STORMWATER MANAGEMENT REPORT

Mirror Lake Parking Lot Expansion

89-150 Patton Road, Devens, MA

PREPARED FOR

MassDevelopment
99 Buena Vista Street
Devens, MA 01434
ATTN: Hillary Clark
978.772.8876

PREPARED BY

99 High Street
Boston, MA 02110
617.728.7777

August 7, 2025

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Checklist for Stormwater Report

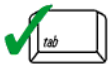
Insert completed, stamped, and signed DEP checklist form (see DEP website for most recent form).

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.

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[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): Permeable Pavement, Deep-sump catch basin

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☐ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☒ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
  Per MassDEP Table 2.1 of the Stormwater Management Handbook, pretreatment is not required for permeable pavements.
- ☐ involves runoff from land uses with higher potential pollutant loads.

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

☐ Limited Project

☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.

☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area

☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff

☐ Bike Path and/or Foot Path

☐ Redevelopment Project

☐ Redevelopment portion of mix of new and redevelopment.

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☐ An Illicit Discharge Compliance Statement is attached;

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

Stormwater Report Narrative

This Stormwater Report has been prepared to demonstrate compliance with the Massachusetts Stormwater Management Standards in accordance with the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00). This report also demonstrates compliance with the Devens, Massachusetts rules and regulations for stormwater design and mitigation.

Project Description

The Applicant, MassDevelopment, is proposing to expand the existing parking lot at the Mirror Lake recreational area to add additional parking spaces for visitors (the Project). As proposed, the Project consists of ancillary landscape improvements, 79 standard parking spaces, 2 trailer parking spaces, and stormwater improvements to support this use.

The Project will entail the construction of the expanded parking lot as well as new curbing, landscaping, and stormwater improvements for the proposed parking lot. The Project is not considered a Land Use with Higher Potential Pollutant Loads (LUHPPL).

Site Description

The Project Site is an approximately 2.5-acre parcel of land (the Site) located at Mirror Lake, 89-150 Patton Road in Devens, Massachusetts (see Figure 1). The Site lies within the surface watershed of the Nashua River and is bounded by Patton Road to the north, meadow and forest as part of the parcel to the south, forest as part of the parcel to the east, and Mirror Lake Road to the west. See Figure 1, Site Locus Map.

According to the Natural Resources Conservation Service (NRCS), surface soils on the Site include Quonset loamy sand, 3 to 8 percent slopes. On-site soils are classified as Hydrologic Soil Groups (HSG) A. The soil groups and infiltration rates were field verified with testing performed by McPhail Associates on June 24-25, 2025. Geotechnical testing found compact to dense natural glacial outwash deposit underlying the topsoil and fill. Rawls infiltration rates ranged between 2.41 in/hr and 8.27 in/hr. Based on the soil evaluation included in Appendix B, the Site is considered to be within an area of rapid infiltration (soils with a saturated hydraulic conductivity greater than 2.4 inches per hour). The Site is also located in the Zone II Water Resource Protection Overlay District.

Existing Drainage Conditions

Under existing conditions, the Site is partially developed with an impervious parking lot, with the remainder of the site being undeveloped pervious meadow and forest with topography varying from flat to steeply rolling. The hydrologic analysis area for the Project is considered the limit of work. Figure 2 illustrates the existing drainage patterns on the Site. Currently, the Site is divided into four (4) drainage areas as stormwater runoff flows to two (2) Design Points. Design Point A has been identified as Patton Road Woods and is located at the northeastern corner and eastern edge of the property. Design Point B has been identified as Mirror Lake and is located to the south of the property. Table 1 below provides a summary of the existing conditions hydrologic data.

Table 1 Existing Conditions Hydrologic Data

Drainage Area	Discharge Location	Design Point	Area (Acres)	Curve Number	Time of Concentration (min)
1A	Patton Road Woods	A	0.88	32	13.7
2A	Patton Road Woods	A	0.27	32	14.0
1B	Mirror Lake	B	0.26	32	10.0
2B	Mirror Lake	B	0.08	32	10.3

Proposed Drainage Conditions

Figure 3 illustrates the proposed "post construction" drainage conditions for the project. As shown, the Site will be divided into five (5) drainage areas that discharge treated stormwater to the two (2) existing Design Points. Table 2 below provides a summary of the proposed conditions hydrologic data.

In the proposed condition, stormwater will be captured by the permeable paved parking lot with an overflow catch basin.

Table 2 Proposed Conditions Hydrologic Data

Drainage Area	Discharge Location	Design Point	Area (Acres)	Curve Number	Time of Concentration (min)
1A	Patton Road Woods	A	0.35	32	13.9
2A	Patton Road Woods	A	0.26	32	17.4
3A	Patton Road Woods	A	0.59	95	5
4A	Patton Road Woods	A	0.06	98	5
1B	Mirror Lake	B	0.23	32	8.6

The site design integrates a comprehensive stormwater management system that has been developed in accordance with the Massachusetts Stormwater Handbook. Because the Project is located within an area of rapid infiltration the proposed stormwater management system has been designed to treat the one-inch Water Quality Volume.

Environmentally Sensitive and Low Impact Development (LID) Techniques

Low Impact Development (LID) techniques and stormwater Best Management Practices (BMPs) implemented into the site design include:

- Minimized disturbance to existing trees and vegetation
- Permeable Pavement
- Deep-sump catch basin

