
240.03	0.26
240.04	0.26
240.05	0.26
240.06	0.26
240.07	0.26
240.08	0.26
240.09	0.26
240.10	0.26
240.11	0.26
240.12	0.26
240.13	0.26
240.14	0.26
240.15	0.26
240.16	0.26
240.17	0.26
240.18	0.26
240.19	0.26
240.20	0.26
240.21	0.26
240.22	0.26
240.23	0.26
240.24	0.26
240.25	0.26
240.26	0.26
240.27	0.26
240.28	0.26
240.29	0.26
240.30	0.26
240.31	0.26
240.32	0.26
240.33	0.26
240.34	0.26
240.35	0.26
240.36	0.26
240.37	0.26
240.38	0.26
240.39	0.26
240.40	0.26
240.41	0.26
240.42	0.26
240.43	0.26
240.44	0.26
240.45	0.26
240.46	0.26
240.47	0.26
240.48	0.26
240.49	0.26
240.50	0.26

Summary for Link POA: Wetland

Inflow Area = 63,859 sf, 14.89% Impervious, Inflow Depth > 0.10" for 10-YR event
Inflow = 0.02 cfs @ 13.74 hrs, Volume= 541 cf
Primary = 0.02 cfs @ 13.74 hrs, Volume= 541 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link POA: Wetland



Summary for Subcatchment P-1: Parking Lot

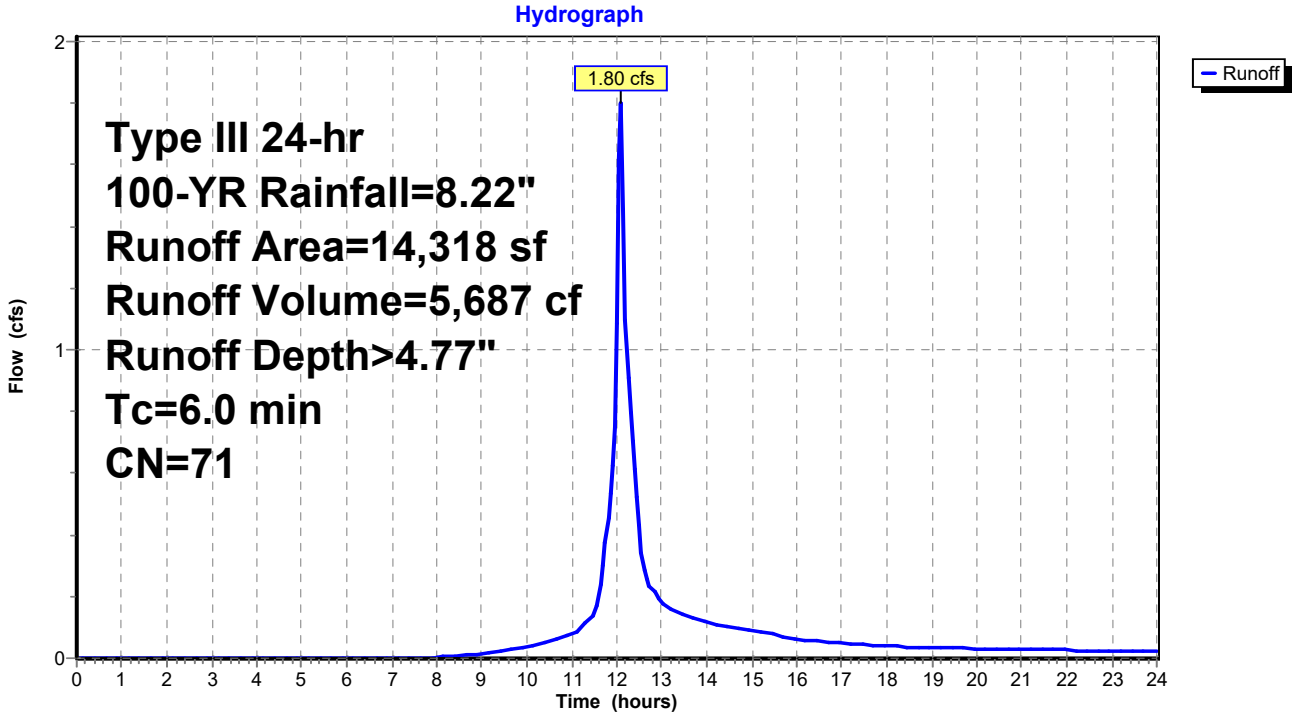
Runoff = 1.80 cfs @ 12.09 hrs, Volume= 5,687 cf, Depth> 4.77"
Routed to Pond SWM-1 : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=8.22"

Area (sf)	CN	Description
7,706	98	Paved parking, HSG A
6,612	39	>75% Grass cover, Good, HSG A
14,318	71	Weighted Average
6,612		46.18% Pervious Area
7,706		53.82% Impervious Area

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

Subcatchment P-1: Parking Lot



Summary for Subcatchment P-2: Remaining

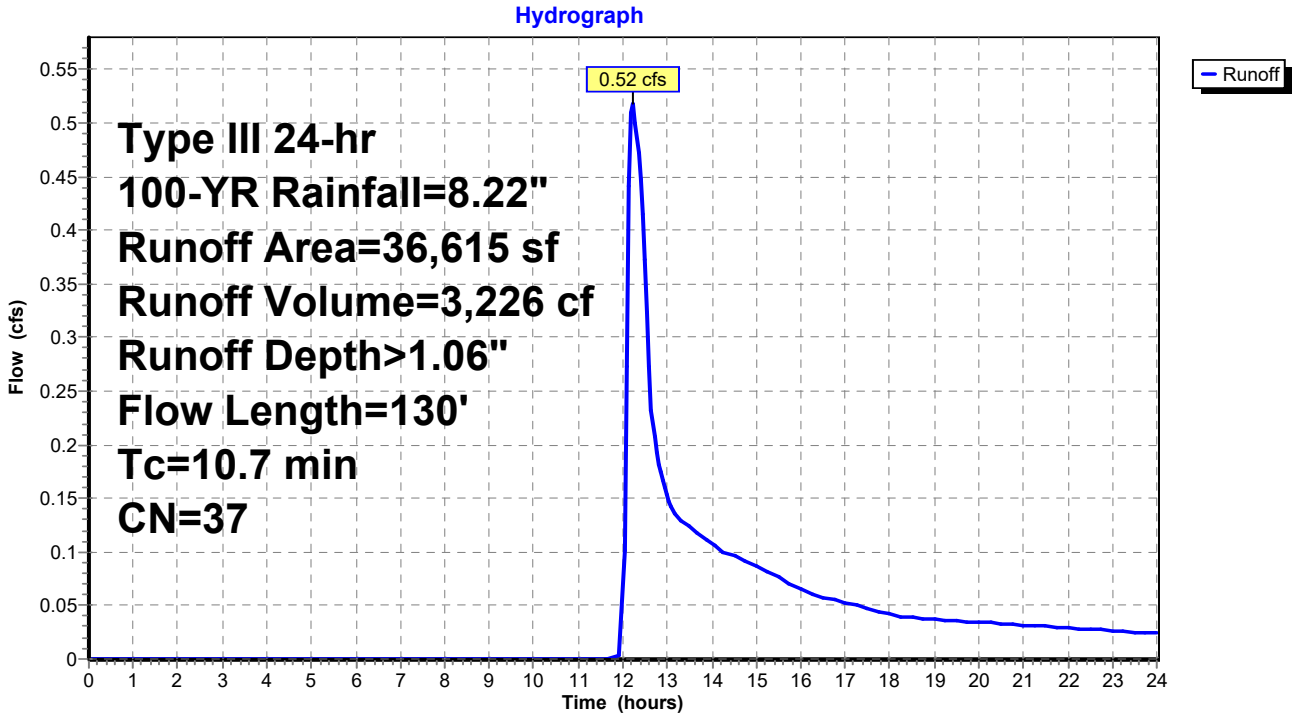
Runoff = 0.52 cfs @ 12.22 hrs, Volume= 3,226 cf, Depth> 1.06"
Routed to Link POA : Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=8.22"

Area (sf)	CN	Description
29,987	36	Woods, Fair, HSG A
6,178	39	>75% Grass cover, Good, HSG A
450	98	Unconnected pavement, HSG A
36,615	37	Weighted Average
36,165		98.77% Pervious Area
450		1.23% Impervious Area
450		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	50	0.1400	0.08		**Sheet Flow, A-B** Woods: Dense underbrush n= 0.800 P2= 3.16"
0.6	52	0.0900	1.50		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.2	28	0.1800	2.12		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
10.7	130	Total			

