STORMWATER REPORT

FOR

BRITE EXCAVATING

4 SPECTACLE POND ROAD

IN

LITTLETON,
MASSACHUSETTS

PREPARED BY: DILLIS & ROY
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PREPARED FOR: BRITE EXCAVATING
14 PATRICIA DRIVE
AYER, MASSACHUSETTS

MARCH 11TH, 2024
CDG PROJECT #6233

DILLIS & ROY
CIVIL DESIGN GROUP
CIVIL ENGINEERS LAND SURVEYORS WETLAND CONSULTANTS

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1.0 Project Narrative

1.1 Project Type

The proposed consists of a 6,000 square foot (60'x100'), single-story building with a paved parking lot. The proposed project will include new utility service connection and the installation of a well & on-site sewage disposal system to service the new building.

1.2 Purpose and Scope

This report has been prepared to comply with the requirements of the Stormwater Management Standards incorporated in the Massachusetts Wetlands Protection Act Regulations, 310 CMR 10.00 and the Town of Littleton Stormwater Management Regulations. These standards are intended to promote increased groundwater recharge and prevent stormwater discharges from causing or contributing to the pollution of surface waters and ground waters of the Commonwealth. The standards aim to accomplish these goals by encouraging the greater use of low impact development techniques and improving the operation and maintenance of stormwater best management practices.

This report addresses compliance of the proposed development with each of the ten stormwater standards, provides calculations to support the compliance information, and provides an Operation and Maintenance Plan and Long-Term Pollution Prevention Plan for the stormwater management system.

1.3 Proposed Development

As mentioned, the proposed project consists of a 6,000 square foot commercial building, paved parking lot, access driveway, and private septic system to serve the new building. The building will consist of an open floor slab which will divided into five (5) units, each with 1,200 square feet of warehouse space. Parking for the proposed building will be in front of each bay, which will have pedestrian & vehicular access doors.

Prior approval has been granted for the installation of the well and septic system shown on the attached plans. The proposed septic system has been designed in accordance with Title V regulations as well as the Town of Littleton Board of Health regulations. The remainder of the site will remain as gravel/dirt, with the exception of the grassed and paved areas adjacent to the building.

1.4 LID Measures

Care has been taken to lay out the proposed site in a manner that works with existing topography. BMPs such as stormceptor treatment units, deep sump hooded catch basins, and subsurface infiltration systems are used to manage the stormwater runoff associated with the proposed development. Runoff from the proposed roof will be routed via roof headers to the subsurface infiltration system. The subsurface system will be used to promote groundwater recharge and limit the runoff leaving the site.

1.5 Site Description

The existing site is approximately 6 acres and lies on the north side of Spectacle Pond Road and is bound by Bennet's Brook. The site is currently used as a material stockpile yard with stone, ledge, & mulch stockpiles. The remainder of the site is vacant with respect to pavement and buildings, with the existing landcover being best described as gravel/dirt.

The site is entirely surrounded by bordering vegetated wetlands, with Bennett's Brook also along the northwest side of the property. The entire property falls with a MassWildlife Natural Heritage & Endangered Species Program Priority Habitat of Rare Species Map (Indicated on MassMapper). The existing limit of disturbance on the site is a short berm that wraps around the entire disturbed portion of the site which runs approximately parallel with the bordering vegetated wetland line.

The site is comprised primarily of Quonset loamy sand which falls within Hydrologic Soils Group (HSG) A. On-site soil testing confirmed that a majority of the site contains 2-4 feet of fill material over the coarse sand and gravel. The proposed development area is located on a portion of the site that belongs to HSG A. Soils belonging to HSG A have a high rate of water transmission (low runoff potential).

1.6 Proposed Stormwater Management System

Runoff from the proposed impervious areas will be conveyed and treated through a combination of BMP's and infiltrated to the groundwater. The infiltration will help to recharge the groundwater and ensure that the proposed development will not cause any off-site flooding. The following is a brief discussion of each conveyance and treatment BMP proposed.

<u>Subsurface Infiltration System</u>

A subsurface infiltration system is proposed at a low point adjacent to the proposed pavement. The infiltration system will collect runoff from a majority of the proposed pavement and the proposed roof area and has been designed to store

and infiltrate the stormwater runoff associated with the 100-year storm event. The infiltration system will consist of 9 concrete galleys embedded in crushed stone as detailed on the attached site plan.

Deep Sump & Hooded Catch Basin

A deep sump & hooded catch basin will be installed to capture stormwater runoff from the proposed pavement. Stormwater will discharge via culvert to a pre-treatment unit (Stormceptor) before ultimately discharging to the subsurface infiltrations system described above. The catch basin & outlet culvert have been designed to accommodate flows associated with the 100-year storm event.

1.7 Methods of Analysis

United States Department of Agriculture Natural Resources Conservation Service (NRCS) soil cover complex methods (TR-20) were employed to compute runoff quantities for the subject property and, where appropriate, adjacent property that drains toward a common discharge point with runoff from the subject site. HydroCAD 10.10 computer software was employed in this hydrologic analysis.

Due to the existing topography of the site, all runoff from the proposed project collect at one of two low points on the site. A pre- and post- development analysis were performed to determine that there will be no flooding during the 2-, 10-, 25-, 50-, and 100-year return frequencies. Watershed boundaries for existing conditions are depicted on the attached pre-development watershed plan. Post-developed watershed boundaries are indicated on the post-development watershed plan.

2.0 Stormwater Standards Compliance

2.1 Standard 1 – Untreated Discharges

The stormwater management system for the proposed development will not result in any new discharges of untreated stormwater to wetland resource areas. Stormwater management structures have been designed such that there is no erosion or scour to wetland resource areas or waters of the Commonwealth.

2.2 Standard 2 – Peak Rate Attenuation

The stormwater management system for the proposed development will employ a subsurface infiltration system consisting of galley style chambers that have been sized to capture and infiltrate the stormwater runoff associated with the 100-year, 24-hour rainfall event.

Hydrologic calculations for existing and proposed site conditions are included in appendices D & E respectively. Calculations for 24-hour rainfall events of 2-, 10-, 25-, 50-, and 100-year return frequencies are provided. For all rainfall events considered, the proposed stormwater management system will control runoff from the development such that the corresponding water levels at the existing low points will not cause any on or off-site flooding. Refer to the table below for a comparison of pre- & post- development stormwater runoff.

	Pre-Developed (cfs)	**Post-Developed (cfs)**	**Delta (cfs)**
Design Point "A"			
2-Year	2.23	1.25	-0.98
10-Year	5.51	3.71	-1.80
25-Year	7.79	5.50	-2.29
50-Year	9.55	6.90	-2.65
100-Year	11.48	8.47	-3.01

Design Point "B"			
2-Year	0.15	0.03	-0.14
10-Year	0.36	0.17	-0.27
25-Year	0.51	0.28	-0.33
50-Year	0.62	0.37	-0.37
100-Year	0.75	0.47	-0.42

2.3 Standard 3 – Recharge

As discussed in the Introduction, Natural Resource Conservation Service data indicates that the areas within the proposed development consist of soils from Hydrologic Soil Group A. A subsurface infiltration system is proposed to provide infiltration of runoff from pavement & roof areas. Recharge calculations can be found in Appendix F.

2.4 Standard 4 – Water Quality

A total of 98% TSS removal was achieved using BMPs. The proposed Stormwater Management Areas combined with the proposed pre-treatment devices (deep sump hooded catch basin into a Stormceptor pretreatment unit). An 8.27 Rawls Rate was used for exfiltration for the proposed soil. On-site soil testing confirmed that the existing soils are well drained and are consistent with the soil maps provided by the Natural Resource Conservation Service. The parking area will be raised using screened sand from the site, providing a similar infiltration rate to the existing soil on the property.

2.5 Standard 5 – Land Uses with Higher Pollutant Loads

The current and proposed uses of the subject site do not constitute land use with higher potential pollutant load, thus Standard 5 does not apply to the proposed project.

2.6 Standard 6 – Critical Areas

The proposed project does not involve a stormwater discharge within or near to any of the areas defined as “Critical Areas” at 314 CMR 9.02 and 310 CMR 10.04.

2.7 Standard 7 – Redevelopment

The project does not qualify for redevelopment provisions.

2.8 Standard 8 – Construction Period Pollution Prevention and Erosion and Sediment Control

The project is subject to the filing of an Environmental Protection Agency Notice of Intent (EPA NOI), the Stormwater Pollution Prevention Plan (SWPPP) will be prepared prior to construction. This document will be prepared to satisfy the requirements of the EPA NOI and the Standard 8 Construction Period Pollution prevention and Erosion and Sedimentation Control Plan.

2.8 Standard 9 – Operation and Maintenance Plan

Refer to Appendix G for a complete copy of the Stormwater Operation and Maintenance Plan.

2.9 Standard 10 – Prohibition of Illicit Discharges

An illicit discharge statement will be prepared after approvals are received and prior to construction.

APPENDIX A

Locus Map

LOCUS MAP

1"=1,500'

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References: 1988 USGS Fitchburg & Ayer Massachusetts Topographic Map

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APPENDIX B

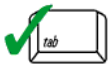
Checklist for Stormwater Report

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

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

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

☐ Reduced Impervious Area (Redevelopment Only)

☒ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

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

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

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☒ Other (describe): Subsurface Infiltration System, Stormceptor Treatment Unit

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☒ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided. 2-feet provided (see mounding analysis)