Figure 1 Site Locus Map

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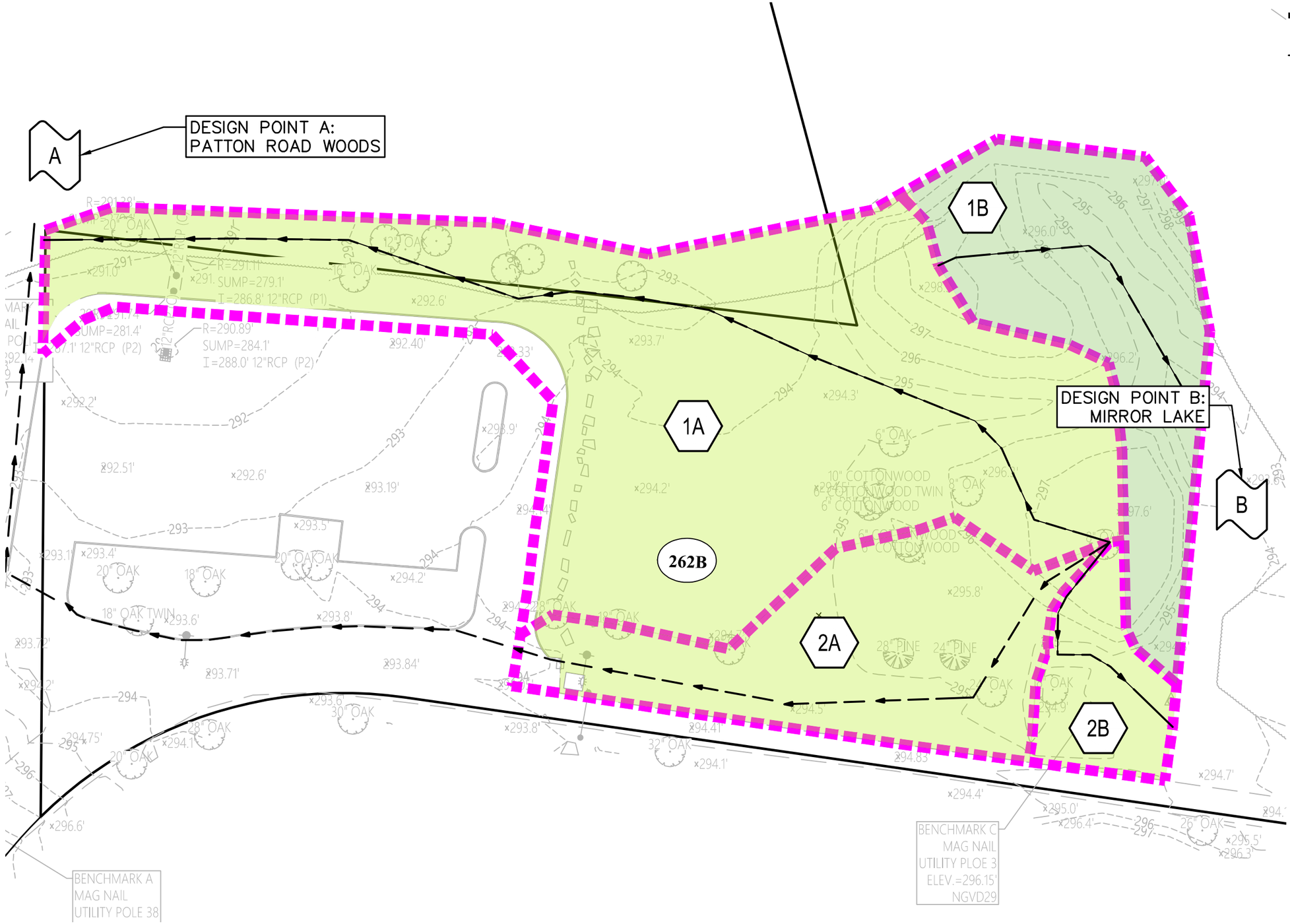
0 100 200 Feet

Site Locus Map
Mirror Lake
Devens, Massachusetts

Figure 1

July 2025

Figure 2 Existing Drainage Area



Legend

SYMBOLS

- X — DESIGN POINT
- X — DRAINAGE AREA DESIGNATION
- X — POND

LINETYPES

- DRAINAGE AREA BOUNDARY
- TIME OF CONCENTRATION FLOW LINE
- LIMIT OF WORK

SCS SOIL CLASSIFICATIONS

- 262B — QUONSET LOAMY SAND, 3 TO 8 PERCENT SLOPES, HSG A

- GRASS
- WOODS
- SITE IMPERVIOUS

0 20 40 80 Feet

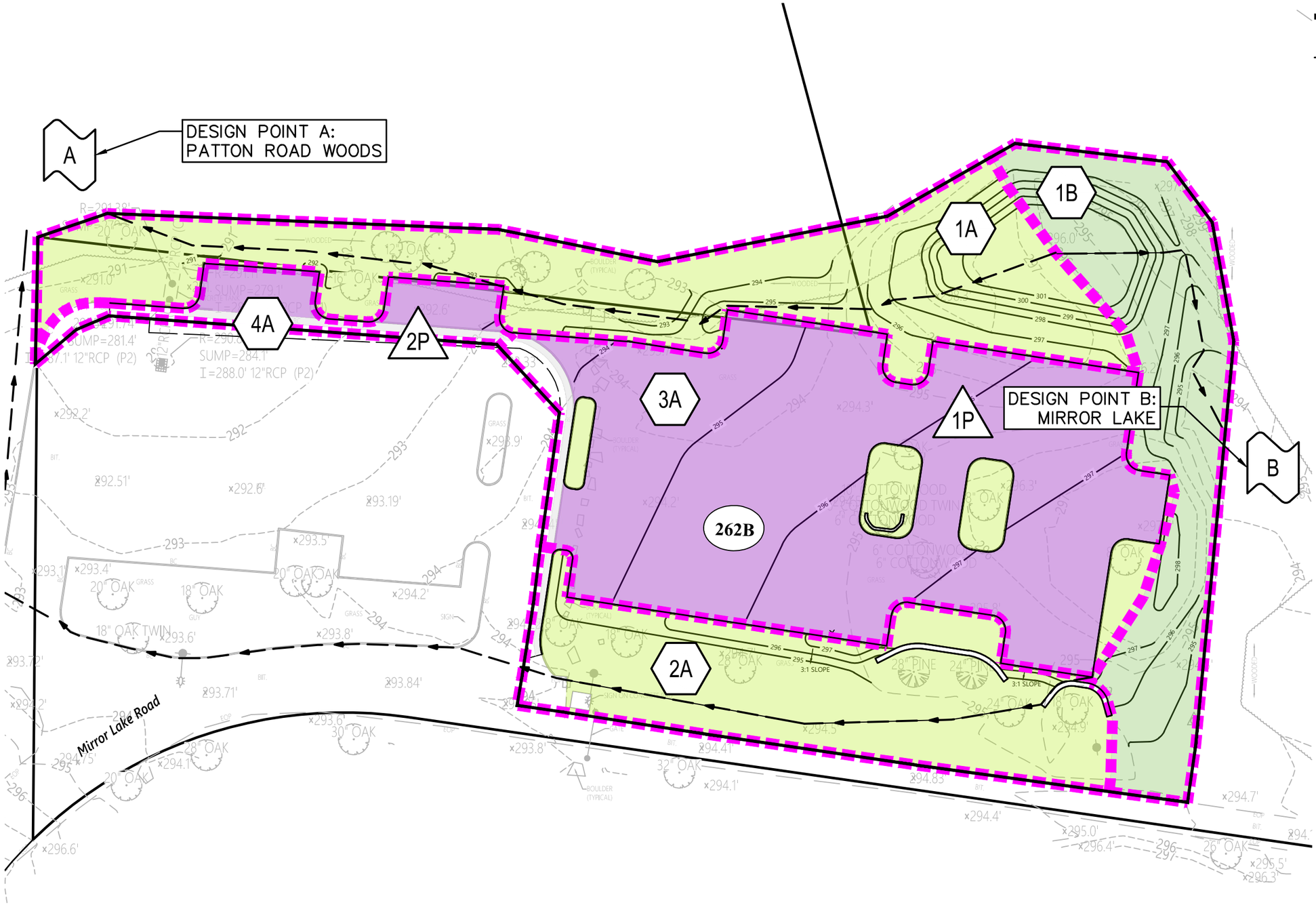
Existing Drainage Conditions

Figure 2

Mirror Lake
Devens, Massachusetts

August 7, 2025

Figure 3 Proposed Drainage Area



Legend

SYMBOLS

- X — **DESIGN POINT**
- X — **DRAINAGE AREA DESIGNATION**
- X — **POND**

LINETYPES

- **DRAINAGE AREA BOUNDARY**
- **TIME OF CONCENTRATION FLOW LINE**
- **LIMIT OF WORK**

SCS SOIL CLASSIFICATIONS

- 262B — **QUONSET LOAMY SAND, 3 TO 8 PERCENT SLOPES, HSG A**

- **GRASS**
- **WOODS**
- **PERMEABLE PAVEMENT**
- **SITE IMPERVIOUS**

0 20 40 80 Feet

Proposed Drainage Conditions

Figure 3

Mirror Lake
Devens, Massachusetts

August 7, 2025

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Regulatory Compliance

Massachusetts Department of Environmental Protection (DEP) – Stormwater Management Standards

As demonstrated below, the proposed Project fully complies with the DEP Stormwater Management Standards.