Subcatchment P-2: Remaining



Summary for Subcatchment P-3: Rice Stone Surface

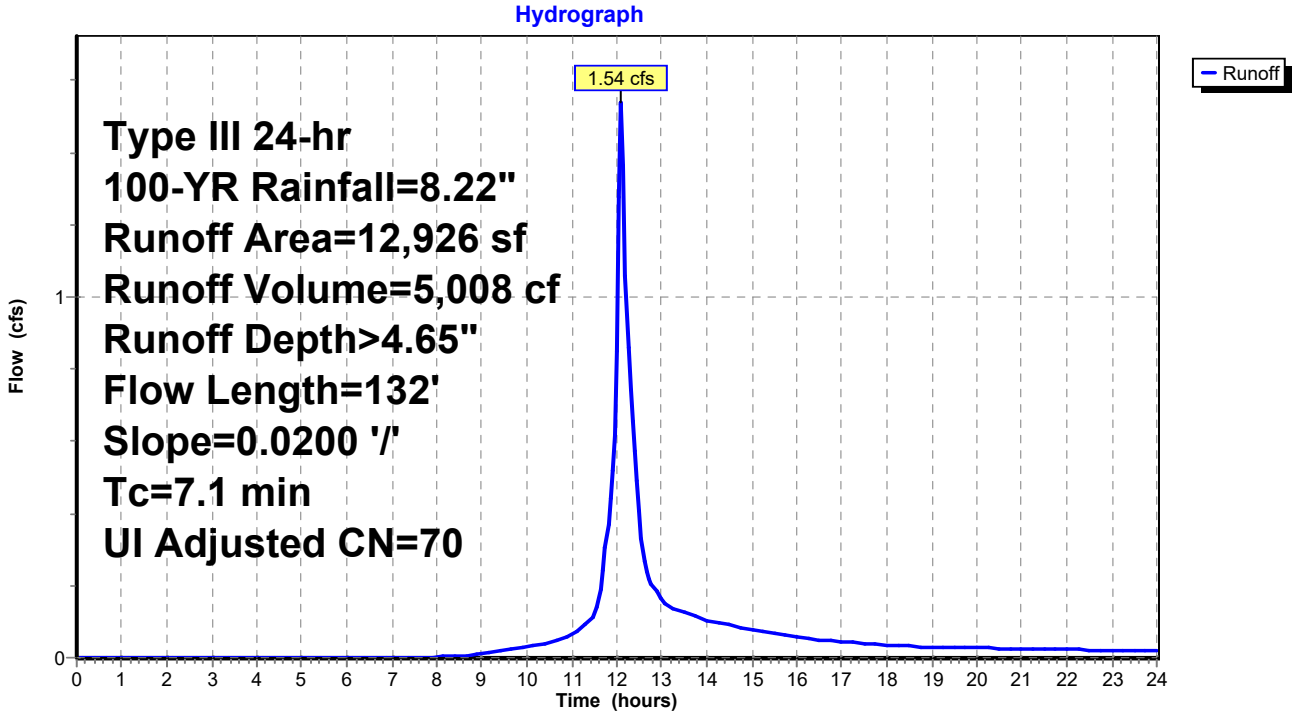
Runoff = 1.54 cfs @ 12.11 hrs, Volume= 5,008 cf, Depth> 4.65"
Routed to Pond SWM-2 : Rice Stone Surface

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=8.22"

Area (sf)	CN	Adj	Description
11,576	68		<50% Grass cover, Poor, HSG A
1,350	98		Unconnected pavement, HSG A
12,926	71	70	Weighted Average, UI Adjusted
11,576			89.56% Pervious Area
1,350			10.44% Impervious Area
1,350			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.16"
1.4	82	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.1	132	Total			

Subcatchment P-3: Rice Stone Surface



Summary for Pond SWM-1: Infiltration Basin

Inflow Area = 14,318 sf, 53.82% Impervious, Inflow Depth > 4.77" for 100-YR event
Inflow = 1.80 cfs @ 12.09 hrs, Volume= 5,687 cf
Outflow = 0.12 cfs @ 13.93 hrs, Volume= 2,888 cf, Atten= 93%, Lag= 110.4 min
Discarded = 0.05 cfs @ 13.93 hrs, Volume= 2,160 cf
Primary = 0.07 cfs @ 13.93 hrs, Volume= 728 cf
Routed to Link POA : Wetland

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 242.43' @ 13.93 hrs Surf.Area= 1,950 sf Storage= 3,325 cf

Plug-Flow detention time= 287.7 min calculated for 2,882 cf (51% of inflow)
Center-of-Mass det. time= 174.8 min (995.7 - 821.0)

Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	5,727 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

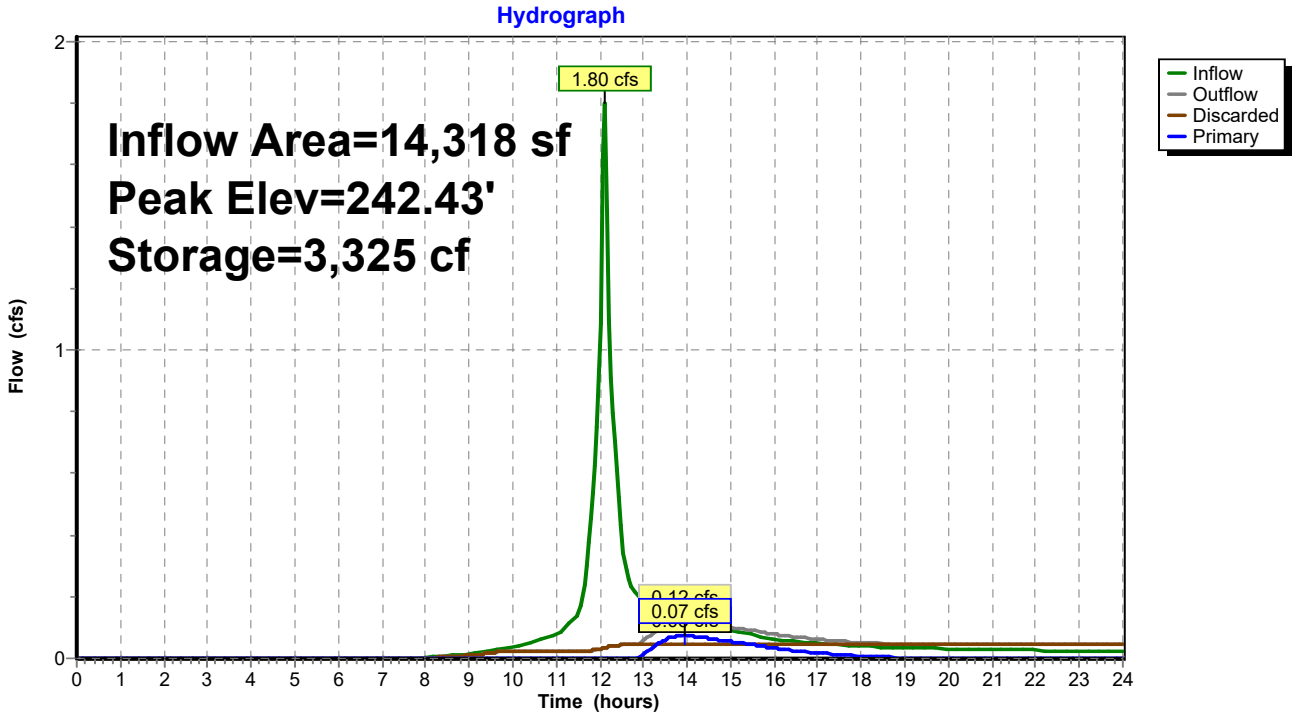
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
240.00	846	128.0	0	0	846
241.00	1,260	147.0	1,046	1,046	1,284
242.00	1,732	166.0	1,490	2,536	1,782
243.00	2,260	185.0	1,990	4,526	2,341
243.50	2,545	194.0	1,201	5,727	2,629

Device	Routing	Invert	Outlet Devices
#1	Discarded	240.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Device 3	242.30'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	240.00'	**12.0" Round Culvert** L= 22.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.00' / 239.75' S= 0.0114 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.05 cfs @ 13.93 hrs HW=242.43' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.07 cfs @ 13.93 hrs HW=242.43' (Free Discharge)
└**3=Culvert** (Passes 0.07 cfs of 4.15 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.07 cfs @ 1.22 fps)