☐ 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

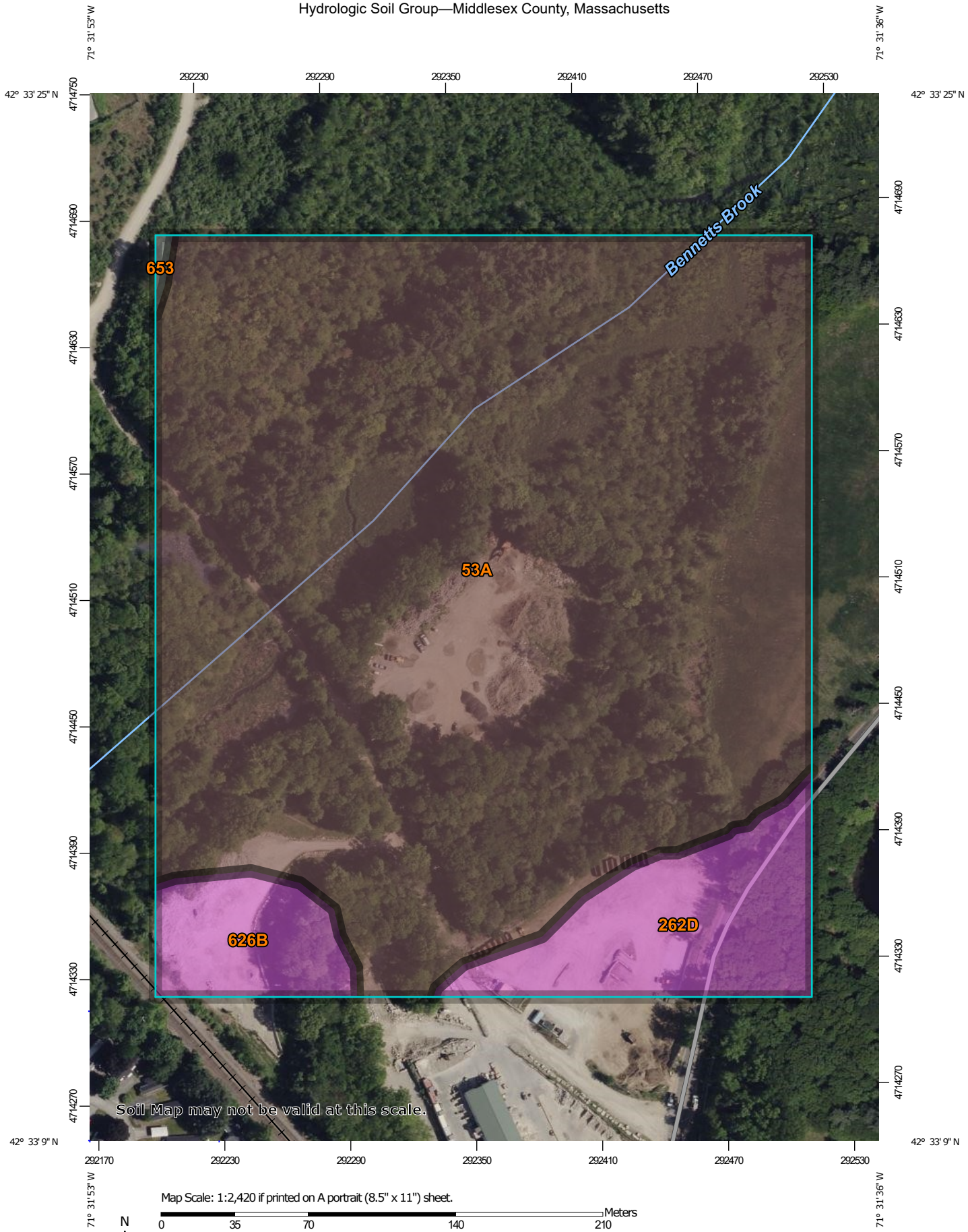
☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ 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 C

NRCS Soils Data



Map Scale: 1:2,420 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 23, Sep 12, 2023

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
53A	Freetown muck, ponded, 0 to 1 percent slopes	B/D	24.3	86.7%
262D	Quonset sandy loam, 15 to 25 percent slopes	A	2.4	8.7%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	1.2	4.4%
653	Udorthents, sandy		0.0	0.2%
Totals for Area of Interest			**28.0**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

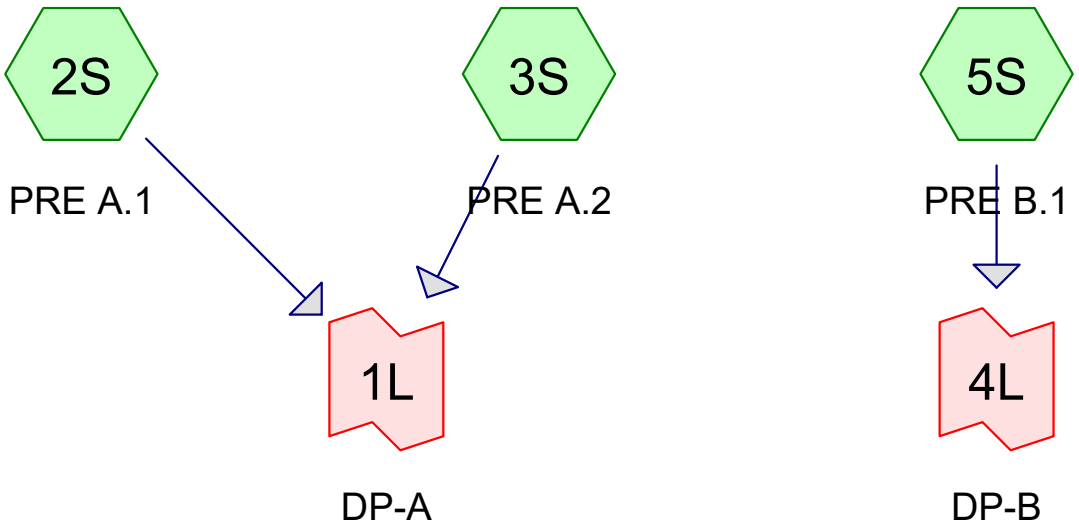
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX D

Existing Conditions – Hydrologic Calculations



Subcat Reach Pond Link

Routing Diagram for 6233-Pre Dev
Prepared by {enter your company name here}, Printed 3/8/2024

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.16	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.86	2
3	25-Year	Type III 24-hr		Default	24.00	1	5.92	2
4	50-Year	Type III 24-hr		Default	24.00	1	6.71	2
5	100-Year	Type III 24-hr		Default	24.00	1	7.56	2

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

Subcatchment2S: PRE A.1 Runoff Area=78,788 sf 0.00% Impervious Runoff Depth=0.90"
Tc=6.0 min CN=72 Runoff=1.74 cfs 0.136 af

Subcatchment3S: PRE A.2 Runoff Area=22,176 sf 0.00% Impervious Runoff Depth=0.90"
Tc=6.0 min CN=72 Runoff=0.49 cfs 0.038 af

Subcatchment5S: PRE B.1 Runoff Area=6,570 sf 0.00% Impervious Runoff Depth=0.90"
Tc=6.0 min CN=72 Runoff=0.15 cfs 0.011 af

Link 1L: DP-A Inflow=2.23 cfs 0.175 af
Primary=2.23 cfs 0.175 af

Link 4L: DP-B Inflow=0.15 cfs 0.011 af
Primary=0.15 cfs 0.011 af

Total Runoff Area = 2.469 ac Runoff Volume = 0.186 af Average Runoff Depth = 0.90"
100.00% Pervious = 2.469 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 2S: PRE A.1

Runoff = 1.74 cfs @ 12.10 hrs, Volume= 0.136 af, Depth= 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
78,788	72	Dirt roads, HSG A
78,788		100.00% Pervious Area

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

Summary for Subcatchment 3S: PRE A.2

Runoff = 0.49 cfs @ 12.10 hrs, Volume= 0.038 af, Depth= 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
22,176	72	Dirt roads, HSG A
22,176		100.00% Pervious Area

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

Summary for Subcatchment 5S: PRE B.1

Runoff = 0.15 cfs @ 12.10 hrs, Volume= 0.011 af, Depth= 0.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
6,570	72	Dirt roads, HSG A
6,570		100.00% Pervious Area

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

Summary for Link 1L: DP-A

Inflow Area = 2.318 ac, 0.00% Impervious, Inflow Depth = 0.90" for 2-Year event
Inflow = 2.23 cfs @ 12.10 hrs, Volume= 0.175 af
Primary = 2.23 cfs @ 12.10 hrs, Volume= 0.175 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link 4L: DP-B

Inflow Area = 0.151 ac, 0.00% Impervious, Inflow Depth = 0.90" for 2-Year event
Inflow = 0.15 cfs @ 12.10 hrs, Volume= 0.011 af
Primary = 0.15 cfs @ 12.10 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment2S: PRE A.1 Runoff Area=78,788 sf 0.00% Impervious Runoff Depth=2.09"
Tc=6.0 min CN=72 Runoff=4.30 cfs 0.315 af

Subcatchment3S: PRE A.2 Runoff Area=22,176 sf 0.00% Impervious Runoff Depth=2.09"
Tc=6.0 min CN=72 Runoff=1.21 cfs 0.089 af

Subcatchment5S: PRE B.1 Runoff Area=6,570 sf 0.00% Impervious Runoff Depth=2.09"
Tc=6.0 min CN=72 Runoff=0.36 cfs 0.026 af

Link 1L: DP-A Inflow=5.51 cfs 0.404 af
Primary=5.51 cfs 0.404 af

Link 4L: DP-B Inflow=0.36 cfs 0.026 af
Primary=0.36 cfs 0.026 af

Total Runoff Area = 2.469 ac Runoff Volume = 0.430 af Average Runoff Depth = 2.09"
100.00% Pervious = 2.469 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 2S: PRE A.1

Runoff = 4.30 cfs @ 12.10 hrs, Volume= 0.315 af, Depth= 2.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

Area (sf)	CN	Description
78,788	72	Dirt roads, HSG A
78,788		100.00% Pervious Area

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

Summary for Subcatchment 3S: PRE A.2

Runoff = 1.21 cfs @ 12.10 hrs, Volume= 0.089 af, Depth= 2.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

Area (sf)	CN	Description
22,176	72	Dirt roads, HSG A
22,176		100.00% Pervious Area

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

Summary for Subcatchment 5S: PRE B.1

Runoff = 0.36 cfs @ 12.10 hrs, Volume= 0.026 af, Depth= 2.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

Area (sf)	CN	Description
6,570	72	Dirt roads, HSG A
6,570		100.00% Pervious Area

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

Summary for Link 1L: DP-A

Inflow Area = 2.318 ac, 0.00% Impervious, Inflow Depth = 2.09" for 10-Year event
Inflow = 5.51 cfs @ 12.10 hrs, Volume= 0.404 af
Primary = 5.51 cfs @ 12.10 hrs, Volume= 0.404 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link 4L: DP-B

Inflow Area = 0.151 ac, 0.00% Impervious, Inflow Depth = 2.09" for 10-Year event
Inflow = 0.36 cfs @ 12.10 hrs, Volume= 0.026 af
Primary = 0.36 cfs @ 12.10 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment2S: PRE A.1 Runoff Area=78,788 sf 0.00% Impervious Runoff Depth=2.93"
Tc=6.0 min CN=72 Runoff=6.08 cfs 0.441 af

Subcatchment3S: PRE A.2 Runoff Area=22,176 sf 0.00% Impervious Runoff Depth=2.93"
Tc=6.0 min CN=72 Runoff=1.71 cfs 0.124 af

Subcatchment5S: PRE B.1 Runoff Area=6,570 sf 0.00% Impervious Runoff Depth=2.93"
Tc=6.0 min CN=72 Runoff=0.51 cfs 0.037 af

Link 1L: DP-A Inflow=7.79 cfs 0.566 af
Primary=7.79 cfs 0.566 af

Link 4L: DP-B Inflow=0.51 cfs 0.037 af
Primary=0.51 cfs 0.037 af

Total Runoff Area = 2.469 ac Runoff Volume = 0.602 af Average Runoff Depth = 2.93"
100.00% Pervious = 2.469 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 2S: PRE A.1

Runoff = 6.08 cfs @ 12.09 hrs, Volume= 0.441 af, Depth= 2.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
78,788	72	Dirt roads, HSG A
78,788		100.00% Pervious Area

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

Summary for Subcatchment 3S: PRE A.2

Runoff = 1.71 cfs @ 12.09 hrs, Volume= 0.124 af, Depth= 2.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
22,176	72	Dirt roads, HSG A
22,176		100.00% Pervious Area

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

Summary for Subcatchment 5S: PRE B.1

Runoff = 0.51 cfs @ 12.09 hrs, Volume= 0.037 af, Depth= 2.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
6,570	72	Dirt roads, HSG A
6,570		100.00% Pervious Area