Standard 1: No New Untreated Discharges or Erosion to Wetlands

The Project has been designed to comply with Standard 1. The entire limit of work drains to either landscape areas with well-draining soils, or permeable pavement with an overflow to a deep-sump catch basin.

Standard 2: Peak Rate Attenuation

The Project has been designed to comply with Standard 2.

The rainfall-runoff response of the Site under existing and proposed conditions was analyzed for storm events with recurrence intervals of 2, 10, 25 and 100 years. The results of the analysis, as summarized in Table 3 below, indicate that there is no increase in peak discharge rates between the existing and proposed conditions for the 2-year and 10-year storms. The selected BMP is not designed to operate under the 100-year storm and will overflow to a deep-sump catch basin or dissipate into the well-draining soil.

Computations and supporting information regarding the hydrologic modeling are included in Appendix A.

Table 3 Peak Discharge Rates (cfs*)

Design Point	2-year	10-year	25-year	100-year
Design Point A: Patton Road Woods				
Existing	0.00	0.00	0.02	0.29
Proposed	0.00	0.00	0.01	0.46
Design Point B: Mirror Lake				
Existing	0.00	0.00	0.01	0.09
Proposed	0.00	0.00	0.00	0.05

Standard 3: Stormwater Recharge

The Project has been designed to comply with Standard 3.

Recharge of stormwater has been provided through the use of permeable pavement, which have been sized using the Static method. The infiltration BMP has been designed to drain completely within 72 hours. Table 4 below provides a summary of the proposed infiltration BMPs utilized for the Project.

Table 4 Summary of Recharge Calculations

Infiltration BMP	Provided Recharge Volume (cubic feet)
Permeable Pavement	25,104
Total Provided Recharge	**13,182**
Total Required Recharge	**1,255**

Soil evaluation (including Geotechnical Report), computations, and supporting information are included in Appendix B.

Standard 4: Water Quality

The Project has been designed to comply with Standard 4.

The proposed stormwater management system implements a treatment train of BMPs that has been designed to provide 80% TSS removal of stormwater runoff from all proposed impervious surfaces.

Per MassDEP Table 2.1 of the Stormwater Management Handbook, pretreatment is not required for permeable pavements.

Computations and supporting information, including the Long-Term Pollution Prevention Plan, are included in Appendix C.

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

The Project is not considered a LUHPPL.

Standard 6: Critical Areas

The Project will not discharge stormwater near or to a critical area.

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the Maximum Extent Practicable

The Project has been designed to comply with all ten of the Stormwater Management Standards.

Refer directly to each Standard for applicable computations and supporting information demonstrating compliance with each.

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

The Project will disturb approximately 1.40 acres of land and is therefore required to obtain coverage under the Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Construction General Permit. As required under this permit, a Stormwater Pollution Prevention Plan (SWPPP) will be developed and submitted before land disturbance begins. Recommended construction period pollution prevention and erosion and sedimentation controls to be finalized in the SWPPP are included in Appendix D.

Standard 9: Operation and Maintenance Plan

In compliance with Standard 9, a Post Construction Stormwater Operation and Maintenance (O&M) Plan has been developed for the Project. The O&M Plan is included in Appendix C as part of the Long Term Pollution Prevention Plan.

Standard 10: Prohibition of Illicit Discharges

The site was previously undeveloped and no sanitary sewer or storm drainage infrastructure is known to exist on the site. The design plans submitted with this report have been designed in full compliance with current standards. The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges.

Appendix A: Standard 2 Computations and Supporting Information

The rainfall-runoff response of the Site under existing and proposed conditions was evaluated for storm events with recurrence intervals of 2, 10, 25 and 100-years. Rainfall volumes used for this analysis were based on the Natural Resources Conservation Service (NRCS) Type III, 24-hour storm and NOAA Atlas 14 precipitation depths for the site: 3.13, 4.68, 5.88, and 8.34 inches, respectively. Runoff coefficients for the pre- and post-development conditions, as previously shown in Tables 1 and 2 respectively, were determined using NRCS Technical Release 55 (TR-55) methodology as provided in HydroCAD. Drainage areas used in the analyses were described in previous sections and shown on Figures 2 and 3. The HydroCAD model is based on the NRCS Technical Release 20 (TR-20) Model for Project Formulation Hydrology.

HydroCAD Analysis: Existing Conditions

2-Year Storm Event – Existing

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1A: (new Subcat) Runoff Area=38,275 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=466' Tc=13.7 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment1B: Runoff Area=11,255 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=143' Tc=10.0 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment2A: (new Subcat) Runoff Area=11,790 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=619' Tc=14.0 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment2B: (new Subcat) Runoff Area=3,587 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=107' Tc=10.3 min CN=32 Runoff=0.00 cfs 0.000 af

Link A: Patton Road Woods Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link B: Mirror Lake Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 1.490 ac Runoff Volume = 0.000 af Average Runoff Depth = 0.00"
100.00% Pervious = 1.490 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1A: (new Subcat)