Pond SWM-1: Infiltration Basin



Stage-Discharge for Pond SWM-1: Infiltration Basin

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
240.00	0.00	0.00	0.00
240.05	0.02	0.02	0.00
240.10	0.02	0.02	0.00
240.15	0.02	0.02	0.00
240.20	0.02	0.02	0.00
240.25	0.02	0.02	0.00
240.30	0.02	0.02	0.00
240.35	0.02	0.02	0.00
240.40	0.02	0.02	0.00
240.45	0.02	0.02	0.00
240.50	0.02	0.02	0.00
240.55	0.03	0.03	0.00
240.60	0.03	0.03	0.00
240.65	0.03	0.03	0.00
240.70	0.03	0.03	0.00
240.75	0.03	0.03	0.00
240.80	0.03	0.03	0.00
240.85	0.03	0.03	0.00
240.90	0.03	0.03	0.00
240.95	0.03	0.03	0.00
241.00	0.03	0.03	0.00
241.05	0.03	0.03	0.00
241.10	0.03	0.03	0.00
241.15	0.03	0.03	0.00
241.20	0.03	0.03	0.00
241.25	0.03	0.03	0.00
241.30	0.03	0.03	0.00
241.35	0.03	0.03	0.00
241.40	0.03	0.03	0.00
241.45	0.03	0.03	0.00
241.50	0.04	0.04	0.00
241.55	0.04	0.04	0.00
241.60	0.04	0.04	0.00
241.65	0.04	0.04	0.00
241.70	0.04	0.04	0.00
241.75	0.04	0.04	0.00
241.80	0.04	0.04	0.00
241.85	0.04	0.04	0.00
241.90	0.04	0.04	0.00
241.95	0.04	0.04	0.00
242.00	0.04	0.04	0.00
242.05	0.04	0.04	0.00
242.10	0.04	0.04	0.00
242.15	0.04	0.04	0.00
242.20	0.04	0.04	0.00
242.25	0.04	0.04	0.00
242.30	0.04	0.04	0.00
242.35	0.06	0.05	0.01
242.40	0.09	0.05	0.04
242.45	0.14	0.05	0.10
242.50	0.22	0.05	0.17
242.55	0.31	0.05	0.26
242.60	0.42	0.05	0.37
242.65	0.54	0.05	0.49
242.70	0.68	0.05	0.63
242.75	0.83	0.05	0.78
242.80	1.00	0.05	0.95
242.85	1.17	0.05	1.12
242.90	1.35	0.05	1.30
242.95	1.54	0.05	1.48
243.00	1.73	0.05	1.67
243.05	1.92	0.05	1.86
243.10	2.11	0.05	2.05
243.15	2.29	0.06	2.23
243.20	2.46	0.06	2.40
243.25	2.61	0.06	2.56
243.30	2.73	0.06	2.67
243.35	2.86	0.06	2.80
243.40	2.99	0.06	2.93
243.45	3.11	0.06	3.05
243.50	**3.22**	**0.06**	**3.16**

Summary for Pond SWM-2: Rice Stone Surface

Inflow Area = 12,926 sf, 10.44% Impervious, Inflow Depth > 4.65" for 100-YR event
Inflow = 1.54 cfs @ 12.11 hrs, Volume= 5,008 cf
Outflow = 0.26 cfs @ 11.75 hrs, Volume= 5,006 cf, Atten= 83%, Lag= 0.0 min
Discarded = 0.26 cfs @ 11.75 hrs, Volume= 5,006 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 240.44' @ 12.61 hrs Surf.Area= 11,090 sf Storage= 1,448 cf

Plug-Flow detention time= 36.2 min calculated for 4,996 cf (100% of inflow)
Center-of-Mass det. time= 36.0 min (860.0 - 823.9)

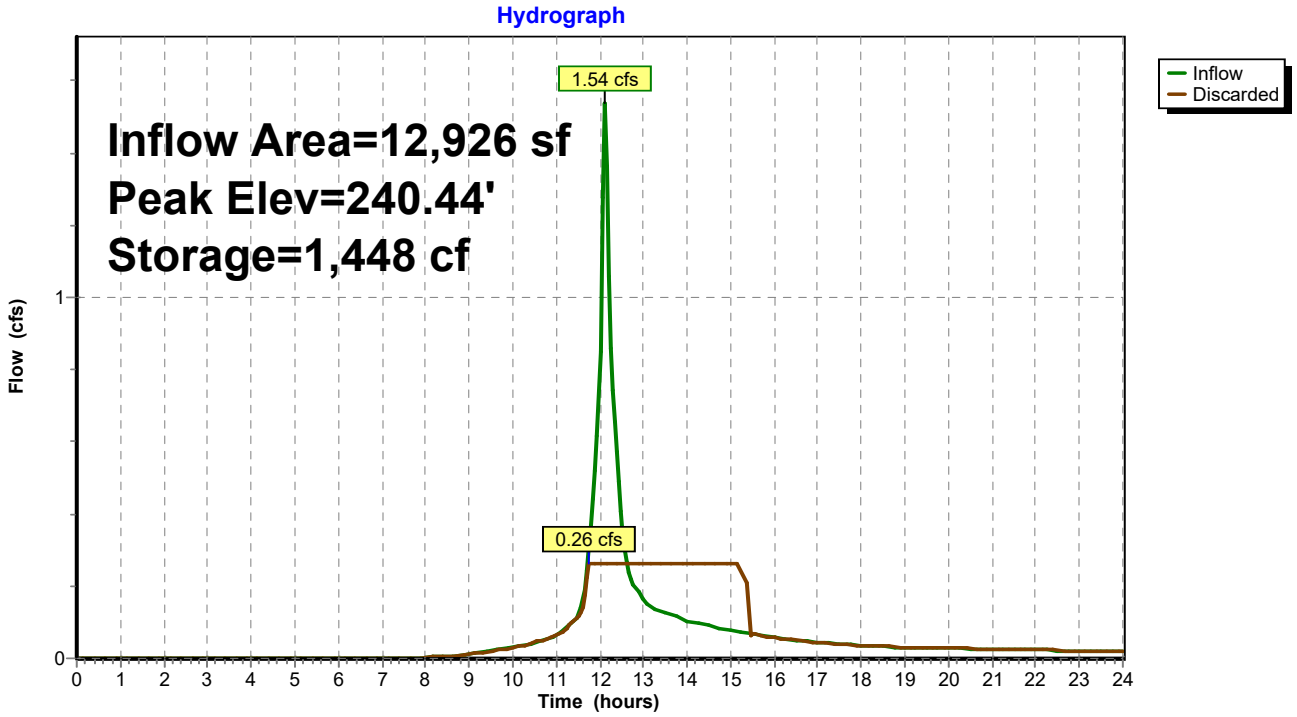
Volume	Invert	Avail.Storage	Storage Description
#1	240.00'	1,664 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 5,545 cf Overall x 30.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
240.00	11,090	0	0
240.50	11,090	5,545	5,545

Device	Routing	Invert	Outlet Devices
#1	Discarded	240.00'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.26 cfs @ 11.75 hrs HW=240.01' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.26 cfs)