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

Summary for Link 1L: DP-A

Inflow Area = 2.318 ac, 0.00% Impervious, Inflow Depth = 2.93" for 25-Year event
Inflow = 7.79 cfs @ 12.09 hrs, Volume= 0.566 af
Primary = 7.79 cfs @ 12.09 hrs, Volume= 0.566 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link 4L: DP-B

Inflow Area = 0.151 ac, 0.00% Impervious, Inflow Depth = 2.93" for 25-Year event
Inflow = 0.51 cfs @ 12.09 hrs, Volume= 0.037 af
Primary = 0.51 cfs @ 12.09 hrs, Volume= 0.037 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment2S: PRE A.1 Runoff Area=78,788 sf 0.00% Impervious Runoff Depth=3.58"
Tc=6.0 min CN=72 Runoff=7.45 cfs 0.540 af

Subcatchment3S: PRE A.2 Runoff Area=22,176 sf 0.00% Impervious Runoff Depth=3.58"
Tc=6.0 min CN=72 Runoff=2.10 cfs 0.152 af

Subcatchment5S: PRE B.1 Runoff Area=6,570 sf 0.00% Impervious Runoff Depth=3.58"
Tc=6.0 min CN=72 Runoff=0.62 cfs 0.045 af

Link 1L: DP-A Inflow=9.55 cfs 0.692 af
Primary=9.55 cfs 0.692 af

Link 4L: DP-B Inflow=0.62 cfs 0.045 af
Primary=0.62 cfs 0.045 af

Total Runoff Area = 2.469 ac Runoff Volume = 0.737 af Average Runoff Depth = 3.58"
100.00% Pervious = 2.469 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 2S: PRE A.1

Runoff = 7.45 cfs @ 12.09 hrs, Volume= 0.540 af, Depth= 3.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.71"

Area (sf)	CN	Description
78,788	72	Dirt roads, HSG A
78,788		100.00% Pervious Area

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

Summary for Subcatchment 3S: PRE A.2

Runoff = 2.10 cfs @ 12.09 hrs, Volume= 0.152 af, Depth= 3.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.71"

Area (sf)	CN	Description
22,176	72	Dirt roads, HSG A
22,176		100.00% Pervious Area

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

Summary for Subcatchment 5S: PRE B.1

Runoff = 0.62 cfs @ 12.09 hrs, Volume= 0.045 af, Depth= 3.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.71"

Area (sf)	CN	Description
6,570	72	Dirt roads, HSG A
6,570		100.00% Pervious Area

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

Summary for Link 1L: DP-A

Inflow Area = 2.318 ac, 0.00% Impervious, Inflow Depth = 3.58" for 50-Year event
Inflow = 9.55 cfs @ 12.09 hrs, Volume= 0.692 af
Primary = 9.55 cfs @ 12.09 hrs, Volume= 0.692 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link 4L: DP-B

Inflow Area = 0.151 ac, 0.00% Impervious, Inflow Depth = 3.58" for 50-Year event
Inflow = 0.62 cfs @ 12.09 hrs, Volume= 0.045 af
Primary = 0.62 cfs @ 12.09 hrs, Volume= 0.045 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment2S: PRE A.1 Runoff Area=78,788 sf 0.00% Impervious Runoff Depth=4.31"
Tc=6.0 min CN=72 Runoff=8.96 cfs 0.650 af

Subcatchment3S: PRE A.2 Runoff Area=22,176 sf 0.00% Impervious Runoff Depth=4.31"
Tc=6.0 min CN=72 Runoff=2.52 cfs 0.183 af

Subcatchment5S: PRE B.1 Runoff Area=6,570 sf 0.00% Impervious Runoff Depth=4.31"
Tc=6.0 min CN=72 Runoff=0.75 cfs 0.054 af

Link 1L: DP-A Inflow=11.48 cfs 0.833 af
Primary=11.48 cfs 0.833 af

Link 4L: DP-B Inflow=0.75 cfs 0.054 af
Primary=0.75 cfs 0.054 af

Total Runoff Area = 2.469 ac Runoff Volume = 0.887 af Average Runoff Depth = 4.31"
100.00% Pervious = 2.469 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 2S: PRE A.1

Runoff = 8.96 cfs @ 12.09 hrs, Volume= 0.650 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.56"

Area (sf)	CN	Description
78,788	72	Dirt roads, HSG A
78,788		100.00% Pervious Area

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

Summary for Subcatchment 3S: PRE A.2

Runoff = 2.52 cfs @ 12.09 hrs, Volume= 0.183 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.56"

Area (sf)	CN	Description
22,176	72	Dirt roads, HSG A
22,176		100.00% Pervious Area

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

Summary for Subcatchment 5S: PRE B.1

Runoff = 0.75 cfs @ 12.09 hrs, Volume= 0.054 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.56"

Area (sf)	CN	Description
6,570	72	Dirt roads, HSG A
6,570		100.00% Pervious Area

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

Summary for Link 1L: DP-A

Inflow Area = 2.318 ac, 0.00% Impervious, Inflow Depth = 4.31" for 100-Year event
Inflow = 11.48 cfs @ 12.09 hrs, Volume= 0.833 af
Primary = 11.48 cfs @ 12.09 hrs, Volume= 0.833 af, Atten= 0%, Lag= 0.0 min

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

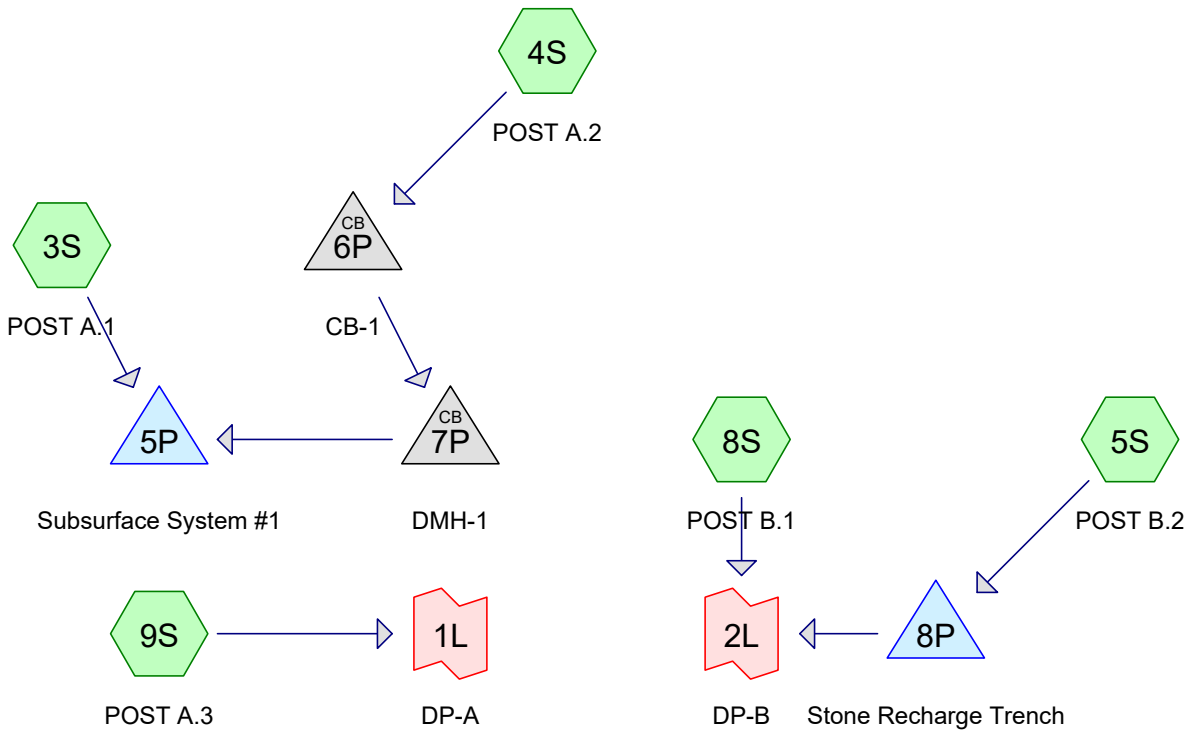
Summary for Link 4L: DP-B

Inflow Area = 0.151 ac, 0.00% Impervious, Inflow Depth = 4.31" for 100-Year event
Inflow = 0.75 cfs @ 12.09 hrs, Volume= 0.054 af
Primary = 0.75 cfs @ 12.09 hrs, Volume= 0.054 af, Atten= 0%, Lag= 0.0 min

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

APPENDIX E

Proposed Conditions – Hydrologic Calculations



Subcat Reach Pond Link

Routing Diagram for 6233-Post Dev

Prepared by {enter your company name here}, Printed 3/20/2024

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.16	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.86	2
3	25-Year	Type III 24-hr		Default	24.00	1	5.92	2
4	50-Year	Type III 24-hr		Default	24.00	1	6.71	2
5	100-Year	Type III 24-hr		Default	24.00	1	7.56	2

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

Subcatchment3S: POST A.1 Runoff Area=6,000 sf 100.00% Impervious Runoff Depth=2.93"
Tc=6.0 min CN=98 Runoff=0.41 cfs 0.034 af

Subcatchment4S: POST A.2 Runoff Area=9,817 sf 100.00% Impervious Runoff Depth=2.93"
Tc=6.0 min CN=98 Runoff=0.67 cfs 0.055 af

Subcatchment5S: POST B.2 Runoff Area=693 sf 100.00% Impervious Runoff Depth=2.93"
Tc=6.0 min CN=98 Runoff=0.05 cfs 0.004 af

Subcatchment8S: POST B.1 Runoff Area=5,549 sf 1.80% Impervious Runoff Depth=0.21"
Tc=6.0 min CN=54 Runoff=0.01 cfs 0.002 af

Subcatchment9S: POST A.3 Runoff Area=85,486 sf 0.00% Impervious Runoff Depth=0.67"
Tc=6.0 min CN=67 Runoff=1.25 cfs 0.109 af

Pond 5P: Subsurface System #1 Peak Elev=217.29' Storage=860 cf Inflow=1.09 cfs 0.089 af
Outflow=0.29 cfs 0.089 af

Pond 6P: CB-1 Peak Elev=218.97' Inflow=0.67 cfs 0.055 af
12.0" Round Culvert n=0.013 L=30.0' S=0.0200 '/' Outflow=0.67 cfs 0.055 af

Pond 7P: DMH-1 Peak Elev=218.13' Inflow=0.67 cfs 0.055 af
12.0" Round Culvert n=0.013 L=6.0' S=0.0200 '/' Outflow=0.67 cfs 0.055 af

Pond 8P: Stone Recharge Trench Peak Elev=220.19' Storage=11 cf Inflow=0.05 cfs 0.004 af
Discarded=0.03 cfs 0.004 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.004 af

Link 1L: DP-A Inflow=1.25 cfs 0.109 af
Primary=1.25 cfs 0.109 af

Link 2L: DP-B Inflow=0.01 cfs 0.002 af
Primary=0.01 cfs 0.002 af

Total Runoff Area = 2.469 ac Runoff Volume = 0.204 af Average Runoff Depth = 0.99"
84.56% Pervious = 2.088 ac 15.44% Impervious = 0.381 ac

Summary for Subcatchment 3S: POST A.1

Runoff = 0.41 cfs @ 12.09 hrs, Volume= 0.034 af, Depth= 2.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
6,000	98	Roofs, HSG A
6,000		100.00% Impervious Area