[45] Hint: Runoff=Zero

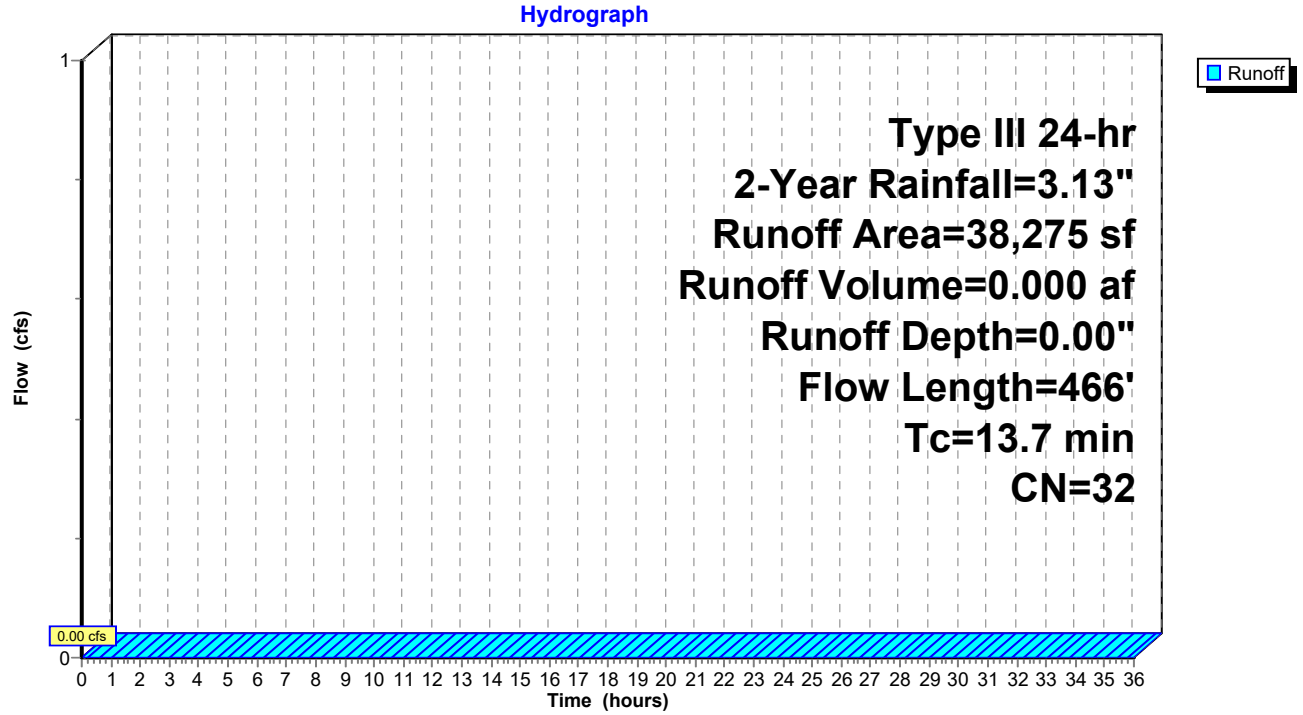
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link A : Patton Road Woods

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.13"

Area (sf)	CN	Description
38,275	32	Woods/grass comb., Good, HSG A
38,275		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0190	0.14		**Sheet Flow, First 50 ft** Grass: Short n= 0.150 P2= 3.13"
3.2	200	0.0220	1.04		**Shallow Concentrated Flow, Next 200 ft** Short Grass Pasture Kv= 7.0 fps
4.7	216	0.0120	0.77		**Shallow Concentrated Flow, Next 200 Ft** Short Grass Pasture Kv= 7.0 fps
13.7	466	Total			

Subcatchment 1A: (new Subcat)



Summary for Subcatchment 1B:

[45] Hint: Runoff=Zero

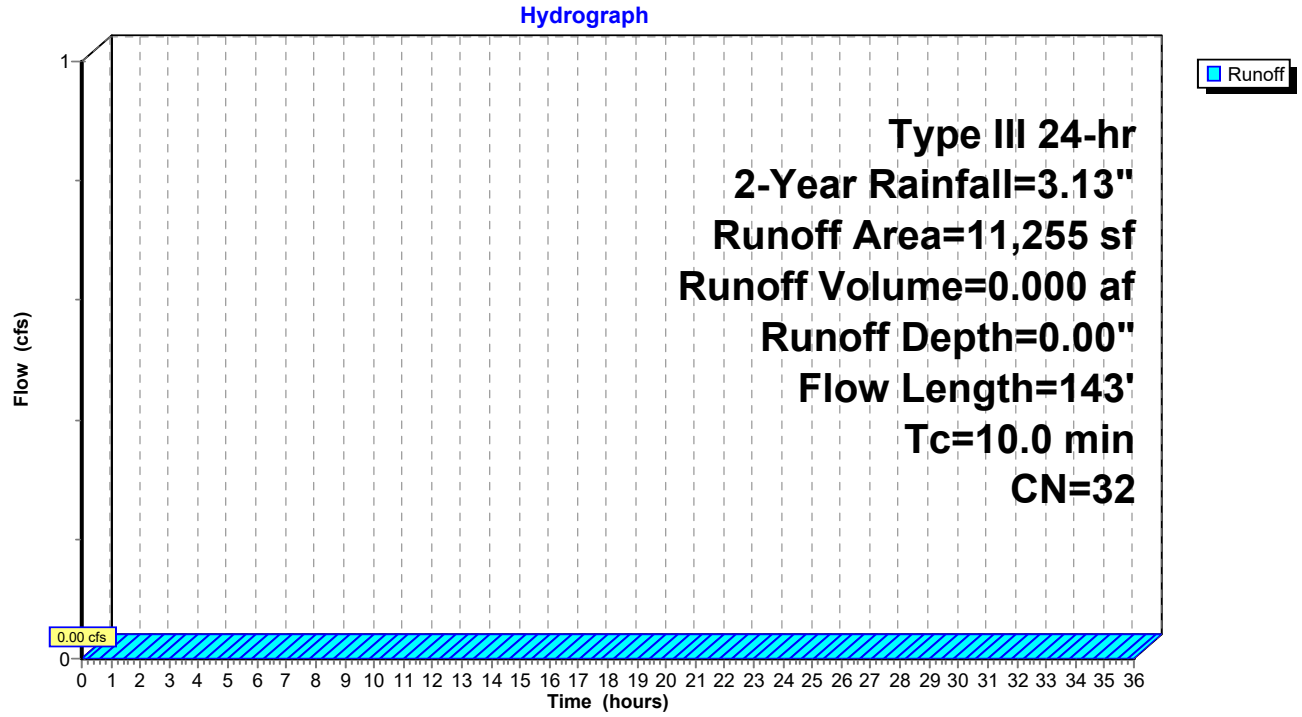
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link B : Mirror Lake

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.13"

Area (sf)	CN	Description
11,255	32	Woods/grass comb., Good, HSG A
11,255		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0530	0.10		**Sheet Flow, First 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.13"
1.6	93	0.0190	0.96		**Shallow Concentrated Flow, Next 100 Ft** Short Grass Pasture Kv= 7.0 fps
10.0	143	Total			

Subcatchment 1B:



Summary for Subcatchment 2A: (new Subcat)