Pond SWM-2: Rice Stone Surface



Stage-Discharge for Pond SWM-2: Rice Stone Surface

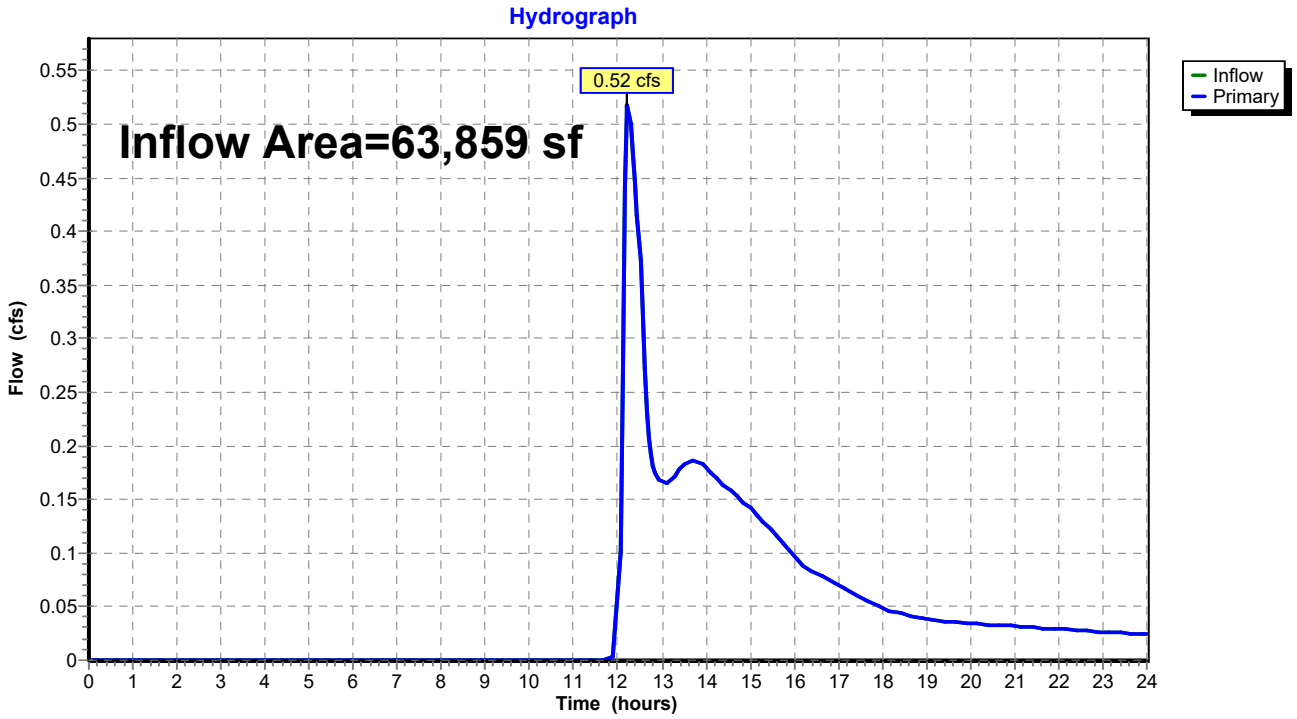
Elevation (feet)	Discarded (cfs)
240.00	0.00
240.01	**0.26**
240.02	0.26
240.03	0.26
240.04	0.26
240.05	0.26
240.06	0.26
240.07	0.26
240.08	0.26
240.09	0.26
240.10	0.26
240.11	0.26
240.12	0.26
240.13	0.26
240.14	0.26
240.15	0.26
240.16	0.26
240.17	0.26
240.18	0.26
240.19	0.26
240.20	0.26
240.21	0.26
240.22	0.26
240.23	0.26
240.24	0.26
240.25	0.26
240.26	0.26
240.27	0.26
240.28	0.26
240.29	0.26
240.30	0.26
240.31	0.26
240.32	0.26
240.33	0.26
240.34	0.26
240.35	0.26
240.36	0.26
240.37	0.26
240.38	0.26
240.39	0.26
240.40	0.26
240.41	0.26
240.42	0.26
240.43	0.26
240.44	0.26
240.45	0.26
240.46	0.26
240.47	0.26
240.48	0.26
240.49	0.26
240.50	0.26

Summary for Link POA: Wetland

Inflow Area = 63,859 sf, 14.89% Impervious, Inflow Depth > 0.74" for 100-YR event
Inflow = 0.52 cfs @ 12.22 hrs, Volume= 3,954 cf
Primary = 0.52 cfs @ 12.22 hrs, Volume= 3,954 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link POA: Wetland



SEDIMENT FOREBAY SIZING CALCULATIONS

This analysis is to evaluate sizing criteria of all proposed sediment forebays according to "Volume 2 Chapter 2: Structural BMP Specifications for the Massachusetts Stormwater Handbook." The proposed sediment forebay will receive surface runoff prior to discharge to downstream infiltration BMPs.

Forebay Upstream of SWM-1: Infiltration Basin

Tributary Impervious Area	= 7,706 ft^2
Forebay Volume Required	= 0.1 inches per impervious acre
	= (7,706 ft^2) x (1 ac/43,560 ft^2) x (0.1/12)
	= 0.0015 ac-ft
	= 65 ft^3
Forebay 1 Volume Provided	= Volume below spillway elevation 243.00 ft
	= **369 ft^3 > 65 ft^3**

DRAWDOWN ANALYSIS

Drawdown Time: $T = Rv / (K*A)$

where
- T = drawdown time (hours)
- Rv = volume below lowest outlet (ft^3)
- K = hydraulic conductivity (ft/hr)
  - = (1.02 in/hr) * (1 ft/12 in)
  - = 0.085 ft/hr
- A = bottom area of infiltration system (ft^2)

Reference Stormwater Handbook Volume 3 Chapter 1 Step 5) “Drawdown Within 72 Hours”.

Infiltration Basin IB-1:
- Rv = 3,078 ft^3
- K = 0.085 ft/hr
- A = 841 ft^2
- T = (3,078 ft^3) / (0.085 ft/hr)(841 ft^2)
  - = **43.1 hours** < 72 hours

Stage-Area-Storage for Pond SWM-1: Infiltration Basin

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
240.00	846	0
240.05	865	43
240.10	884	86
240.15	903	131
240.20	922	177
240.25	942	223
240.30	962	271
240.35	982	320
240.40	1,002	369
240.45	1,022	420
240.50	1,043	471
240.55	1,064	524
240.60	1,085	578
240.65	1,106	632
240.70	1,127	688
240.75	1,149	745
240.80	1,171	803
240.85	1,193	862
240.90	1,215	922
240.95	1,237	984
241.00	1,260	1,046
241.05	1,282	1,110
241.10	1,304	1,174
241.15	1,326	1,240
241.20	1,348	1,307
241.25	1,371	1,375
241.30	1,394	1,444
241.35	1,417	1,514
241.40	1,440	1,586
241.45	1,463	1,658
241.50	1,487	1,732
241.55	1,510	1,807
241.60	1,534	1,883
241.65	1,558	1,960
241.70	1,583	2,039
241.75	1,607	2,119
241.80	1,632	2,200
241.85	1,656	2,282
241.90	1,681	2,365
241.95	1,707	2,450
242.00	1,732	2,536
242.05	1,757	2,623
242.10	1,782	2,712
242.15	1,807	2,801
242.20	1,832	2,892
242.25	1,857	2,984
242.30	1,883	3,078
242.35	1,909	3,173
242.40	1,935	3,269
242.45	1,961	3,366
242.50	1,987	3,465
242.55	2,014	3,565
242.60	2,040	3,666
242.65	2,067	3,769
242.70	2,094	3,873
242.75	2,121	3,978
242.80	2,149	4,085
242.85	2,176	4,193
242.90	2,204	4,303
242.95	2,232	4,414
243.00	2,260	4,526
243.05	2,288	4,640
243.10	2,316	4,755
243.15	2,344	4,871
243.20	2,372	4,989
243.25	2,400	5,109
243.30	2,429	5,229
243.35	2,458	5,351
243.40	2,487	5,475
243.45	2,516	5,600
243.50	**2,545**	**5,727**

WATER QUALITY VOLUME CALCULATIONS

This analysis is to evaluate water quality volume criteria according to "Volume 1 Chapter 1: Stormwater Management Standards." The Project utilizes one (1) surface infiltration basin.

Recharge Volume Required:

Impervious Area in A Soils	= 9,506 ft^2
Volume to Recharge Requirement for A Soils	= 0.60 inches of runoff
Required Recharge Volume (A Soils)	= (9,506 ft^2) x (0.60/12)
	= **476** ft^3

Water Quality Volume Required:

Paved Impervious Area (Excluding Roof Areas)	= 9,506 ft^2
Water Quality Volume Requirement	= 1 inch over total impervious area
	= (9,506 ft^2) x (1in/12 in/ft)
	= **792 ft^3**

Total Volume Required for Recharge & Water Quality

Recharge and Water Quality Volume	= 476 ft^3 + 792 ft^3
	= **1,268 ft^3**

Water Quality Volume Provided in Infiltration BMPs:

SWM-1: Infiltration Basin	= Volume below spillway elevation 242.30'
	= 3,078 ft^3
Total Volume Provided	= **3,078 ft^3 > 1,268 ft^3**

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: Memorial Drive, Ashland, MA

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Infiltration Basin SWM-1 w/ Sediment Forebay	0.80	1.00	0.80	0.20