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

Summary for Subcatchment 4S: POST A.2

Runoff = 0.67 cfs @ 12.09 hrs, Volume= 0.055 af, Depth= 2.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
9,817	98	Paved parking, HSG A
9,817		100.00% Impervious Area

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

Summary for Subcatchment 5S: POST B.2

Runoff = 0.05 cfs @ 12.09 hrs, Volume= 0.004 af, Depth= 2.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
693	98	Paved parking, HSG A
693		100.00% Impervious Area

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

Summary for Subcatchment 8S: POST B.1

Runoff = 0.01 cfs @ 12.37 hrs, Volume= 0.002 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
100	98	Paved parking, HSG A
3,117	39	>75% Grass cover, Good, HSG A
2,332	72	Dirt roads, HSG A
5,549	54	Weighted Average
5,449		98.20% Pervious Area
100		1.80% Impervious Area

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

Summary for Subcatchment 9S: POST A.3

Runoff = 1.25 cfs @ 12.11 hrs, Volume= 0.109 af, Depth= 0.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
72,098	72	Dirt roads, HSG A
13,388	39	>75% Grass cover, Good, HSG A
85,486	67	Weighted Average
85,486		100.00% Pervious Area

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

Summary for Pond 5P: Subsurface System #1

Inflow Area = 0.363 ac,100.00% Impervious, Inflow Depth = 2.93" for 2-Year event
Inflow = 1.09 cfs @ 12.09 hrs, Volume= 0.089 af
Outflow = 0.29 cfs @ 12.45 hrs, Volume= 0.089 af, Atten= 74%, Lag= 21.6 min
Discarded = 0.29 cfs @ 12.45 hrs, Volume= 0.089 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 217.29' @ 12.45 hrs Surf.Area= 1,008 sf Storage= 860 cf
Flood Elev= 221.50' Surf.Area= 1,008 sf Storage= 3,600 cf

Plug-Flow detention time= 18.5 min calculated for 0.089 af (100% of inflow)
Center-of-Mass det. time= 18.5 min (775.2 - 756.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	216.33'	0 cf	**24.00'W x 42.00'L x 4.67'H Field A** 4,707 cf Overall - 4,707 cf Embedded = 0 cf x 40.0% Voids
#2A	216.33'	3,600 cf	**Shea Leaching Chamber 8x14x4.7**x 9 Inside #1 Inside= 84.0"W x 48.0"H => 30.77 sf x 13.00'L = 400.0 cf Outside= 96.0"W x 56.0"H => 37.36 sf x 14.00'L = 523.0 cf 9 Chambers in 3 Rows
		3,600 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	216.33'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 214.33'

Discarded OutFlow Max=0.29 cfs @ 12.45 hrs HW=217.28' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.29 cfs)

Summary for Pond 6P: CB-1

Inflow Area = 0.225 ac,100.00% Impervious, Inflow Depth = 2.93" for 2-Year event
Inflow = 0.67 cfs @ 12.09 hrs, Volume= 0.055 af
Outflow = 0.67 cfs @ 12.09 hrs, Volume= 0.055 af, Atten= 0%, Lag= 0.0 min
Primary = 0.67 cfs @ 12.09 hrs, Volume= 0.055 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 218.97' @ 12.09 hrs
Flood Elev= 221.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	218.50'	**12.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 218.50' / 217.90' S= 0.0200 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.66 cfs @ 12.09 hrs HW=218.97' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 0.66 cfs @ 1.83 fps)

Summary for Pond 7P: DMH-1

Inflow Area = 0.225 ac,100.00% Impervious, Inflow Depth = 2.93" for 2-Year event
Inflow = 0.67 cfs @ 12.09 hrs, Volume= 0.055 af
Outflow = 0.67 cfs @ 12.09 hrs, Volume= 0.055 af, Atten= 0%, Lag= 0.0 min
Primary = 0.67 cfs @ 12.09 hrs, Volume= 0.055 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 218.13' @ 12.09 hrs
Flood Elev= 221.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	217.65'	**12.0" Round Culvert**

L= 6.0' CPP, projecting, no headwall, Ke= 0.900
Inlet / Outlet Invert= 217.65' / 217.53' S= 0.0200 '/' Cc= 0.900
n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.66 cfs @ 12.09 hrs HW=218.12' (Free Discharge)
1=Culvert (Barrel Controls 0.66 cfs @ 2.66 fps)

Summary for Pond 8P: Stone Recharge Trench

Inflow Area = 0.016 ac,100.00% Impervious, Inflow Depth = 2.93" for 2-Year event
Inflow = 0.05 cfs @ 12.09 hrs, Volume= 0.004 af
Outflow = 0.03 cfs @ 12.21 hrs, Volume= 0.004 af, Atten= 42%, Lag= 7.2 min
Discarded = 0.03 cfs @ 12.21 hrs, Volume= 0.004 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 220.19' @ 12.21 hrs Surf.Area= 140 sf Storage= 11 cf
Flood Elev= 223.50' Surf.Area= 140 sf Storage= 112 cf

Plug-Flow detention time= 2.1 min calculated for 0.004 af (100% of inflow)
Center-of-Mass det. time= 2.1 min (758.7 - 756.7)

Volume	Invert	Avail.Storage	Storage Description
#1	220.00'	112 cf	**2.00'W x 70.00'L x 2.00'H Prismatoid** 280 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	220.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 214.33'
#2	Primary	221.50'	**1.5' long x 70.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.03 cfs @ 12.21 hrs HW=220.19' (Free Discharge)
1=Exfiltration (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=220.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Link 1L: DP-A

Inflow Area = 1.962 ac, 0.00% Impervious, Inflow Depth = 0.67" for 2-Year event
Inflow = 1.25 cfs @ 12.11 hrs, Volume= 0.109 af
Primary = 1.25 cfs @ 12.11 hrs, Volume= 0.109 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link 2L: DP-B

Inflow Area = 0.143 ac, 12.70% Impervious, Inflow Depth = 0.19" for 2-Year event
Inflow = 0.01 cfs @ 12.37 hrs, Volume= 0.002 af
Primary = 0.01 cfs @ 12.37 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment3S: POST A.1 Runoff Area=6,000 sf 100.00% Impervious Runoff Depth=4.62"
Tc=6.0 min CN=98 Runoff=0.64 cfs 0.053 af

Subcatchment4S: POST A.2 Runoff Area=9,817 sf 100.00% Impervious Runoff Depth=4.62"
Tc=6.0 min CN=98 Runoff=1.05 cfs 0.087 af

Subcatchment5S: POST B.2 Runoff Area=693 sf 100.00% Impervious Runoff Depth=4.62"
Tc=6.0 min CN=98 Runoff=0.07 cfs 0.006 af

Subcatchment8S: POST B.1 Runoff Area=5,549 sf 1.80% Impervious Runoff Depth=0.85"
Tc=6.0 min CN=54 Runoff=0.09 cfs 0.009 af

Subcatchment9S: POST A.3 Runoff Area=85,486 sf 0.00% Impervious Runoff Depth=1.71"
Tc=6.0 min CN=67 Runoff=3.71 cfs 0.279 af

Pond 5P: Subsurface System #1 Peak Elev=218.11' Storage=1,601 cf Inflow=1.69 cfs 0.140 af
Outflow=0.36 cfs 0.140 af

Pond 6P: CB-1 Peak Elev=219.11' Inflow=1.05 cfs 0.087 af
12.0" Round Culvert n=0.013 L=30.0' S=0.0200 '/' Outflow=1.05 cfs 0.087 af

Pond 7P: DMH-1 Peak Elev=218.27' Inflow=1.05 cfs 0.087 af
12.0" Round Culvert n=0.013 L=6.0' S=0.0200 '/' Outflow=1.05 cfs 0.087 af

Pond 8P: Stone Recharge Trench Peak Elev=220.56' Storage=31 cf Inflow=0.07 cfs 0.006 af
Discarded=0.03 cfs 0.006 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.006 af

Link 1L: DP-A Inflow=3.71 cfs 0.279 af
Primary=3.71 cfs 0.279 af

Link 2L: DP-B Inflow=0.09 cfs 0.009 af
Primary=0.09 cfs 0.009 af

Total Runoff Area = 2.469 ac Runoff Volume = 0.434 af Average Runoff Depth = 2.11"
84.56% Pervious = 2.088 ac 15.44% Impervious = 0.381 ac

Summary for Subcatchment 3S: POST A.1

Runoff = 0.64 cfs @ 12.09 hrs, Volume= 0.053 af, Depth= 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

Area (sf)	CN	Description
6,000	98	Roofs, HSG A
6,000		100.00% Impervious Area

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

Summary for Subcatchment 4S: POST A.2

Runoff = 1.05 cfs @ 12.09 hrs, Volume= 0.087 af, Depth= 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

Area (sf)	CN	Description
9,817	98	Paved parking, HSG A
9,817		100.00% Impervious Area

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

Summary for Subcatchment 5S: POST B.2

Runoff = 0.07 cfs @ 12.09 hrs, Volume= 0.006 af, Depth= 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

Area (sf)	CN	Description
693	98	Paved parking, HSG A
693		100.00% Impervious Area

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

Summary for Subcatchment 8S: POST B.1

Runoff = 0.09 cfs @ 12.11 hrs, Volume= 0.009 af, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

Area (sf)	CN	Description
100	98	Paved parking, HSG A
3,117	39	>75% Grass cover, Good, HSG A
2,332	72	Dirt roads, HSG A
5,549	54	Weighted Average
5,449		98.20% Pervious Area
100		1.80% Impervious Area

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

Summary for Subcatchment 9S: POST A.3

Runoff = 3.71 cfs @ 12.10 hrs, Volume= 0.279 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.86"

Area (sf)	CN	Description
72,098	72	Dirt roads, HSG A
13,388	39	>75% Grass cover, Good, HSG A
85,486	67	Weighted Average
85,486		100.00% Pervious Area

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

Summary for Pond 5P: Subsurface System #1

Inflow Area = 0.363 ac,100.00% Impervious, Inflow Depth = 4.62" for 10-Year event
Inflow = 1.69 cfs @ 12.09 hrs, Volume= 0.140 af
Outflow = 0.36 cfs @ 12.49 hrs, Volume= 0.140 af, Atten= 78%, Lag= 24.5 min
Discarded = 0.36 cfs @ 12.49 hrs, Volume= 0.140 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 218.11' @ 12.49 hrs Surf.Area= 1,008 sf Storage= 1,601 cf
Flood Elev= 221.50' Surf.Area= 1,008 sf Storage= 3,600 cf

Plug-Flow detention time= 29.6 min calculated for 0.140 af (100% of inflow)
Center-of-Mass det. time= 29.6 min (778.1 - 748.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	216.33'	0 cf	**24.00'W x 42.00'L x 4.67'H Field A** 4,707 cf Overall - 4,707 cf Embedded = 0 cf x 40.0% Voids
#2A	216.33'	3,600 cf	**Shea Leaching Chamber 8x14x4.7**x 9 Inside #1 Inside= 84.0"W x 48.0"H => 30.77 sf x 13.00'L = 400.0 cf Outside= 96.0"W x 56.0"H => 37.36 sf x 14.00'L = 523.0 cf 9 Chambers in 3 Rows
		3,600 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	216.33'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 214.33'