[45] Hint: Runoff=Zero

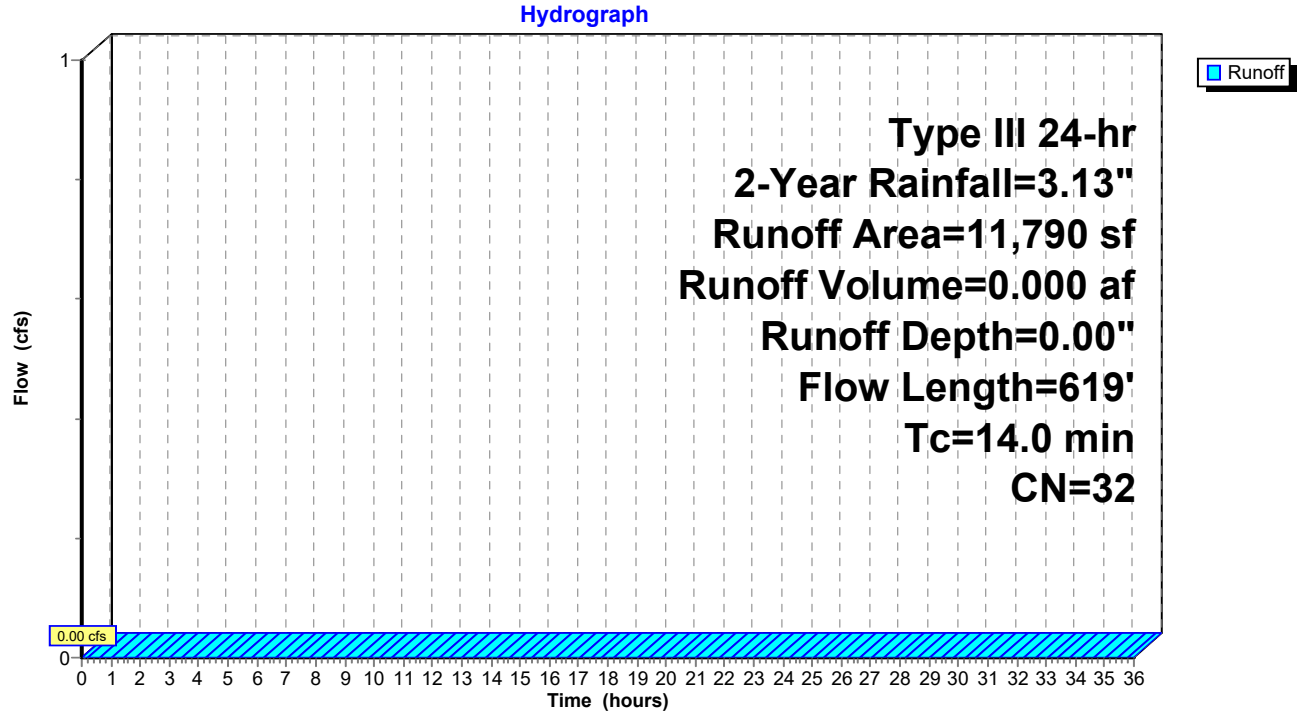
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link A : Patton Road Woods

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.13"

Area (sf)	CN	Description
11,790	32	Woods/grass comb., Good, HSG A
11,790		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0480	0.21		**Sheet Flow, First 50 Ft** Grass: Short n= 0.150 P2= 3.13"
6.1	200	0.0060	0.54		**Shallow Concentrated Flow, Next 200 ft** Short Grass Pasture Kv= 7.0 fps
2.8	230	0.0047	1.39		**Shallow Concentrated Flow, Next 230 Ft** Paved Kv= 20.3 fps
1.1	139	0.0210	2.17		**Shallow Concentrated Flow, Next 140 Ft** Grassed Waterway Kv= 15.0 fps
14.0	619	Total			

Subcatchment 2A: (new Subcat)



Summary for Subcatchment 2B: (new Subcat)

[45] Hint: Runoff=Zero

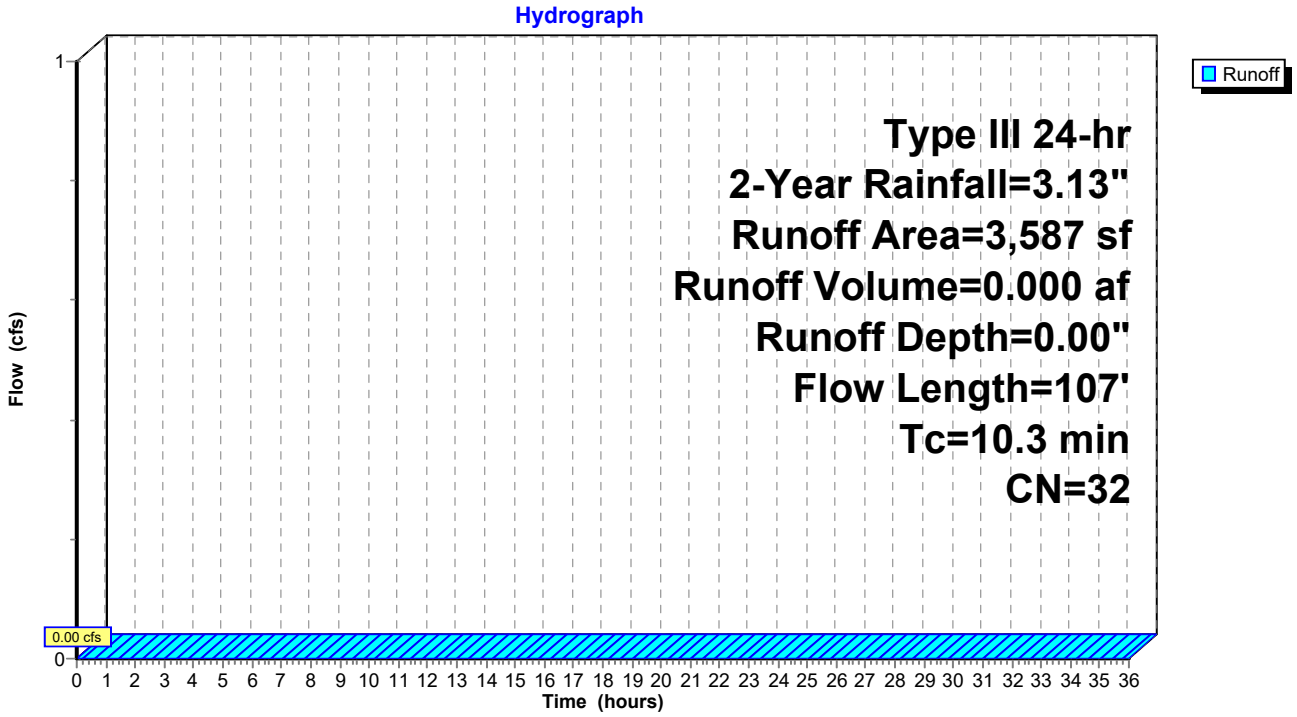
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link B : Mirror Lake

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.13"

Area (sf)	CN	Description
3,587	32	Woods/grass comb., Good, HSG A
3,587		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0530	0.10		**Sheet Flow, First 50 ft** Woods: Light underbrush n= 0.400 P2= 3.13"
1.9	57	0.0050	0.49		**Shallow Concentrated Flow, Next 60 Ft** Short Grass Pasture Kv= 7.0 fps
10.3	107	Total			

Subcatchment 2B: (new Subcat)