Total TSS Removal = 80%

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

Project: Ashland Dog Park

Prepared By: NCK

Date: 10/18/24

*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

APPENDIX C: SUPPORTING INFORMATION

NOAA Atlas 14, Volume 10, Version 3
Location name: Ashland, Massachusetts, USA*
Latitude: 42.2628°, Longitude: -71.4642°
Elevation: 189 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)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.332 (0.258-0.424)	0.400 (0.310-0.511)	0.511 (0.394-0.655)	0.602 (0.463-0.776)	0.728 (0.542-0.981)	0.823 (0.601-1.13)	0.922 (0.655-1.32)	1.03 (0.695-1.51)	1.20 (0.774-1.81)	1.33 (0.840-2.05)
10-min	0.471 (0.366-0.601)	0.566 (0.440-0.724)	0.722 (0.558-0.926)	0.852 (0.655-1.10)	1.03 (0.768-1.39)	1.16 (0.851-1.61)	1.31 (0.927-1.87)	1.46 (0.986-2.14)	1.69 (1.10-2.56)	1.88 (1.19-2.91)
15-min	0.554 (0.430-0.707)	0.666 (0.517-0.852)	0.850 (0.657-1.09)	1.00 (0.771-1.29)	1.21 (0.904-1.64)	1.37 (1.00-1.89)	1.54 (1.09-2.20)	1.72 (1.16-2.52)	1.99 (1.29-3.02)	2.21 (1.40-3.42)
30-min	0.760 (0.590-0.970)	0.913 (0.709-1.17)	1.16 (0.900-1.49)	1.37 (1.06-1.77)	1.66 (1.24-2.24)	1.88 (1.37-2.58)	2.10 (1.49-3.01)	2.36 (1.59-3.45)	2.72 (1.76-4.12)	3.02 (1.91-4.67)
60-min	0.965 (0.750-1.23)	1.16 (0.900-1.48)	1.48 (1.14-1.90)	1.74 (1.34-2.25)	2.11 (1.57-2.84)	2.38 (1.74-3.28)	2.67 (1.90-3.82)	2.99 (2.01-4.38)	3.45 (2.24-5.23)	3.83 (2.43-5.92)
2-hr	1.23 (0.960-1.56)	1.48 (1.16-1.88)	1.90 (1.48-2.42)	2.25 (1.74-2.88)	2.73 (2.05-3.66)	3.08 (2.27-4.24)	3.46 (2.49-4.96)	3.92 (2.65-5.70)	4.61 (3.00-6.94)	5.20 (3.30-7.98)
3-hr	1.41 (1.11-1.79)	1.71 (1.34-2.17)	2.20 (1.72-2.79)	2.61 (2.03-3.33)	3.17 (2.39-4.25)	3.58 (2.65-4.92)	4.03 (2.92-5.78)	4.58 (3.10-6.63)	5.43 (3.53-8.14)	6.16 (3.92-9.42)
6-hr	1.81 (1.43-2.27)	2.20 (1.74-2.76)	2.84 (2.23-3.57)	3.36 (2.63-4.26)	4.09 (3.11-5.45)	4.63 (3.45-6.32)	5.21 (3.80-7.44)	5.94 (4.03-8.54)	7.07 (4.62-10.5)	8.06 (5.14-12.2)
12-hr	2.30 (1.83-2.86)	2.80 (2.22-3.48)	3.62 (2.86-4.52)	4.29 (3.38-5.40)	5.23 (4.00-6.92)	5.92 (4.44-8.02)	6.67 (4.88-9.44)	7.60 (5.18-10.8)	9.03 (5.92-13.3)	10.3 (6.57-15.5)
24-hr	2.72 (2.19-3.37)	3.35 (2.69-4.15)	4.38 (3.50-5.44)	5.24 (4.15-6.54)	6.41 (4.93-8.43)	7.28 (5.49-9.80)	8.22 (6.05-11.6)	9.40 (6.44-13.3)	11.2 (7.39-16.5)	12.8 (8.23-19.2)
2-day	3.03 (2.45-3.72)	3.79 (3.05-4.65)	5.02 (4.04-6.19)	6.05 (4.83-7.50)	7.46 (5.79-9.77)	8.49 (6.46-11.4)	9.64 (7.17-13.6)	11.1 (7.63-15.6)	13.4 (8.86-19.6)	15.5 (9.97-23.0)
3-day	3.27 (2.66-4.00)	4.08 (3.31-5.00)	5.40 (4.36-6.64)	6.50 (5.21-8.02)	8.01 (6.23-10.4)	9.11 (6.96-12.2)	10.3 (7.71-14.5)	11.9 (8.19-16.7)	14.4 (9.51-20.9)	16.6 (10.7-24.5)
4-day	3.51 (2.86-4.28)	4.35 (3.53-5.31)	5.72 (4.63-7.00)	6.85 (5.51-8.43)	8.41 (6.56-10.9)	9.55 (7.31-12.7)	10.8 (8.07-15.1)	12.4 (8.57-17.4)	15.0 (9.91-21.7)	17.2 (11.1-25.4)
7-day	4.20 (3.44-5.10)	5.09 (4.16-6.17)	6.53 (5.32-7.95)	7.72 (6.25-9.46)	9.37 (7.34-12.1)	10.6 (8.12-14.0)	11.9 (8.89-16.4)	13.6 (9.39-18.8)	16.1 (10.7-23.1)	18.3 (11.9-26.8)
10-day	4.87 (4.00-5.88)	5.79 (4.75-6.99)	7.28 (5.95-8.82)	8.51 (6.91-10.4)	10.2 (8.02-13.1)	11.5 (8.81-15.0)	12.8 (9.57-17.5)	14.5 (10.1-20.0)	17.0 (11.3-24.3)	19.1 (12.4-27.9)
20-day	6.87 (5.68-8.23)	7.85 (6.49-9.42)	9.45 (7.78-11.4)	10.8 (8.82-13.0)	12.6 (9.93-15.9)	14.0 (10.8-18.0)	15.4 (11.4-20.6)	17.0 (11.9-23.3)	19.3 (12.9-27.4)	21.2 (13.8-30.6)
30-day	8.50 (7.07-10.2)	9.53 (7.91-11.4)	11.2 (9.26-13.4)	12.6 (10.3-15.2)	14.5 (11.4-18.1)	16.0 (12.3-20.4)	17.4 (12.9-23.0)	19.0 (13.3-25.8)	21.1 (14.1-29.7)	22.7 (14.8-32.7)
45-day	10.5 (8.78-12.5)	11.6 (9.65-13.8)	13.3 (11.1-15.9)	14.8 (12.2-17.7)	16.8 (13.3-20.8)	18.3 (14.1-23.2)	19.8 (14.6-25.8)	21.3 (15.0-28.8)	23.1 (15.6-32.4)	24.5 (16.0-35.1)
60-day	12.2 (10.2-14.4)	13.3 (11.1-15.7)	15.1 (12.5-17.9)	16.5 (13.7-19.8)	18.6 (14.7-23.0)	20.2 (15.6-25.4)	21.7 (16.0-28.1)	23.1 (16.3-31.2)	24.8 (16.7-34.6)	25.9 (16.9-37.0)

[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.

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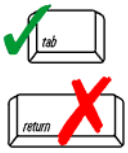
PF graphical

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

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

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.

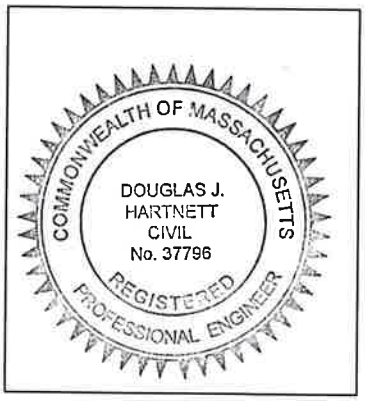
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



Signature and Date 10-18-2024

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:

- [X] No disturbance to any Wetland Resource Areas
- [ ] Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- [ ] Reduced Impervious Area (Redevelopment Only)
- [X] Minimizing disturbance to existing trees and shrubs
- [ ] LID Site Design Credit Requested:
  - [ ] Credit 1
  - [ ] Credit 2
  - [ ] Credit 3
- [X] 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): _____

Standard 1: No New Untreated Discharges

- [X] 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.

APPENDIX D: OPERATION AND MAINTENANCE PLANS

Dog Park
Memorial Drive
Ashland, Massachusetts

Dated: October 18, 2024

I. OWNER:

Town of Ashland
101 Main Street
Ashland, MA 01721

II. RESPONSIBLE PARTY:

Town of Ashland
101 Main Street
Ashland, MA 01721

III. PROJECT OVERVIEW:

Prevention of offsite flooding, improvement to water quality prior to leaving the property, and promoting groundwater recharge are the main priorities of the project with respect to the drainage design. The proposed project is a new construction; therefore the project is designed to meet all Massachusetts Stormwater standards. The project will improve existing stormwater management within the property with respect to what occurs today by installing Best Management Practices (BMPs) within the stormwater collection system. Water quality BMPs to mitigate the runoff generated by the site improvements during construction include temporary Silt Sack® catch basin inserts (or similar product), construction entrance with anti-tracking pad, straw wattle along the work zone perimeter, and periodic sweeping to remove sand and sediment.

The BMPs used in this design were chosen for their effectiveness and ease of maintenance, repair/replacement, and modification. Providing for maintenance requirements that are practical is essential to achieve the desired result of improved stormwater quality. This plan will be provided to the property owner, property manager, and general contractor to educate them on the recommendations of this plan and the Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas.