Discarded OutFlow Max=0.36 cfs @ 12.49 hrs HW=218.11' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.36 cfs)

Summary for Pond 6P: CB-1

Inflow Area = 0.225 ac,100.00% Impervious, Inflow Depth = 4.62" for 10-Year event
Inflow = 1.05 cfs @ 12.09 hrs, Volume= 0.087 af
Outflow = 1.05 cfs @ 12.09 hrs, Volume= 0.087 af, Atten= 0%, Lag= 0.0 min
Primary = 1.05 cfs @ 12.09 hrs, Volume= 0.087 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 219.11' @ 12.09 hrs
Flood Elev= 221.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	218.50'	**12.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 218.50' / 217.90' S= 0.0200 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.02 cfs @ 12.09 hrs HW=219.10' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 1.02 cfs @ 2.08 fps)

Summary for Pond 7P: DMH-1

Inflow Area = 0.225 ac,100.00% Impervious, Inflow Depth = 4.62" for 10-Year event
Inflow = 1.05 cfs @ 12.09 hrs, Volume= 0.087 af
Outflow = 1.05 cfs @ 12.09 hrs, Volume= 0.087 af, Atten= 0%, Lag= 0.0 min
Primary = 1.05 cfs @ 12.09 hrs, Volume= 0.087 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 218.27' @ 12.09 hrs
Flood Elev= 221.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	217.65'	**12.0" Round Culvert**

L= 6.0' CPP, projecting, no headwall, Ke= 0.900
Inlet / Outlet Invert= 217.65' / 217.53' S= 0.0200 '/' Cc= 0.900
n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.02 cfs @ 12.09 hrs HW=218.26' (Free Discharge)
1=Culvert (Barrel Controls 1.02 cfs @ 2.89 fps)

Summary for Pond 8P: Stone Recharge Trench

Inflow Area = 0.016 ac,100.00% Impervious, Inflow Depth = 4.62" for 10-Year event
Inflow = 0.07 cfs @ 12.09 hrs, Volume= 0.006 af
Outflow = 0.03 cfs @ 12.31 hrs, Volume= 0.006 af, Atten= 60%, Lag= 13.2 min
Discarded = 0.03 cfs @ 12.31 hrs, Volume= 0.006 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 220.56' @ 12.31 hrs Surf.Area= 140 sf Storage= 31 cf
Flood Elev= 223.50' Surf.Area= 140 sf Storage= 112 cf

Plug-Flow detention time= 4.9 min calculated for 0.006 af (100% of inflow)
Center-of-Mass det. time= 4.9 min (753.4 - 748.5)

Volume	Invert	Avail.Storage	Storage Description
#1	220.00'	112 cf	**2.00'W x 70.00'L x 2.00'H Prismatoid** 280 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	220.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 214.33'
#2	Primary	221.50'	**1.5' long x 70.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.03 cfs @ 12.31 hrs HW=220.56' (Free Discharge)
1=Exfiltration (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=220.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Link 1L: DP-A

Inflow Area = 1.962 ac, 0.00% Impervious, Inflow Depth = 1.71" for 10-Year event
Inflow = 3.71 cfs @ 12.10 hrs, Volume= 0.279 af
Primary = 3.71 cfs @ 12.10 hrs, Volume= 0.279 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link 2L: DP-B

Inflow Area = 0.143 ac, 12.70% Impervious, Inflow Depth = 0.76" for 10-Year event
Inflow = 0.09 cfs @ 12.11 hrs, Volume= 0.009 af
Primary = 0.09 cfs @ 12.11 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment3S: POST A.1 Runoff Area=6,000 sf 100.00% Impervious Runoff Depth=5.68"
Tc=6.0 min CN=98 Runoff=0.78 cfs 0.065 af

Subcatchment4S: POST A.2 Runoff Area=9,817 sf 100.00% Impervious Runoff Depth=5.68"
Tc=6.0 min CN=98 Runoff=1.28 cfs 0.107 af

Subcatchment5S: POST B.2 Runoff Area=693 sf 100.00% Impervious Runoff Depth=5.68"
Tc=6.0 min CN=98 Runoff=0.09 cfs 0.008 af

Subcatchment8S: POST B.1 Runoff Area=5,549 sf 1.80% Impervious Runoff Depth=1.40"
Tc=6.0 min CN=54 Runoff=0.18 cfs 0.015 af

Subcatchment9S: POST A.3 Runoff Area=85,486 sf 0.00% Impervious Runoff Depth=2.47"
Tc=6.0 min CN=67 Runoff=5.50 cfs 0.404 af

Pond 5P: Subsurface System #1 Peak Elev=218.65' Storage=2,084 cf Inflow=2.06 cfs 0.172 af
Outflow=0.42 cfs 0.172 af

Pond 6P: CB-1 Peak Elev=219.19' Inflow=1.28 cfs 0.107 af
12.0" Round Culvert n=0.013 L=30.0' S=0.0200 '/' Outflow=1.28 cfs 0.107 af

Pond 7P: DMH-1 Peak Elev=218.36' Inflow=1.28 cfs 0.107 af
12.0" Round Culvert n=0.013 L=6.0' S=0.0200 '/' Outflow=1.28 cfs 0.107 af

Pond 8P: Stone Recharge Trench Peak Elev=220.86' Storage=48 cf Inflow=0.09 cfs 0.008 af
Discarded=0.03 cfs 0.008 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.008 af

Link 1L: DP-A Inflow=5.50 cfs 0.404 af
Primary=5.50 cfs 0.404 af

Link 2L: DP-B Inflow=0.18 cfs 0.015 af
Primary=0.18 cfs 0.015 af

Total Runoff Area = 2.469 ac Runoff Volume = 0.598 af Average Runoff Depth = 2.91"
84.56% Pervious = 2.088 ac 15.44% Impervious = 0.381 ac

Summary for Subcatchment 3S: POST A.1

Runoff = 0.78 cfs @ 12.09 hrs, Volume= 0.065 af, Depth= 5.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
6,000	98	Roofs, HSG A
6,000		100.00% Impervious Area

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

Summary for Subcatchment 4S: POST A.2

Runoff = 1.28 cfs @ 12.09 hrs, Volume= 0.107 af, Depth= 5.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
9,817	98	Paved parking, HSG A
9,817		100.00% Impervious Area

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

Summary for Subcatchment 5S: POST B.2

Runoff = 0.09 cfs @ 12.09 hrs, Volume= 0.008 af, Depth= 5.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
693	98	Paved parking, HSG A
693		100.00% Impervious Area

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

Summary for Subcatchment 8S: POST B.1

Runoff = 0.18 cfs @ 12.11 hrs, Volume= 0.015 af, Depth= 1.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
100	98	Paved parking, HSG A
3,117	39	>75% Grass cover, Good, HSG A
2,332	72	Dirt roads, HSG A
5,549	54	Weighted Average
5,449		98.20% Pervious Area
100		1.80% Impervious Area

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

Summary for Subcatchment 9S: POST A.3

Runoff = 5.50 cfs @ 12.10 hrs, Volume= 0.404 af, Depth= 2.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
72,098	72	Dirt roads, HSG A
13,388	39	>75% Grass cover, Good, HSG A
85,486	67	Weighted Average
85,486		100.00% Pervious Area

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

Summary for Pond 5P: Subsurface System #1

Inflow Area = 0.363 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 2.06 cfs @ 12.09 hrs, Volume= 0.172 af
Outflow = 0.42 cfs @ 12.51 hrs, Volume= 0.172 af, Atten= 80%, Lag= 25.4 min
Discarded = 0.42 cfs @ 12.51 hrs, Volume= 0.172 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 218.65' @ 12.51 hrs Surf.Area= 1,008 sf Storage= 2,084 cf
Flood Elev= 221.50' Surf.Area= 1,008 sf Storage= 3,600 cf

Plug-Flow detention time= 35.7 min calculated for 0.172 af (100% of inflow)
Center-of-Mass det. time= 35.7 min (781.0 - 745.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	216.33'	0 cf	**24.00'W x 42.00'L x 4.67'H Field A** 4,707 cf Overall - 4,707 cf Embedded = 0 cf x 40.0% Voids
#2A	216.33'	3,600 cf	**Shea Leaching Chamber 8x14x4.7**x 9 Inside #1 Inside= 84.0"W x 48.0"H => 30.77 sf x 13.00'L = 400.0 cf Outside= 96.0"W x 56.0"H => 37.36 sf x 14.00'L = 523.0 cf 9 Chambers in 3 Rows
		3,600 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	216.33'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 214.33'

Discarded OutFlow Max=0.42 cfs @ 12.51 hrs HW=218.64' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.42 cfs)

Summary for Pond 6P: CB-1

Inflow Area = 0.225 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 1.28 cfs @ 12.09 hrs, Volume= 0.107 af
Outflow = 1.28 cfs @ 12.09 hrs, Volume= 0.107 af, Atten= 0%, Lag= 0.0 min
Primary = 1.28 cfs @ 12.09 hrs, Volume= 0.107 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 219.19' @ 12.09 hrs
Flood Elev= 221.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	218.50'	**12.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 218.50' / 217.90' S= 0.0200 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.24 cfs @ 12.09 hrs HW=219.17' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 1.24 cfs @ 2.21 fps)

Summary for Pond 7P: DMH-1

Inflow Area = 0.225 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 1.28 cfs @ 12.09 hrs, Volume= 0.107 af
Outflow = 1.28 cfs @ 12.09 hrs, Volume= 0.107 af, Atten= 0%, Lag= 0.0 min
Primary = 1.28 cfs @ 12.09 hrs, Volume= 0.107 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 218.36' @ 12.09 hrs
Flood Elev= 221.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	217.65'	**12.0" Round Culvert**

L= 6.0' CPP, projecting, no headwall, Ke= 0.900
Inlet / Outlet Invert= 217.65' / 217.53' S= 0.0200 '/' Cc= 0.900
n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.24 cfs @ 12.09 hrs HW=218.34' (Free Discharge)
1=Culvert (Barrel Controls 1.24 cfs @ 3.01 fps)

Summary for Pond 8P: Stone Recharge Trench

Inflow Area = 0.016 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 0.09 cfs @ 12.09 hrs, Volume= 0.008 af
Outflow = 0.03 cfs @ 12.36 hrs, Volume= 0.008 af, Atten= 66%, Lag= 16.4 min
Discarded = 0.03 cfs @ 12.36 hrs, Volume= 0.008 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 220.86' @ 12.36 hrs Surf.Area= 140 sf Storage= 48 cf
Flood Elev= 223.50' Surf.Area= 140 sf Storage= 112 cf

Plug-Flow detention time= 7.3 min calculated for 0.008 af (100% of inflow)
Center-of-Mass det. time= 7.3 min (752.6 - 745.3)

Volume	Invert	Avail.Storage	Storage Description
#1	220.00'	112 cf	**2.00'W x 70.00'L x 2.00'H Prismatoid** 280 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	220.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 214.33'
#2	Primary	221.50'	**1.5' long x 70.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.03 cfs @ 12.36 hrs HW=220.86' (Free Discharge)
1=Exfiltration (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=220.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Link 1L: DP-A