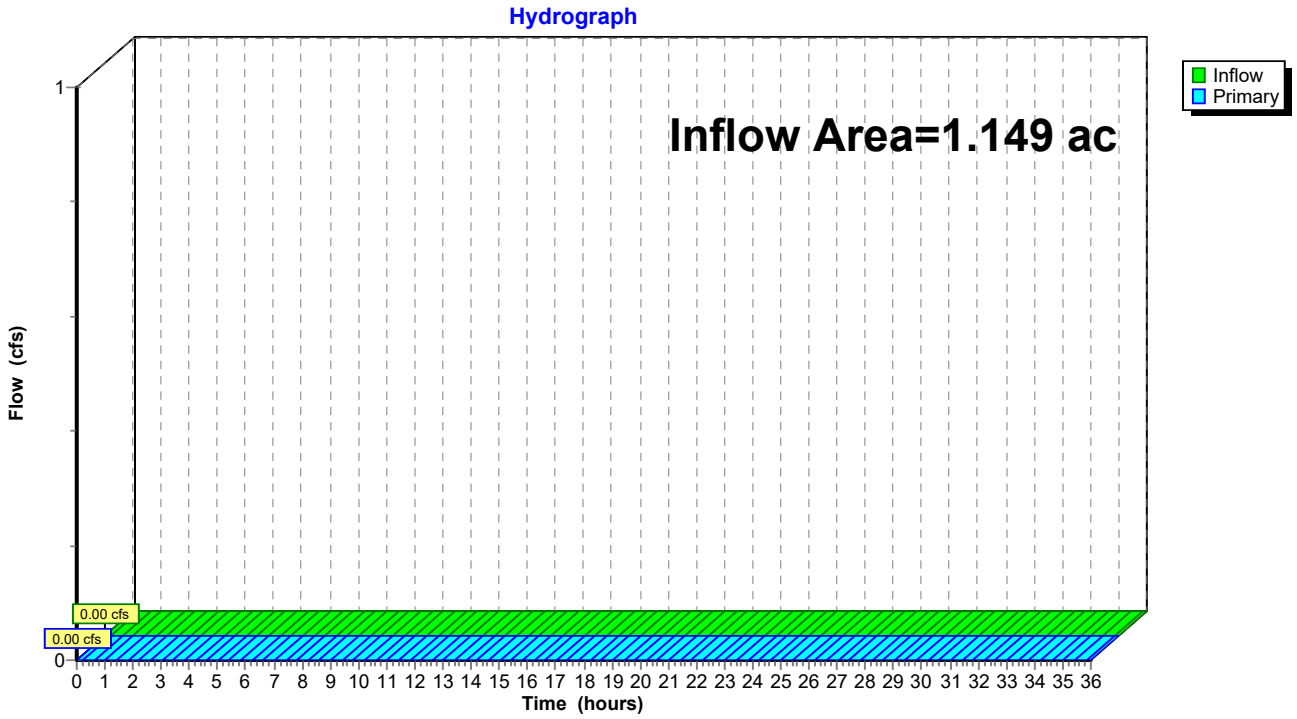


Summary for Link A: Patton Road Woods

Inflow Area = 1.149 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link A: Patton Road Woods

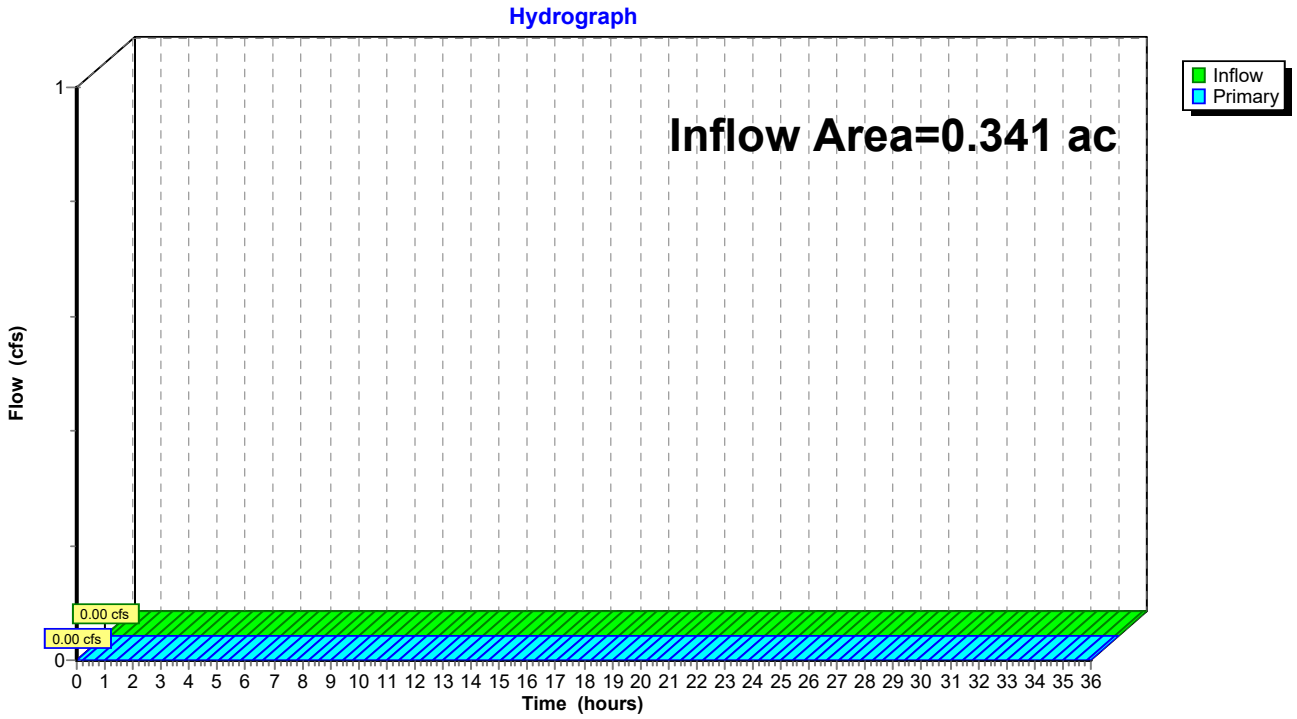


Summary for Link B: Mirror Lake

Inflow Area = 0.341 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link B: Mirror Lake



10-Year Storm Event – Existing

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1A: (new Subcat) Runoff Area=38,275 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=466' Tc=13.7 min CN=32 Runoff=0.00 cfs 0.001 af

Subcatchment1B: Runoff Area=11,255 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=143' Tc=10.0 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment2A: (new Subcat) Runoff Area=11,790 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=619' Tc=14.0 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment2B: (new Subcat) Runoff Area=3,587 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=107' Tc=10.3 min CN=32 Runoff=0.00 cfs 0.000 af

Link A: Patton Road Woods Inflow=0.00 cfs 0.001 af
Primary=0.00 cfs 0.001 af

Link B: Mirror Lake Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 1.490 ac Runoff Volume = 0.001 af Average Runoff Depth = 0.01"
100.00% Pervious = 1.490 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1A: (new Subcat)