IV. CONSTRUCTION PERIOD – BEST MANAGEMENT PRACTICES:

a) MONITORING

During construction operations, the stormwater management system will be inspected at least once every seven (7) calendar days, or once every fourteen (14) calendar days, and within twenty-four (24) hours after a storm event of one quarter inch (0.25") or greater. Sediment accumulation shall be removed once a depth of one-third the height of the erosion control device is achieved unless otherwise stated. Damaged erosion controls shall be replaced immediately.

b) WASTE DISPOSAL

Metal dumpster-type waste disposal receptacles will be located on site. The project site will be policed daily by a person appointed by the General Contractor to ensure the project site is kept free of construction debris.

c) DUST MONITORING PLAN

A dust monitoring plan will be established prior to the start of construction to be kept on site at all times. This will reduce the amount of particulates in the air and reduce impacts to the surrounding areas. Recommended methods for controlling dust include:

- Provide a vegetative cover to disturbed areas at the end of earth disturbing activities as soon as practical, but no longer than 14 days.
- Apply a mulch layer to disturbed areas at the end of earth disturbing activities as soon as practical, but no longer than 14 days.
- Cover stockpiles unused for a maximum of 7 days with poly sheeting or tarps.
- Water surface materials and soil stockpiles.
- Use covered trucks.
- Minimize spoils stockpiled on site.
- Monitor construction practices to minimize unnecessary disturbance and transfer of soil materials.
- Conduct periodic street cleaning along the site frontage during excavation and hauling of materials.
- Pave driveways and parking surfaces (where applicable and feasible).
- Assign a person to remove windblown debris daily.
- Limit the idling of engines or stopped vehicles (with the exception of asphalt and cement concrete mixing trucks and equipment) to five minutes.

d) SPILL PREVENTION AND RESPONSE

Construction activities for this project will necessitate the use of equipment fuels, engine fluids, paints, and adhesives on the construction site and must be considered in the spill prevention and response practices for the project.

The general contractor will ensure areas where potential pollutants can occur are well protected with erosion control barriers and clean up equipment to prevent discharge of wastewater, fuels, and oil from vehicles and any other toxic or hazardous spills from the project site.

Should a spill occur, equipment necessary to attend to spills or leaks shall be stored on site in an equipment trailer and shall consist of the following:

- Safety goggles.
- Chemically resistant gloves and overshoe boots.
- Water and chemical fire extinguishers.
- Shovels.
- Absorbent materials.
- Containers suitable for storage of site-specific materials.
- First Aid kits.

Spills and leaks shall be treated according to the type, volume, and location of the released material. Generally, mitigation shall consist of the following:

- Prevention of additional material storage.
- Containment of spilled material.
- Safe, thorough, and environmentally sound removal of spilled material.
- Remediation of environmental damage.

The following describes specific preventative methods to be employed for materials to be used on site.

Fuels, Antifreeze, and Coolant for Construction Equipment and Generators:

In the case of a fuel spill on a pervious surface, the spill shall be contained and treated with absorbent polymer material immediately and the affected soil shall be excavated and stored in an impervious, bermed area for removal by a professional hazardous material removal company. In the case of a fuel spill on an impervious surface, the spill shall be contained to prevent runoff and treated with absorbent material.

Adhesive and Paints:

Adhesive and paint materials shall be transferred to the site on an as needed basis. Any containers to be stored on site shall be clearly labeled and stored in non-flammable lockers. Wash water from paints shall be containerized; washing of paints into the storm drainage system shall be prohibited. Water-based and latex paints shall either be recycled or dried up and thrown out with the regular household trash, and oil-based paints and thinners shall be removed from the site by a local professional hazardous material removal company.

Town of Ashland Emergency Contacts are as Follows:

- Emergency Management: (888) 304-1133 (MassDEP 24-Hour Spill Reporting)
- Police Department: 911
- Ashland Fire Department: (508) 881-2323

For spills of less than five (5) gallons of material, mitigation shall consist of source control, containment, and clean-up with absorbent materials, unless an imminent hazard necessitates that a local professional hazardous material removal company become involved to mitigate the spill.

For spills greater than five (5) gallons of material, the incident shall be reported immediately to the MassDEP Hazardous Waste Incident Response Group at (617)-792-7653 and a professional emergency response contractor. Information that shall be provided to the said contractor is as follows:

- Type of material spilled.
- Quantity of material spilled.
- Location of the spill.
- Time of the spill.

The contractor shall then employ measures to prevent further spillage, contain and/or clean up the spill.

If a Reportable Quantity (RQ) of material is spilled during construction, the National Response Center (NRC) shall be notified immediately at (800) 424-8802. Reportable Quantities of hazardous material are available in 310 CMR 40: Massachusetts Contingency Plan Subpart P: Massachusetts Oil and Hazardous Material List. Within 14 days a report shall be submitted to the EPA New England Regional Office describing the following:

- Type of material released.
- Date and circumstances of the release.
- Measures taken to prevent future releases.

The report shall be submitted to the EPA New England Regional Office at the following address:

EPA New England, Region 1
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Frequent inspections of areas where potential spill could occur is key to prevention. Inspection shall take place at a minimum of once every calendar days, or once every 14 calendar days and within 24 hours of the occurrence of a storm event of 0.25 inches or greater or the occurrence of runoff from snowmelt sufficient to cause a discharge.

An inspection report must be completed within 24 hours of completing any site inspection. Each inspection report must include the following:

- The inspection date.
- Names and titles of personnel making the inspection.
- A summary of your inspection findings, covering at a minimum the observations you made in accordance with Part 4.6 of the 2017 Construction General Permit (as amended), including any necessary maintenance or corrective actions.
- If inspecting because of rainfall measuring 0.25 inches or greater, include the applicable rain gauge or weather station readings that triggered the inspection.
- If determined that it is unsafe to inspect a portion of the site, describe the reason found to be unsafe and specify the locations to which the conditions apply.

e) STATE & LOCAL SANITARY LAWS

Portable sanitary units will be placed on-site during construction and will be serviced weekly.

V. CONSTRUCTION PERIOD - STRUCTURAL BEST MANAGEMENT PRACTICES

Structural BMPs are those physical facilities that are designed to manage both stormwater quantity and quality. Proper maintenance of the proposed structural BMPs will ensure design performance, promote longevity, and decrease operator maintenance costs. The structural BMPs selected for the proposed site development include straw wattle erosion control barrier, Siltsack® temporary catch basin inserts, trench drains, and construction entrance anti-tracking pad.

a) FILTER SOCK EROSION CONTROL BARRIERS

Filter sock erosion control barriers shall be installed as specified on the "Site Preparation & Erosion Controls" (sheet C100 of the Site Development Plans) prior to commencing construction activities. The filter sock wattles shall be inspected daily and maintained throughout construction. Sediment shall be removed before it has accumulated to one-third of the above-ground height of the wattles. Any breach in the barrier shall be repaired within 24 hours. Wattles shall remain in place for the duration of construction.

b) **SILTSACK® DRAINAGE INLET INSERTS FOR EXISTING CATCH BASIN**

The existing catch basin located in the public right of way adjacent to the construction entrance shall be equipped with Siltsacks® as shown on the "Site Preparation & Erosion Controls" (plan sheet C100).

Siltsacks® shall be regular flow units installed below grate castings and be equipped with internal emergency bypass devices. Siltsacks® are to remain in place until the end of the construction and the site is stabilized. During construction, all catch basins and Siltsacks® shall be inspected every fourteen (14) calendar days and after a storm of a quarter inch (0.25") or greater. Sediment accumulation shall be removed once sediment accumulates above the expansion restraint within the bag. Damaged Siltsacks® shall be replaced immediately. The contractor shall keep a minimum of two (2) extra Siltsacks® on site in case damaged units need to be replaced. Disposal of accumulated sediment and trash is to be in accordance with applicable local, state, and federal guidelines and regulations. Upon completion of the work, contractor is responsible for inspection and cleaning of units to ensure delivery of clean units to owner prior to completion of project.

c) **CONSTRUCTION ENTRANCE ANTI-TRACKING PAD**

Construction entrance anti-tracking pads shall be installed as specified on the "Site Preparation & Erosion Controls" (sheet C100) to minimize the track-out of sediment into the public right of way from vehicles leaving the construction site. The sub-base for the pads will be compacted and covered with a filter cloth. Two-inch crushed stone will be placed on top of the filter cloth at a minimum thickness of 6-inches. The anti-tracking pads will remain in place and maintained until the parking lot receives an asphalt binder course.

Maintenance requirements include:

- Construction vehicles will be restricted to using only the designated entrance/exit armored with the tracking pad until the site has been stabilized with an asphalt binder course. The removed stone and sediment from the pad will be hauled off site and disposed in accordance with local, state and federal regulations.