Inflow Area = 1.962 ac, 0.00% Impervious, Inflow Depth = 2.47" for 25-Year event
Inflow = 5.50 cfs @ 12.10 hrs, Volume= 0.404 af
Primary = 5.50 cfs @ 12.10 hrs, Volume= 0.404 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link 2L: DP-B

Inflow Area = 0.143 ac, 12.70% Impervious, Inflow Depth = 1.24" for 25-Year event
Inflow = 0.18 cfs @ 12.11 hrs, Volume= 0.015 af
Primary = 0.18 cfs @ 12.11 hrs, Volume= 0.015 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment3S: POST A.1 Runoff Area=6,000 sf 100.00% Impervious Runoff Depth=6.47"
Tc=6.0 min CN=98 Runoff=0.89 cfs 0.074 af

Subcatchment4S: POST A.2 Runoff Area=9,817 sf 100.00% Impervious Runoff Depth=6.47"
Tc=6.0 min CN=98 Runoff=1.45 cfs 0.122 af

Subcatchment5S: POST B.2 Runoff Area=693 sf 100.00% Impervious Runoff Depth=6.47"
Tc=6.0 min CN=98 Runoff=0.10 cfs 0.009 af

Subcatchment8S: POST B.1 Runoff Area=5,549 sf 1.80% Impervious Runoff Depth=1.85"
Tc=6.0 min CN=54 Runoff=0.25 cfs 0.020 af

Subcatchment9S: POST A.3 Runoff Area=85,486 sf 0.00% Impervious Runoff Depth=3.08"
Tc=6.0 min CN=67 Runoff=6.90 cfs 0.503 af

Pond 5P: Subsurface System #1 Peak Elev=219.06' Storage=2,455 cf Inflow=2.33 cfs 0.196 af
Outflow=0.46 cfs 0.196 af

Pond 6P: CB-1 Peak Elev=219.24' Inflow=1.45 cfs 0.122 af
12.0" Round Culvert n=0.013 L=30.0' S=0.0200 '/' Outflow=1.45 cfs 0.122 af

Pond 7P: DMH-1 Peak Elev=218.41' Inflow=1.45 cfs 0.122 af
12.0" Round Culvert n=0.013 L=6.0' S=0.0200 '/' Outflow=1.45 cfs 0.122 af

Pond 8P: Stone Recharge Trench Peak Elev=221.10' Storage=62 cf Inflow=0.10 cfs 0.009 af
Discarded=0.03 cfs 0.009 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.009 af

Link 1L: DP-A Inflow=6.90 cfs 0.503 af
Primary=6.90 cfs 0.503 af

Link 2L: DP-B Inflow=0.25 cfs 0.020 af
Primary=0.25 cfs 0.020 af

Total Runoff Area = 2.469 ac Runoff Volume = 0.727 af Average Runoff Depth = 3.54"
84.56% Pervious = 2.088 ac 15.44% Impervious = 0.381 ac

Summary for Subcatchment 3S: POST A.1

Runoff = 0.89 cfs @ 12.09 hrs, Volume= 0.074 af, Depth= 6.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.71"

Area (sf)	CN	Description
6,000	98	Roofs, HSG A
6,000		100.00% Impervious Area

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

Summary for Subcatchment 4S: POST A.2

Runoff = 1.45 cfs @ 12.09 hrs, Volume= 0.122 af, Depth= 6.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.71"

Area (sf)	CN	Description
9,817	98	Paved parking, HSG A
9,817		100.00% Impervious Area

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

Summary for Subcatchment 5S: POST B.2

Runoff = 0.10 cfs @ 12.09 hrs, Volume= 0.009 af, Depth= 6.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.71"

Area (sf)	CN	Description
693	98	Paved parking, HSG A
693		100.00% Impervious Area

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

Summary for Subcatchment 8S: POST B.1

Runoff = 0.25 cfs @ 12.10 hrs, Volume= 0.020 af, Depth= 1.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.71"

Area (sf)	CN	Description
100	98	Paved parking, HSG A
3,117	39	>75% Grass cover, Good, HSG A
2,332	72	Dirt roads, HSG A
5,549	54	Weighted Average
5,449		98.20% Pervious Area
100		1.80% Impervious Area

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

Summary for Subcatchment 9S: POST A.3

Runoff = 6.90 cfs @ 12.10 hrs, Volume= 0.503 af, Depth= 3.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.71"

Area (sf)	CN	Description
72,098	72	Dirt roads, HSG A
13,388	39	>75% Grass cover, Good, HSG A
85,486	67	Weighted Average
85,486		100.00% Pervious Area

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

Summary for Pond 5P: Subsurface System #1

Inflow Area = 0.363 ac,100.00% Impervious, Inflow Depth = 6.47" for 50-Year event
Inflow = 2.33 cfs @ 12.09 hrs, Volume= 0.196 af
Outflow = 0.46 cfs @ 12.52 hrs, Volume= 0.196 af, Atten= 80%, Lag= 25.9 min
Discarded = 0.46 cfs @ 12.52 hrs, Volume= 0.196 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 219.06' @ 12.52 hrs Surf.Area= 1,008 sf Storage= 2,455 cf
Flood Elev= 221.50' Surf.Area= 1,008 sf Storage= 3,600 cf

Plug-Flow detention time= 39.9 min calculated for 0.196 af (100% of inflow)
Center-of-Mass det. time= 39.8 min (783.4 - 743.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	216.33'	0 cf	**24.00'W x 42.00'L x 4.67'H Field A** 4,707 cf Overall - 4,707 cf Embedded = 0 cf x 40.0% Voids
#2A	216.33'	3,600 cf	**Shea Leaching Chamber 8x14x4.7**x 9 Inside #1 Inside= 84.0"W x 48.0"H => 30.77 sf x 13.00'L = 400.0 cf Outside= 96.0"W x 56.0"H => 37.36 sf x 14.00'L = 523.0 cf 9 Chambers in 3 Rows
		3,600 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	216.33'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 214.33'

Discarded OutFlow Max=0.46 cfs @ 12.52 hrs HW=219.06' (Free Discharge)
↑**1=Exfiltration** (Controls 0.46 cfs)

Summary for Pond 6P: CB-1

Inflow Area = 0.225 ac,100.00% Impervious, Inflow Depth = 6.47" for 50-Year event
Inflow = 1.45 cfs @ 12.09 hrs, Volume= 0.122 af
Outflow = 1.45 cfs @ 12.09 hrs, Volume= 0.122 af, Atten= 0%, Lag= 0.0 min
Primary = 1.45 cfs @ 12.09 hrs, Volume= 0.122 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 219.24' @ 12.09 hrs
Flood Elev= 221.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	218.50'	**12.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 218.50' / 217.90' S= 0.0200 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.41 cfs @ 12.09 hrs HW=219.23' (Free Discharge)
↑**1=Culvert** (Inlet Controls 1.41 cfs @ 2.30 fps)

Summary for Pond 7P: DMH-1

Inflow Area = 0.225 ac,100.00% Impervious, Inflow Depth = 6.47" for 50-Year event
Inflow = 1.45 cfs @ 12.09 hrs, Volume= 0.122 af
Outflow = 1.45 cfs @ 12.09 hrs, Volume= 0.122 af, Atten= 0%, Lag= 0.0 min
Primary = 1.45 cfs @ 12.09 hrs, Volume= 0.122 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 218.41' @ 12.09 hrs
Flood Elev= 221.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	217.65'	**12.0" Round Culvert**

L= 6.0' CPP, projecting, no headwall, Ke= 0.900
Inlet / Outlet Invert= 217.65' / 217.53' S= 0.0200 '/' Cc= 0.900
n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.41 cfs @ 12.09 hrs HW=218.40' (Free Discharge)
1=Culvert (Barrel Controls 1.41 cfs @ 3.09 fps)

Summary for Pond 8P: Stone Recharge Trench

Inflow Area = 0.016 ac,100.00% Impervious, Inflow Depth = 6.47" for 50-Year event
Inflow = 0.10 cfs @ 12.09 hrs, Volume= 0.009 af
Outflow = 0.03 cfs @ 12.39 hrs, Volume= 0.009 af, Atten= 69%, Lag= 18.2 min
Discarded = 0.03 cfs @ 12.39 hrs, Volume= 0.009 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 221.10' @ 12.39 hrs Surf.Area= 140 sf Storage= 62 cf
Flood Elev= 223.50' Surf.Area= 140 sf Storage= 112 cf

Plug-Flow detention time= 9.2 min calculated for 0.009 af (100% of inflow)
Center-of-Mass det. time= 9.2 min (752.7 - 743.5)

Volume	Invert	Avail.Storage	Storage Description
#1	220.00'	112 cf	**2.00'W x 70.00'L x 2.00'H Prismatoid** 280 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	220.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 214.33'
#2	Primary	221.50'	**1.5' long x 70.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.03 cfs @ 12.39 hrs HW=221.10' (Free Discharge)
1=Exfiltration (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=220.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Link 1L: DP-A

Inflow Area = 1.962 ac, 0.00% Impervious, Inflow Depth = 3.08" for 50-Year event
Inflow = 6.90 cfs @ 12.10 hrs, Volume= 0.503 af
Primary = 6.90 cfs @ 12.10 hrs, Volume= 0.503 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link 2L: DP-B

Inflow Area = 0.143 ac, 12.70% Impervious, Inflow Depth = 1.65" for 50-Year event
Inflow = 0.25 cfs @ 12.10 hrs, Volume= 0.020 af
Primary = 0.25 cfs @ 12.10 hrs, Volume= 0.020 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment3S: POST A.1 Runoff Area=6,000 sf 100.00% Impervious Runoff Depth=7.32"
Tc=6.0 min CN=98 Runoff=1.00 cfs 0.084 af

Subcatchment4S: POST A.2 Runoff Area=9,817 sf 100.00% Impervious Runoff Depth=7.32"
Tc=6.0 min CN=98 Runoff=1.63 cfs 0.137 af

Subcatchment5S: POST B.2 Runoff Area=693 sf 100.00% Impervious Runoff Depth=7.32"
Tc=6.0 min CN=98 Runoff=0.12 cfs 0.010 af

Subcatchment8S: POST B.1 Runoff Area=5,549 sf 1.80% Impervious Runoff Depth=2.39"
Tc=6.0 min CN=54 Runoff=0.33 cfs 0.025 af

Subcatchment9S: POST A.3 Runoff Area=85,486 sf 0.00% Impervious Runoff Depth=3.76"
Tc=6.0 min CN=67 Runoff=8.47 cfs 0.615 af

Pond 5P: Subsurface System #1 Peak Elev=219.51' Storage=2,861 cf Inflow=2.63 cfs 0.222 af
Outflow=0.50 cfs 0.222 af

Pond 6P: CB-1 Peak Elev=219.30' Inflow=1.63 cfs 0.137 af
12.0" Round Culvert n=0.013 L=30.0' S=0.0200 '/' Outflow=1.63 cfs 0.137 af

Pond 7P: DMH-1 Peak Elev=218.48' Inflow=1.63 cfs 0.137 af
12.0" Round Culvert n=0.013 L=6.0' S=0.0200 '/' Outflow=1.63 cfs 0.137 af

Pond 8P: Stone Recharge Trench Peak Elev=221.37' Storage=77 cf Inflow=0.12 cfs 0.010 af
Discarded=0.03 cfs 0.010 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.010 af