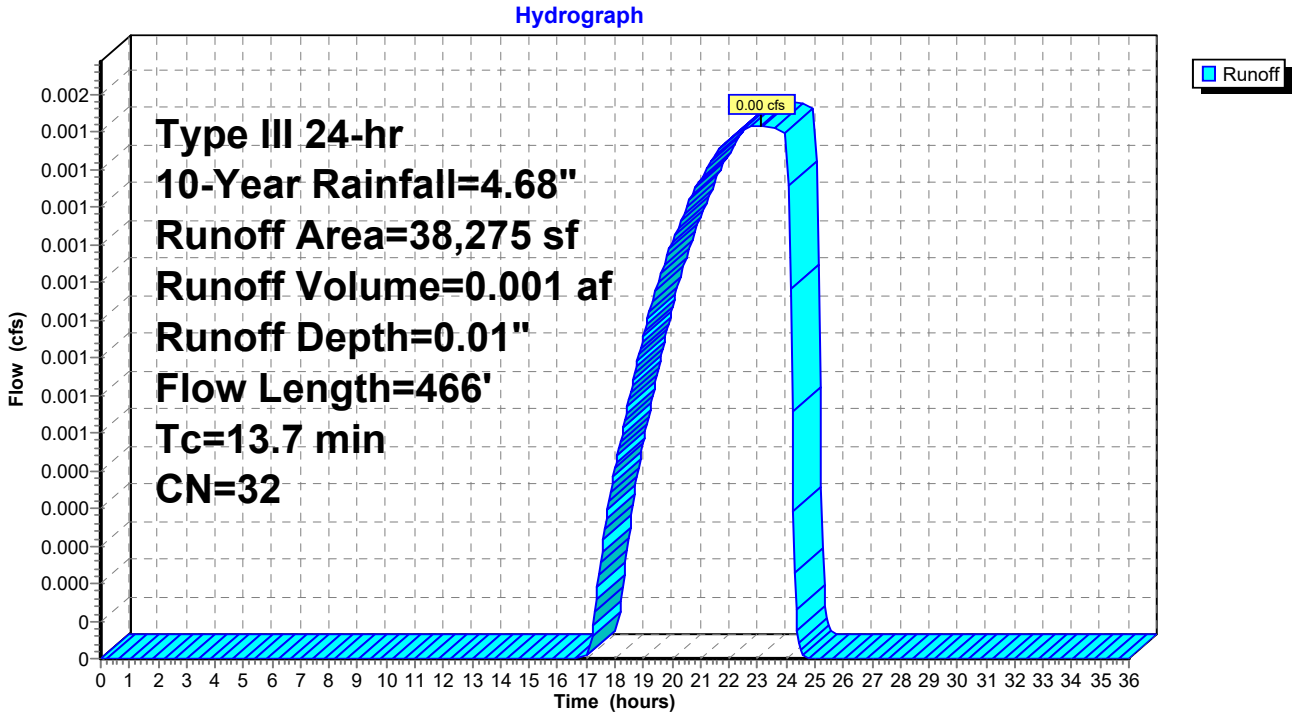
Runoff = 0.00 cfs @ 23.10 hrs, Volume= 0.001 af, Depth= 0.01"
Routed to Link A : Patton Road Woods

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.68"

Area (sf)	CN	Description
38,275	32	Woods/grass comb., Good, HSG A
38,275		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0190	0.14		**Sheet Flow, First 50 ft** Grass: Short n= 0.150 P2= 3.13"
3.2	200	0.0220	1.04		**Shallow Concentrated Flow, Next 200 ft** Short Grass Pasture Kv= 7.0 fps
4.7	216	0.0120	0.77		**Shallow Concentrated Flow, Next 200 Ft** Short Grass Pasture Kv= 7.0 fps
13.7	466	Total			

Subcatchment 1A: (new Subcat)



Summary for Subcatchment 1B:

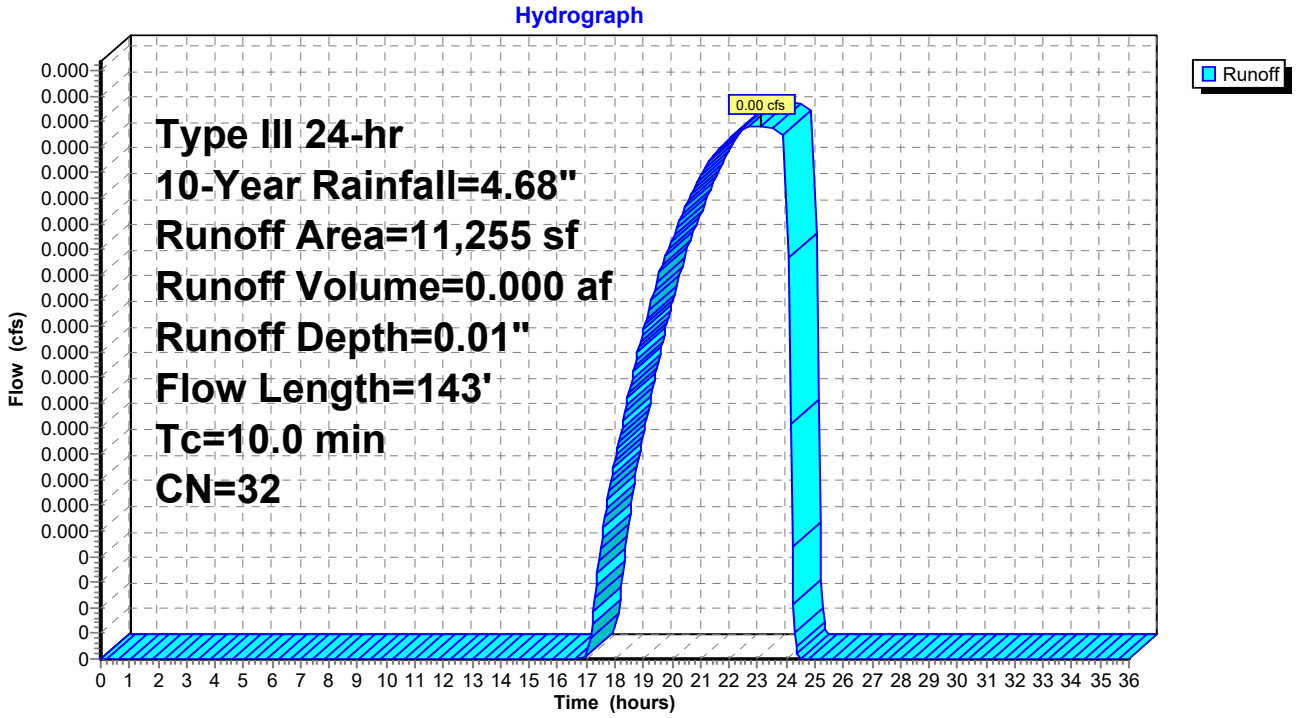
Runoff = 0.00 cfs @ 23.08 hrs, Volume= 0.000 af, Depth= 0.01"
Routed to Link B : Mirror Lake

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.68"

Area (sf)	CN	Description
11,255	32	Woods/grass comb., Good, HSG A
11,255		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0530	0.10		**Sheet Flow, First 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.13"
1.6	93	0.0190	0.96		**Shallow Concentrated Flow, Next 100 Ft** Short Grass Pasture Kv= 7.0 fps
10.0	143	Total			

Subcatchment 1B:



Summary for Subcatchment 2A: (new Subcat)