- The exit will be maintained in a condition that will prevent tracking or flowing of sediment off-site. This could require additional crushed stone to be placed within the exits. Sediment shall be swept form the anti-tracking pads at least weekly, or more often if necessary. If excess sediment has clogged the pads, the exit will be top dressed with new crushed stone. Replacement of entire pad may be necessary when it becomes completely filled with sediment. The pad will be reshaped as needed for drainage and runoff control.

- Where sediment has been tracked-out from the site, the deposited sediment shall be removed by the end of the same workday. Sediment must be removed by sweeping, shoveling, or vacuuming of these surfaces. Hosing or sweeping tracked-out sediment

into a public or private stormwater system is prohibited.

- The exit will be inspected once every seven (7) calendar days and within 24-hours of storm events of 0.25 inches or greater, or the occurrence of runoff from snowmelt sufficient to cause a discharge.

END

Dog Park
Memorial Drive
Ashland, Massachusetts

Dated: October 18, 2024

I. OWNER:

Town of Ashland
101 Main Street
Ashland, MA 01721

II. RESPONSIBLE PARTY:

Town of Ashland
101 Main Street
Ashland, MA 01721

III. PROJECT OVERVIEW:

Prevention of offsite flooding, improvement to water quality prior to leaving the property, and promoting groundwater recharge are the main priorities of the project with respect to the drainage design. The proposed project is a new construction; therefore the project is designed to meet all Massachusetts Stormwater standards. The project will improve existing stormwater management within the property with respect to what occurs today by installing Best Management Practices (BMPs) within the stormwater collection system. Water quality BMPs to mitigate the runoff generated by the site improvements during construction include temporary Silt Sack® catch basin inserts (or similar product), construction entrance with anti-tracking pad, straw wattle along the work zone perimeter, and periodic sweeping to remove sand and sediment.

The BMPs used in this design were chosen for their effectiveness and ease of maintenance, repair/replacement, and modification. Providing for maintenance requirements that are practical is essential to achieve the desired result of improved stormwater quality. This plan will be provided to the property owner, property manager, and general contractor to educate them on the recommendations of this plan and the Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas.

IV. POST CONSTRUCTION - BEST MANAGEMENT PRACTICES:

a) NON-STRUCTURAL DRAINAGE BEST MANAGEMENT PRACTICES

Implementing source controls can aid in reducing the types and concentrations of contaminants in stormwater runoff. This principle for pollution prevention and non-structural controls, or BMPs, is to minimize the volume of runoff and to minimize contact of stormwater with potential pollutants. Measures such as street sweeping, managing snow removal, and educating the owner/operator of good maintenance practices are examples of non-structural BMPs.

i. PUBLIC AWARENESS

The responsible party shall issue periodic reminders to the building tenant to avoid dumping or releasing pollutants into storm drains, onto the ground, and into on-site wetland resource areas.

ii. STREET SWEEPING

Pavement sweeping is an integral part of the stormwater management plan as a fundamental component of source reduction efforts. Parking lot sweeping activities shall begin around March 1. However, sweeping may be done after winter thaw and the onset of early spring. It is critical to remove the accumulated sediment in the parking areas from the winter months as soon as possible before spring precipitation.

Parking lot sweeping should be performed a minimum of three times annually (March 1, May 1, and November 1).

iii. SNOW AND SNOWMELT MANAGEMENT

All snow stockpiling and disposal activities shall be conducted in accordance with the Massachusetts DEP Bureau of Water Resources Snow Disposal Guidance Document dated December 11, 2020.

The removal contractor shall avoid stockpiling snow within surface detention/infiltration basins, wetland resource areas, and upland areas directly tributary to wetland resource areas. The removal contractor shall also avoid stockpiled snow within the paved parking lots, driveways, and loading and trailer storage areas to allow normal vehicular maneuverability. The owner shall remove sediment from snow storage areas every spring.

No sodium-based de-icing compounds such as calcium chloride ($CaCl_2$), calcium magnesium acetate (CMA) or the like shall be used on site. The snow removal contractor shall store all sand off-site. No quantities of sand compounds shall be stored on site.

iv. PUBLIC SAFETY FEATURES

The project has been designed with consideration for public safety and does not require any specific features as part of the stormwater management system.

b) STRUCTURAL DRAINAGE BEST MANAGEMENT PRACTICES:

Structural BMPs are those physical facilities that are designed to manage both stormwater quantity and quality. Proper maintenance of the proposed structural BMPs will ensure design performance and promote longevity of the structure and may decrease operator maintenance costs.

i. DETENTION/INFILTRATION BASIN AND SEDIMENT FOREBAY

One (1) vegetated detention/infiltration basin is proposed on-site west of the parking area. The basin is designed to mitigate peak runoff increases associated with the proposed project for all storm events up to and including the 100-year storm. The system is equipped with an outlet control structure to allow controlled downstream discharge of overflow runoff toward on-site wetland resource areas. The detention/infiltration basin is equipped with a sediment forebay, which provides water quality pre-treatment of surface runoff from proposed paved areas.

The sediment forebay shall be inspected monthly, and cleaning shall be done on a quarterly basis. Check for erosion and cracking on side slopes and at spillways. Check for undesirable vegetative growth (i.e. trees) and differential settlement on side slopes and forebay floors. The stone aprons up gradient of each forebay shall be checked for clogging and wash-out and cleaned and re-stabilized as conditions warrant. Mowing of side slopes and forebay floor shall be performed in conjunction with overall site mowing schedule; clippings shall be removed from forebays.

The detention/infiltration basin shall be inspected twice a year at minimum and cleaned as needed. Check for erosion and cracking on side slopes. Check for undesirable vegetative growth (i.e., trees) and differential settlement on side slopes and basin floors. Confirm spillways are clear of trash, sediment, debris, organics, or other obstructions. Clogged surfaces shall be broken up by way of deep tilling and re-vegetated immediately. Light machinery shall be used for all maintenance to avoid compaction of underlying soil. Mowing shall be performed in conjunction with overall site mowing schedule; clippings shall be removed from all basins.

Disposal of accumulated sediment and trash is to be in accordance with applicable local, state, and federal guidelines and regulations.

c) SITE FURNISHINGS BEST MANAGEMENT PRACTICES:

Site furnishings, as they pertain to this Operation and Maintenance Plan, comprise driveways and parking lots; walkways; fences and walls; and landscape areas.

i. DRIVEWAYS AND PARKING LOTS

All driveways, parking lots, truck court areas, and emergency access ways shall be inspected twice annually (early Spring and Fall) to assess damage, cracking, differential settlement, and fading of pavement markings. Deteriorated asphalt and damaged curbs, berms, and signage shall be repaired as needed based on observation. Faded striping shall be re-painted in kind as needed.

Landscape vegetation around the perimeter of the driveway, parking, loading, and trailer storage areas shall be inspected for overgrowth twice annually (early Spring and Summer) and pruned as needed based on inspection.

ii. WALKWAYS

All concrete walkways and landings shall be inspected annually for spalling, cracking, and heaving. Cracked or spalled concrete shall be patched and repaired with cement or grout as needed based on inspection. In the case of widespread structural damage to concrete surfaces, slabs shall be demolished and reconstructed in kind and sub-base shall be inspected for settlement or heaving and corrected and/or re-compacted as needed.

Galvanized handrails at concrete stair locations shall be inspected annually. Structurally compromised handrails shall be replaced in kind immediately upon observation. If rust accumulation is observed, it shall be sanded off manually, and handrail surfaces shall be smoothed and re-painted to prevent further deterioration.

iii. FENCES AND WALLS

All chain link fences and boulder retaining walls shall be inspected annually.

Chain link fences shall be repaired of damaged mesh, rails, and hardware immediately upon observation. Accumulated debris, leaf litter, and trash shall be removed from edge of fence immediately upon observation.

Boulder retaining walls shall be inspected for damage, subsidence, and settlement of adjacent surfaces. Any such observed defects shall be repaired immediately. The Responsible Party shall monitor repairs on a weekly basis once established to ensure integrity of corrective action and coordinate follow-up action immediately upon observation of resurgence of defects, if applicable.

Guardrails shall be inspected for rail and post damage and dislodgement, rot, and defacing. Any timber members observed to be structurally damaged or rotted shall be replaced in kind immediately upon observation.

iv. LANDSCAPE AREAS

Spring clean-up shall be conducted twice annually in the months of March and April. Spring clean-up comprises removal of winter wraps from trees, lawn raking/ leaf blowing, weeding, and fertilization as needed. Landscape edges shall also be inspected and re-established as needed during Spring clean-up activities.