Link 1L: DP-A Inflow=8.47 cfs 0.615 af
Primary=8.47 cfs 0.615 af

Link 2L: DP-B Inflow=0.33 cfs 0.025 af
Primary=0.33 cfs 0.025 af

Total Runoff Area = 2.469 ac Runoff Volume = 0.871 af Average Runoff Depth = 4.23"
84.56% Pervious = 2.088 ac 15.44% Impervious = 0.381 ac

Summary for Subcatchment 3S: POST A.1

Runoff = 1.00 cfs @ 12.09 hrs, Volume= 0.084 af, Depth= 7.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.56"

Area (sf)	CN	Description
6,000	98	Roofs, HSG A
6,000		100.00% Impervious Area

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

Summary for Subcatchment 4S: POST A.2

Runoff = 1.63 cfs @ 12.09 hrs, Volume= 0.137 af, Depth= 7.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.56"

Area (sf)	CN	Description
9,817	98	Paved parking, HSG A
9,817		100.00% Impervious Area

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

Summary for Subcatchment 5S: POST B.2

Runoff = 0.12 cfs @ 12.09 hrs, Volume= 0.010 af, Depth= 7.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.56"

Area (sf)	CN	Description
693	98	Paved parking, HSG A
693		100.00% Impervious Area

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

Summary for Subcatchment 8S: POST B.1

Runoff = 0.33 cfs @ 12.10 hrs, Volume= 0.025 af, Depth= 2.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.56"

Area (sf)	CN	Description
100	98	Paved parking, HSG A
3,117	39	>75% Grass cover, Good, HSG A
2,332	72	Dirt roads, HSG A
5,549	54	Weighted Average
5,449		98.20% Pervious Area
100		1.80% Impervious Area

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

Summary for Subcatchment 9S: POST A.3

Runoff = 8.47 cfs @ 12.09 hrs, Volume= 0.615 af, Depth= 3.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.56"

Area (sf)	CN	Description
72,098	72	Dirt roads, HSG A
13,388	39	>75% Grass cover, Good, HSG A
85,486	67	Weighted Average
85,486		100.00% Pervious Area

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

Summary for Pond 5P: Subsurface System #1

Inflow Area = 0.363 ac,100.00% Impervious, Inflow Depth = 7.32" for 100-Year event
Inflow = 2.63 cfs @ 12.09 hrs, Volume= 0.222 af
Outflow = 0.50 cfs @ 12.52 hrs, Volume= 0.222 af, Atten= 81%, Lag= 26.2 min
Discarded = 0.50 cfs @ 12.52 hrs, Volume= 0.222 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 219.51' @ 12.52 hrs Surf.Area= 1,008 sf Storage= 2,861 cf
Flood Elev= 221.50' Surf.Area= 1,008 sf Storage= 3,600 cf

Plug-Flow detention time= 44.0 min calculated for 0.222 af (100% of inflow)
Center-of-Mass det. time= 44.0 min (785.9 - 741.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	216.33'	0 cf	**24.00'W x 42.00'L x 4.67'H Field A** 4,707 cf Overall - 4,707 cf Embedded = 0 cf x 40.0% Voids
#2A	216.33'	3,600 cf	**Shea Leaching Chamber 8x14x4.7**x 9 Inside #1 Inside= 84.0"W x 48.0"H => 30.77 sf x 13.00'L = 400.0 cf Outside= 96.0"W x 56.0"H => 37.36 sf x 14.00'L = 523.0 cf 9 Chambers in 3 Rows
		3,600 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	216.33'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 214.33'

Discarded OutFlow Max=0.50 cfs @ 12.52 hrs HW=219.51' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.50 cfs)

Summary for Pond 6P: CB-1

Inflow Area = 0.225 ac,100.00% Impervious, Inflow Depth = 7.32" for 100-Year event
Inflow = 1.63 cfs @ 12.09 hrs, Volume= 0.137 af
Outflow = 1.63 cfs @ 12.09 hrs, Volume= 0.137 af, Atten= 0%, Lag= 0.0 min
Primary = 1.63 cfs @ 12.09 hrs, Volume= 0.137 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 219.30' @ 12.09 hrs
Flood Elev= 221.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	218.50'	**12.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 218.50' / 217.90' S= 0.0200 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.59 cfs @ 12.09 hrs HW=219.29' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 1.59 cfs @ 2.39 fps)

Summary for Pond 7P: DMH-1

Inflow Area = 0.225 ac,100.00% Impervious, Inflow Depth = 7.32" for 100-Year event
Inflow = 1.63 cfs @ 12.09 hrs, Volume= 0.137 af
Outflow = 1.63 cfs @ 12.09 hrs, Volume= 0.137 af, Atten= 0%, Lag= 0.0 min
Primary = 1.63 cfs @ 12.09 hrs, Volume= 0.137 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 218.48' @ 12.09 hrs
Flood Elev= 221.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	217.65'	**12.0" Round Culvert**

L= 6.0' CPP, projecting, no headwall, Ke= 0.900
Inlet / Outlet Invert= 217.65' / 217.53' S= 0.0200 '/' Cc= 0.900
n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.59 cfs @ 12.09 hrs HW=218.46' (Free Discharge)
1=Culvert (Barrel Controls 1.59 cfs @ 3.18 fps)

Summary for Pond 8P: Stone Recharge Trench

Inflow Area = 0.016 ac,100.00% Impervious, Inflow Depth = 7.32" for 100-Year event
Inflow = 0.12 cfs @ 12.09 hrs, Volume= 0.010 af
Outflow = 0.03 cfs @ 12.42 hrs, Volume= 0.010 af, Atten= 71%, Lag= 19.8 min
Discarded = 0.03 cfs @ 12.42 hrs, Volume= 0.010 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 221.37' @ 12.42 hrs Surf.Area= 140 sf Storage= 77 cf
Flood Elev= 223.50' Surf.Area= 140 sf Storage= 112 cf

Plug-Flow detention time= 11.4 min calculated for 0.010 af (100% of inflow)
Center-of-Mass det. time= 11.4 min (753.3 - 741.9)

Volume	Invert	Avail.Storage	Storage Description
#1	220.00'	112 cf	**2.00'W x 70.00'L x 2.00'H Prismatoid** 280 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	220.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 214.33'
#2	Primary	221.50'	**1.5' long x 70.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.03 cfs @ 12.42 hrs HW=221.37' (Free Discharge)
1=Exfiltration (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=220.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Link 1L: DP-A

Inflow Area = 1.962 ac, 0.00% Impervious, Inflow Depth = 3.76" for 100-Year event
Inflow = 8.47 cfs @ 12.09 hrs, Volume= 0.615 af
Primary = 8.47 cfs @ 12.09 hrs, Volume= 0.615 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link 2L: DP-B

Inflow Area = 0.143 ac, 12.70% Impervious, Inflow Depth = 2.12" for 100-Year event
Inflow = 0.33 cfs @ 12.10 hrs, Volume= 0.025 af
Primary = 0.33 cfs @ 12.10 hrs, Volume= 0.025 af, Atten= 0%, Lag= 0.0 min

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

APPENDIX F

Recharge Volume / Water Quality Volume / TSS Removal / Mounding Calculations

4 Spectacle Pond Road
Littleton, MA 01460

March 11, 2024
6233

Subsurface Infiltration System

Stormwater Recharge Calculations

CALCULATIONS

Recharge Volume, Rv:

$R_v = A_C x F$

Hydrologic Soil Group	Impervious Area (Ac) [1]	Target Depth (F)	Recharge Volume (Rv) Ac-feet
A	0.363	0.6	0.018
Total	**0.363**		**0.018**

Total Recharge Volume Required = 0.018 Ac-ft
Total Recharge Volume Required (Rv) = 791 C.ft
Recharge Vol. Provided (from Infil. Structure) = 2,861.0

Required Sediment Forebay vol, Fv:

$F_v = A_C(cu.ft)x0.1inch$ of impervious area

[1] Imp. area captured by ponds, Ap = 0.363 Ac
Required Sediment Forebay vol, Fv= 132 C.ft

Sediment Volume Provided = 0 **C.ft** **(Pretreatment provided with Stormceptor unit)**

REFERENCES

Table 2.3.2: Recharge Target Depth by Hydrologic Soil Group

NRCS Hydrologic Soil Group	Approx. Soil Texture	Target Depth Factor (F)
A	sand	0.6 inch
B	loam	0.35 inch
C	silty loam	0.25 inch
D	clay	0.1 inch

Drawdown Calculations

CALCULATIONS

Proposed Infiltration Area Calculations:

$$Drawdown = \frac{R_V}{(Rawls\ Rate)(Bottom\ Area)}$$

Drawdown Calculations:

Soil Texture: 1 Sand

Bottom Surface Area (A): 1,008 SF
Rawls Rate: 8.27 in/hr
Total Recharge Volume Provided= 2,861 C.ft
Drawdown: 4.12 hr
Drawdown is less than 72 Hours as Required

REFERENCES

Table 2.3.3: 1982 Rawls Rates

Texture Class	NRCS Hydrologic Soil Group	Infiltration Rate
1 Sand	A	8.27 in/hr
2 Loamy Sand	A	2.41 in/hr
3 Sandy Loam	B	1.02 in/hr
4 Loam	B	0.52 in/hr
5 Silt Loam	C	0.27 in/hr
6 Sandy Clay Loam	C	0.17 in/hr
7 Clay Loam	D	0.09 in/hr
8 Silty Clay Loam	D	0.06 in/hr
9 Sandy Clay	D	0.05 in/hr
10 Silty Clay	D	0.04 in/hr
11 Clay	D	0.02 in/hr

NOTES:

Input Values

[1] = Refer to Proposed Conditions HydroCAD modeling report

4 Spectacle Pond Road
Littleton, MA

March 11, 2024
6233

Adjusted Recharge/WQV Calcs

Stormwater Recharge Calculations

Capture Area Adjustment, Rvadj:

$$R_v adj = \frac{A_t}{A_p} x R_v$$

[1] Imp. area captured by ponds, Ap =	0.363	Ac
[1] Total proposed impervious area on site, AT =	0.381	Ac
Recharge volume required, Rv =	830	C.ft
Capture Rate=	**95%**	OK
Capture Area Adjustment Factor=	**1.05**	
Adjusted Recharge Volume Required Rvadj =	**871**	**C.ft**
[1] Total Recharge Volume Provided =	2,861.0	**C.ft**

NOTES:

Input Values

[1] = Sum of Recharge Vol. Provided from Infil. Area 1, Infil. Area 2, Infil. Area 3 and Infil. Basin

Water Quality Calculations

CALCULATIONS

Water Quality Calculation:

$$V_{WQ} = D_{WQ}(ft) x\, A_T(ft^2)$$

Water Quality Depth =	1	in
Water Quality Depth , DWQ =	**0.08**	**ft.**
Total impervious area on site, AT =	0.381	Ac.
AT =	**16,596**	**ft²**
Required Water Quality Volume, VWQ =	**1,383**	**C.ft.**

REFERENCES

1 inch depth
Zone II discharges
IWPA discharges
Critical Area
Runoff from LUHPPL
Infiltration rate >2.4 inches/hour
1/2 inch depth
Discharge to other ares
8 inch
9 inch
10 inch
11 inch