Mulch areas shall be inspected once annually during the month of April. New mulch shall be added to planting beds as needed and washed-out mulch shall be removed from adjacent areas. Subgrade in washout areas shall be checked for erosion and re-graded as needed prior to replacement of mulch. Pre-emergent weed control shall be applied to planting beds concurrently with inspection activities.

Shrub and tree planting fertilization activities shall be limited to twice annually between April 15 and October 15 as needed. Fertilizer use shall be minimized to the extent practicable and shall never be applied before a heavy rainfall event, on frozen ground, or within vegetated stormwater management BMPs (i.e., forebays, grassed swales, and detention/infiltration basins). Insect and disease sprays shall be used as needed on shrub and tree plantings throughout the Summer and never during frozen ground conditions or before heavy rainfall events.

The irrigation system shall operate between April and October. The irrigation shall be winterized in advance of cold-weather months to prevent freeze damage.

Mowing shall be conducted as necessary between the months of May and October. Lawn clippings shall be removed from vegetated stormwater management BMPs prior to next rainfall. Shrub and ornamental tree pruning shall be conducted twice annually during the months of July and August. Structural tree pruning shall be conducted twice annually during the months of August and September. Grass clippings and landscape debris shall not be dumped into any sensitive areas such as wetlands and stormwater BMP's.

Turf aeration and overseeding shall be conducted once annually in the month of October. Aeration equipment shall be utilized to relieve soil compaction and allow oxygenation of roots. Aerated turf shall subsequently be overseeded.

Fall cleanup shall be conducted twice annually during the months of October and November. Fall cleanup activities comprise application of winter wraps to trees, raking/leaf blowing lawn areas, and weeding. Lawn fertilization, if conducted during fall cleanup, shall not occur after October 15. Lime application treatment for lawn areas shall be conducted once annually in the month of November.

V. SPILL PREVENTION, CONTAINMENT, AND COUNTERMASURES PLAN

Landscape maintenance and parking and loading operations which occur on site necessitate the use of various materials and must be considered in the spill prevention and response practices. The following is a summary of pollutants and the respective property use and maintenance activities generating each:

Pollutant-Generating Activity	**Pollutants or Pollutant Constituents** (that could be discharged if exposed to stormwater)	**Location on Site**
Landscaping Maintenance Operations	Gasoline (from lawnmowers), fertilizers	Lawn and landscape areas throughout site
Parking and Loading Operations	Hydraulic oil/fluid, Antifreeze, diesel/gasoline (all from automobiles)	Driveway, parking, and loading areas throughout site

The Owner/Responsible Party shall be responsible for coordinating necessary containment and cleanup efforts in the event of a spill at any location on the Campus. Should a spill occur, equipment necessary to attend to spills or leaks shall be stored on site in a designated storage area within the building and shall consist, at minimum, of the following:

- Safety goggles.
- Chemically resistant gloves and overshoe boots.
- Water and chemical fire extinguishers.
- Shovels.
- Absorbent materials.
- Proprietary compact spill containment berms.
- Containers suitable for storage of site-specific materials.
- First aid kits.

Spills and leaks shall be treated according to the type, volume, and location of the released material. Generally, mitigation shall consist of the following:

- Prevention of additional material storage.
- Containment of spilled material.
- Safe, thorough, and environmentally sound removal of spilled material.
- Remediation of environmental damage.

The following describes specific preventative methods to be employed for materials to be used on site.

SPILLS FROM VEHICLES ACCESSING PARKING AND LOADING AREA

Spills due to vehicular operations are not anticipated on pervious surfaces. In the case of a spill in the driveway, parking or loading areas, the spill shall be contained using spill berms and/or adhesive drain seals at all vulnerable trench drain grate inlets; or gravel areas to prevent entering the drainage system, and the spill shall then be treated with absorbent material.

SPILLS FROM LANDSCAPE AND LAWN MAINTENANCE EQUIPMENT

In the case of a spill on a pervious surface, the spill shall be contained and treated with absorbent polymer material immediately and the affected soil, mulch, and/or planted vegetation shall be excavated and stored in a proprietary spill containment berm (by Ultratech or the like) for removal by a professional hazardous material removal company.

Town of Ashland Emergency Contacts are as follows:

- Emergency Management: (888) 304-1133 (MassDEP 24-Hour Spill Reporting)
- Police Department: 911
- Ashland Fire Department: (508) 881-2323

For spills of less than five (5) gallons of material, mitigation shall consist of source control, containment and clean-up with absorbent materials, unless an imminent hazard necessitates that a local professional hazardous material removal company become involved to mitigate the spill.

For spills greater than five (5) gallons of material, the incident shall be reported immediately to the MassDEP Hazardous Waste Incident Response Group at (617) 792-7653 and a professional emergency response contractor (ERC). Information that shall be provided to the said ERC is as follows:

- Type of material spilled.
- Quantity of material spilled.
- Location of the spill.
- Time of the spill.

The Owner/Responsible Party shall then employ measures to prevent further spillage, contain and/or clean up the spill.

If a Reportable Quantity (RQ) of material is spilled during site maintenance and access activities, the National Response Center (NRC) shall be notified immediately at (800) 424-8802. Reportable Quantities of hazardous material are available in 310 CMR 40: Massachusetts Contingency Plan Subpart P: Massachusetts Oil and Hazardous Material List. Within 14 days a report shall be submitted to the EPA New England Regional Office describing the following:

- Type of material released.
- Date and circumstances of the release.
- Measures taken to prevent future releases.

SPILL PREVENTION AND COUNTERMEASURES PLAN

Equipment Material Inspection List

	Q1 END Inspector Signature	END OF Q4 Inspector Signature
Safety Goggles		
Chemically Resistant Gloves		
Chemically Resistant Overshoe Boots		
Water & Chemical Fire Extinguishers		
Shovels		
Absorbent Materials		
Proprietary Compact Spill Containment Berms		
Containers Suitable for Storage of Site-Specific Material		
First Aid Kids		

O&M UPDATE FORM

DATE OF UPDATE	DATE OF LAST UPDATE TO O&M PLAN

SECTIONS OUT OF DATE / REQUIRED UPDATES

MAINTENANCE LOG REVIEW

BMP	INSPECTION AND MAINTENANCE FREQUENCY		ACTION REQ'D?* (CIRCLE ONE)
	REQUIRED	ACTUAL	
VEGETATED INFILTRATION BASIN			Y N
			Y N
			Y N
			Y N
			Y N
			Y N

*See next page for corrective action and training requirement updates (if applicable)

CORRECTIVE ACTION TO SCHEDULE(S) REQUIRED (IF YES TO ANY OF ABOVE)
EMPLOYEE AND CONTRACTOR TRAINING UPDATES (ATTACH BROCHURES AS NEEDED)

ANNUAL SITE INSPECTION AND UPDATE

OVERALL SITE CONDITION

_____
_____
_____
_____
_____

INSPECTION RESULTS

_____
_____
_____
_____
_____

EXCEPTIONAL CIRCUMSTANCES OBSERVED? _____

IF YES, DESCRIBE CIRCUMSTANCES AND CORRECTIVE ACTIONS NEEDED.

_____
_____
_____
_____
_____

OVERALL O&M PLAN EFFECTIVENESS (DESCRIBE)

_____
_____
_____
_____
_____

Reproduce update forms as necessary over the life of this Operation and Maintenance Plan.

INSPECTION FORM: VEGETATED INFILTRATION BASIN

Inspector Name:

Date/Time:

Weather:

TYPE OF INSPECTION (CHECK ONE)	
	Routine (Every Six Months)
	Annual
	Post-Storm (Depth =_____inches; Storm Duration =_____hrs; Storm End Date =_____)
	Post-Spill (Time/Date of Spill:_____)

INSPECTION CHECKLIST (CHECK ALL THAT APPLY)	
	Sediment Forebay/ Precast Outlet Control Structure inspections and forms also completed?
	Check for erosion and cracking on side slopes
	Check for tree growth on side slopes and at basin floor
	Check for differential settlement at basin floor
	Confirm outlet control structure is clear of debris, organics
	Mow side slopes and basin floor; remove clippings
	Remove accumulated trash, sediment, organics
CORRECTIVE ACTION REQUIRED	
ADDITIONALNOTES/OBSERVATIONS	

BMP MAINTENANCE LOG

DATE	NAME OF MAINTENANCE PERSONNEL/COMPANY	TYPE OF MAINTENANCE PERFORMED	ISSUES/NEED FOR FOLLOW-UP	WORK ORDER PROVIDED?

Reproduce log sheets as necessary over the life of this Operation and Maintenance Plan.