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: 4 Spectacle Pond Road - Littleton, MA

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Proprietary Treatment Practice	**0.89**	**0.75**	**0.67**	**0.08**
	0.00	**0.08**	**0.00**	**0.08**
	0.00	**0.08**	**0.00**	**0.08**
	0.00	**0.08**	**0.00**	**0.08**

Total TSS Removal = **92%**

Project: **Brite Excavating**
Prepared By: **RWP**
Date: **11-Mar-24**

*Equals remaining load from previous BMP (E) which enters the BMP

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: 4 Spectacle Pond Road - Littleton, MA

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Proprietary Treatment Practice	0.89	0.75	0.67	0.08
Subsurface Infiltration Structure	0.80	0.08	0.07	0.02
	0.00	0.02	0.00	0.02
	0.00	0.02	0.00	0.02

Total TSS Removal = 98%

Project: Brite Excavating
Prepared By: RWP
Date: 11-Mar-24

*Equals remaining load from previous BMP (E) which enters the BMP

MOUNDSOLV
GROUNDWATER MOUNDING ANALYSIS
FOR A SLOPING WATER-TABLE AQUIFER
ZLOTNIK ET AL. (2017) SOLUTION

Solution Method

Zlotnik et al. (2017) transient solution for a rectangular source (linearization method 1)

Site Description

Aquifer Data

Property	Value
Horizontal hydraulic conductivity, *K* (ft/d)	20.4
Specific yield, *Sy*	0.25
Initial saturated thickness, h_0 (ft)	10
Maximum allowable water-table rise, σ (ft)	5
Dip, *i* (ft/ft)	0
Slope rotation from x axis, γ (°)	0

Recharge Sources

Property	Source 1
X coordinate at center, *X* (ft)	0
Y coordinate at center, *Y* (ft)	0
Dimension along x* axis, *L* (ft)	24
Dimension along y* axis, *W* (ft)	42
Rotation from slope direction, ϕ (°)	0
Recharge rate, *Q* (ft^3/d)	8336.16
Infiltration rate, *q* (ft/d)	8.27
Recharge duration, t_0 (d)	1.01

Monitoring Points

Elapsed Time, t = 3 d

Name	x (ft)	y (ft)	s (ft)	h (ft)	z (ft)
Source 1	0	0	1.303	11.3	0

APPENDIX G

Operation and Maintenance Plan

STORMWATER OPERATION & MAINTENANCE MANUAL

FOR

BRITE EXCAVATING
4 SPECTACLE POND ROAD

IN

LITTLETON,
MASSACHUSETTS

PREPARED BY: DILLIS & ROY
CIVIL DESIGN GROUP, INC.
1 Main Street, Suite #1
Lunenburg, MA 01462

PREPARED FOR: BRITE EXCAVATING
4 SPECTACLE POND ROAD
LITTLETON, MASSACHUSETTS

MARCH 11TH, 2024

CDG PROJECT #6233

DILLIS & ROY
CIVIL DESIGN GROUP
CIVIL ENGINEERS LAND SURVEYORS WETLAND CONSULTANTS

TABLE OF CONTENTS:

1.0 Project Narrative

1.1 Proposed Stormwater Management System

Runoff from the proposed development will be conveyed and treated through a combination of Best Management Practices (BMP's). The following is a brief discussion of each conveyance and treatment BMP proposed.

Subsurface Infiltration System

A subsurface infiltration system is proposed to capture runoff associated with proposed pavement and roof areas. The stormwater management area has been designed to accommodate the runoff associated with the 2-, 10-, 25-, 50-, & 100-year storm event, with no flooding during the 100-year storm event. Pretreatment is provided using a deep-sump hooded catch basin and stormceptor treatment unit. Stormwater will be routed into the subsurface system through a trench drain and into a deep sump hooded catch basin before discharging into the subsurface infiltration system. The catch basin & isolator row will increase the settlement of heavy solids before emptying into the infiltration basin.

Stormceptor (Model STC 450i)

A stormceptor treatment unit is proposed upstream of the subsurface infiltration system to provide pretreatment of stormwater runoff. Runoff captured from the proposed catch basin will route stormwater runoff through the treatment unit via culvert before ultimately discharging to the subsurface system.

Stone Recharge Trench

A stone recharge trench is proposed adjacent to the proposed access driveway to capture and provide infiltration of stormwater associated with the access driveway. The stone trench will consist of ¾"-1 ½" crushed stone wrapped in a geotextile filter fabric. The trench will be underlain with a 4" PVC pipe along the centerline to encourage infiltration.

1.2 Operation & Maintenance Tasks

The following activities shall be performed routinely to allow for proper functioning of the stormwater system. The following are guidelines referring to each major component of the stormwater management system.

1.2.1 Street Sweeping

Street sweeping shall be performed at least annually. For most effective results, sweeping shall be performed by a vacuum style truck in the early spring before spring rain events can wash silt and sediment into the

stormwater system. Silt and sediment shall be disposed of in accordance with local, state, and federal guidelines for hazardous waste.

1.2.2 Storm Drain lines

Storm drain inlets and outlets shall be inspected incidentally with all structure inspections. Evidence of debris intrusion or excessive siltation or sedimentation could result in the need to clean a storm drain line. Flushing or jetting shall be performed as required. All flushing and jetting shall be performed in the direction away from any outlet devices. A vacuum truck shall be used at the opposite end of the flushing or jetting to remove any silt or sediment that is cleaned from the storm drain.

1.2.3 Deep Sump Catch Basin

Deep sump catch basins shall be inspected at least semi-annually for signs of wear, settling, cracking, or other fatigue. Catch basin castings shall be inspected for signs of root intrusion or significant water infiltration. Catch basin sumps shall be checked for silt/sediment buildup and cleaned as necessary. Cleaning shall be performed by a vacuum truck. Catch basins shall be resealed as required and outlets shall be inspected incidentally with all structure inspections.

1.2.4 Subsurface Infiltration System (Leaching Galleys)

The subsurface infiltration system shall be monitored and maintained regularly to ensure no obstructions in the systems are present. Any depressions in the area could indicate that the system has collapsed and shall be inspected immediately. The systems are equipped with multiple inspection ports to monitor the buildup of sedimentation. If the depth of sedimentation is in excess of the manufacturer's guidelines, the system will need to be cleaned out with high pressure water. The high-pressure water shall be used on one end a vacuum truck will be used on the opposite end to remove any silt or sediment that is cleaned from the chambers. Other maintenance will include checking the inlets for debris, survey the surrounding area for depressions and confirm no unauthorized modifications have been performed to the system.

1.2.5 Stormceptor Treatment Unit

The proposed Stormceptor treatment unit shall be inspected at least semi-annually for signs of wear, settling, cracking, or other fatigue. The treatment unit should be monitored for the accumulation of sediment and oil, both of which can be easily measured through the access manhole. When the sediment depth reaches 8-inches, it shall be removed via

vacuum truck. Accumulated oil shall be removed with a portable pump and contained in a secondary containment tank.

1.2.6 Stone Recharge Trench

The stone recharge trench shall be inspected periodically for signs of sediment build up. Organic materials (sticks, leaves, etc.) shall be removed immediately. If the trench is clogged with debris, sediment, or organic matter, the stone shall be replaced as necessary.

1.2.7 Snow Storage

Snow shall be cleared from traveled ways and stockpiled in the locations indicated on the Site Plans. Snow stockpiles shall be stored outside the wetland buffer zone to the maximum extent practicable.

O&M Schedule

	O&M Task	Monthly	Quarterly	Spring	Fall	2-years	As-required
1.	**Street Sweeping**			**x**	**x**		
2.	**Subsurface Infiltration System**						
	Inspection			**x**	**x**		
	Remove Sediment					**x**	**x**
	Inspect interior inlet pipes					**x**	
	Remove Debris						**x**
3.	**Catch Basins**						
	Inspect Rims			**x**	**x**		
	Inspect inside/inlet and outlet pipes					**x**	
	Remove sediment					**x**	**x**
4.	**Drain Manholes**						
	Inspect rims			**x**	**x**		
	Inspect inside/inlet and outlet pipes					**x**	
	Remove sediment					**x**	**x**
5.	**Storm Drain Lines**						
	Inspection			**x**			**x**
	Clean						**x**
6.	**Stormceptor Treatment Unit**						
	Inspection			**x**		**x**	
	Inspect inside/inlet and outlet pipes					**x**	**x**
	Remove sediment & oil						**x**
7.	**Stone Recharge Trench**						
	Inspection			**x**	**x**		
	Remove Sediment						**x**
	Replace Stone						**x**
7.	**Snow Removal**						
	Snow Plowing						**x**

APPENDIX A

Stormwater Management System Owners/Operators

Steve Breitmaier
Brite Excavating
14 Patricia Drive
Ayer, Massachusetts

I certify that I have read and agree to perform the operation & maintenance requirements detailed in this Operation & Maintenance Manual

Signature Date

APPENDIX H

Long Term Pollution Prevention Plan

LONG-TERM POLLUTION PREVENTION PLAN

FOR

BRITE EXCAVATING
4 SPECTACLE POND ROAD

IN

LITTLETON,
MASSACHUSETTS

PREPARED BY: DILLIS & ROY
CIVIL DESIGN GROUP, INC.
1 Main Street, Suite #1
Lunenburg, MA 01462

PREPARED FOR: BRITE EXCAVATING
14 PATRICIA DRIVE
AYER, MASSACHUSETTS

MARCH 11TH, 2024

CDG PROJECT #6233

DILLIS & ROY
CIVIL DESIGN GROUP
CIVIL ENGINEERS LAND SURVEYORS WETLAND CONSULTANTS

1.0 Summary

This Long-Term Pollution Prevention Plan (LTPPP) has been prepared by Dillis & Roy Civil Design Group, Inc. pursuant to the Massachusetts Stormwater Regulations. The proposed project includes the construction of a new building with a paved parking lot. The stormwater management system has been designed in accordance with the Massachusetts Stormwater Regulations as well as the Town of Littleton's Stormwater Rules and Regulations to provide pretreatment of the stormwater prior to discharge.

2.0 Spill Prevention Plan

No hazardous materials other than normal cleaning items are expected to be stored on site after the construction period has ended.

It is expected that normal DEP notification procedures would be triggered for major spills such as heating oil or propane and natural gas leaks.

3.0 Stormwater System O&M

A Stormwater Operation & Maintenance plan has been prepared for the proposed stormwater management system. Refer to this document for details pertaining to the required inspections, routine maintenance and operation details.

4.0 Fertilizers, herbicides, and pesticides

Application of fertilizer, herbicides and pesticides shall be performed in a manner consistent with the industry standards for the application.

No application of chemicals is to be performed within the stormwater management areas on the site.

5.0 Snow/Salt Management

5.1 Snow Plowing

It is expected that the site will be plowed by the owner or a private contractor.

5.2 Salt/Sand Usage

It is expected that sanding and salting will be performed on an infrequent basis during times when unusually icy conditions persist for periods of time.

6.0 Waste Management

6.1 Solid Waste

A dumpster will be located on the site during construction. This area will be the primary area for the on-site storage of solid waste prior to pick-up by a waste management company.