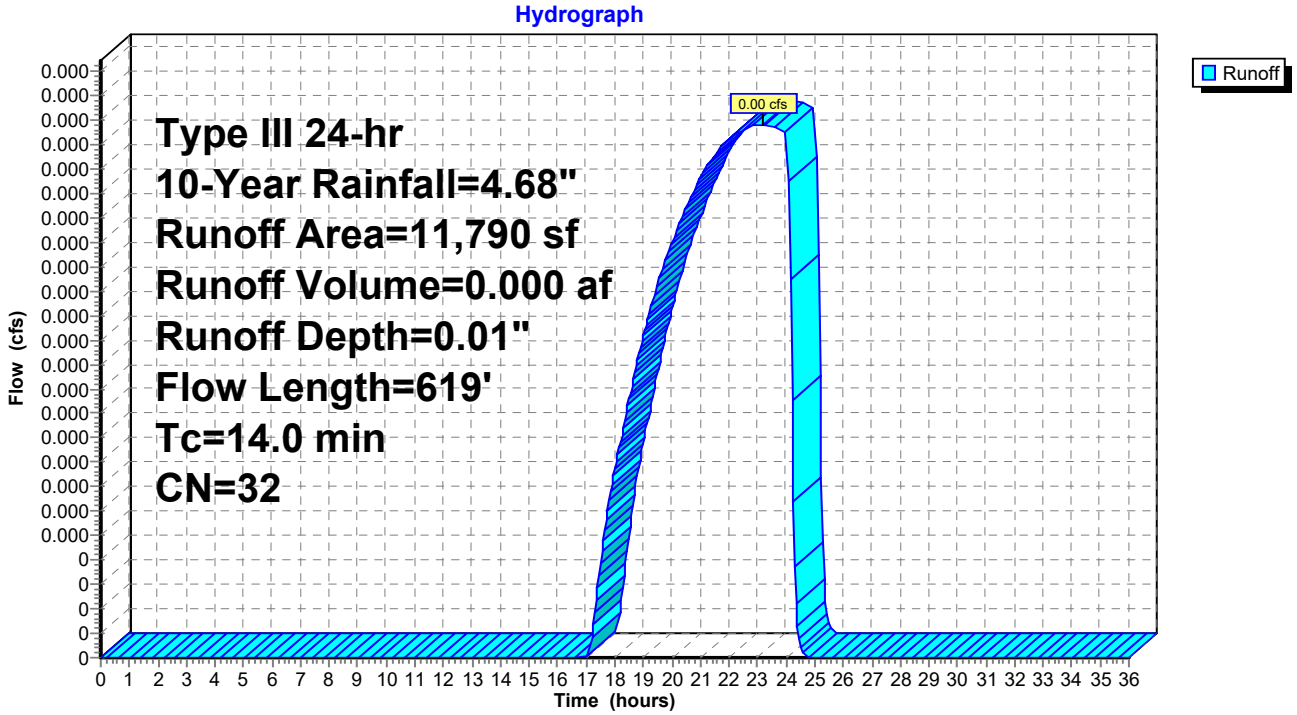
Runoff = 0.00 cfs @ 23.15 hrs, Volume= 0.000 af, Depth= 0.01"
Routed to Link A : Patton Road Woods

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.68"

Area (sf)	CN	Description
11,790	32	Woods/grass comb., Good, HSG A
11,790		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0480	0.21		**Sheet Flow, First 50 Ft** Grass: Short n= 0.150 P2= 3.13"
6.1	200	0.0060	0.54		**Shallow Concentrated Flow, Next 200 ft** Short Grass Pasture Kv= 7.0 fps
2.8	230	0.0047	1.39		**Shallow Concentrated Flow, Next 230 Ft** Paved Kv= 20.3 fps
1.1	139	0.0210	2.17		**Shallow Concentrated Flow, Next 140 Ft** Grassed Waterway Kv= 15.0 fps
14.0	619	Total			

Subcatchment 2A: (new Subcat)



Summary for Subcatchment 2B: (new Subcat)

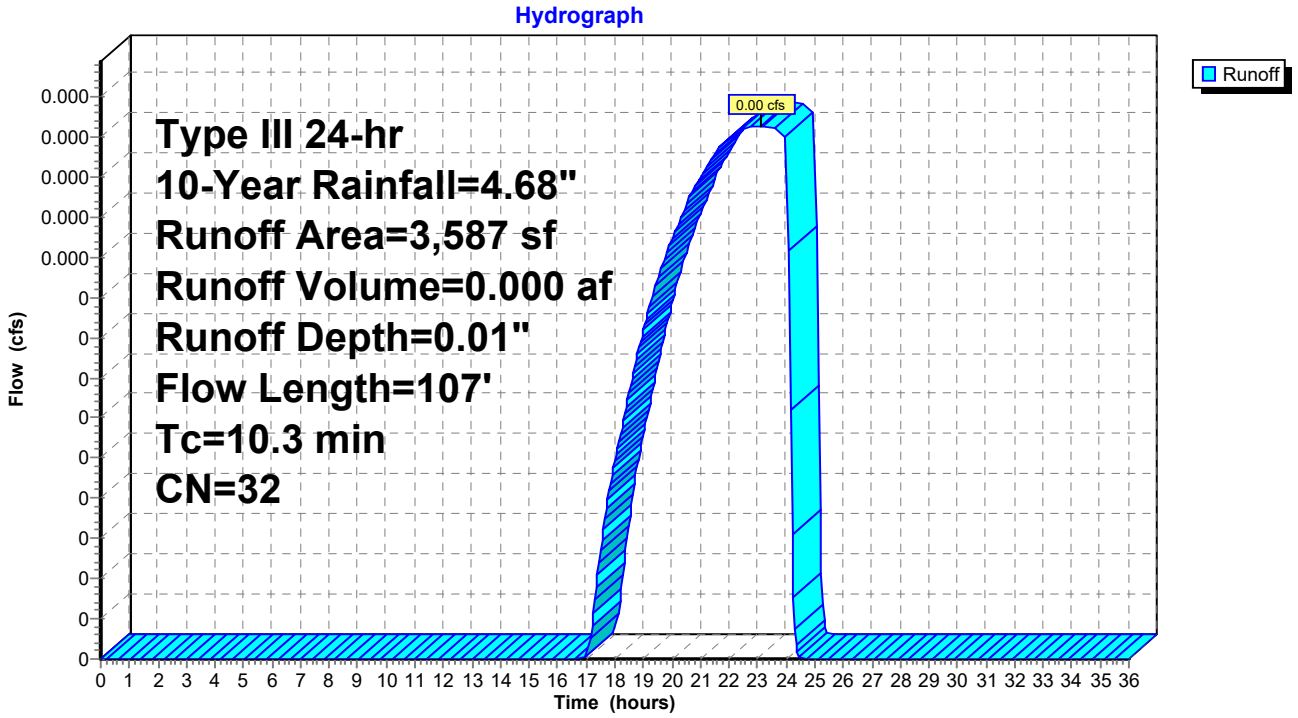
Runoff = 0.00 cfs @ 23.09 hrs, Volume= 0.000 af, Depth= 0.01"
Routed to Link B : Mirror Lake

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.68"

Area (sf)	CN	Description
3,587	32	Woods/grass comb., Good, HSG A
3,587		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0530	0.10		**Sheet Flow, First 50 ft** Woods: Light underbrush n= 0.400 P2= 3.13"
1.9	57	0.0050	0.49		**Shallow Concentrated Flow, Next 60 Ft** Short Grass Pasture Kv= 7.0 fps
10.3	107	Total			

Subcatchment 2B: (new Subcat)

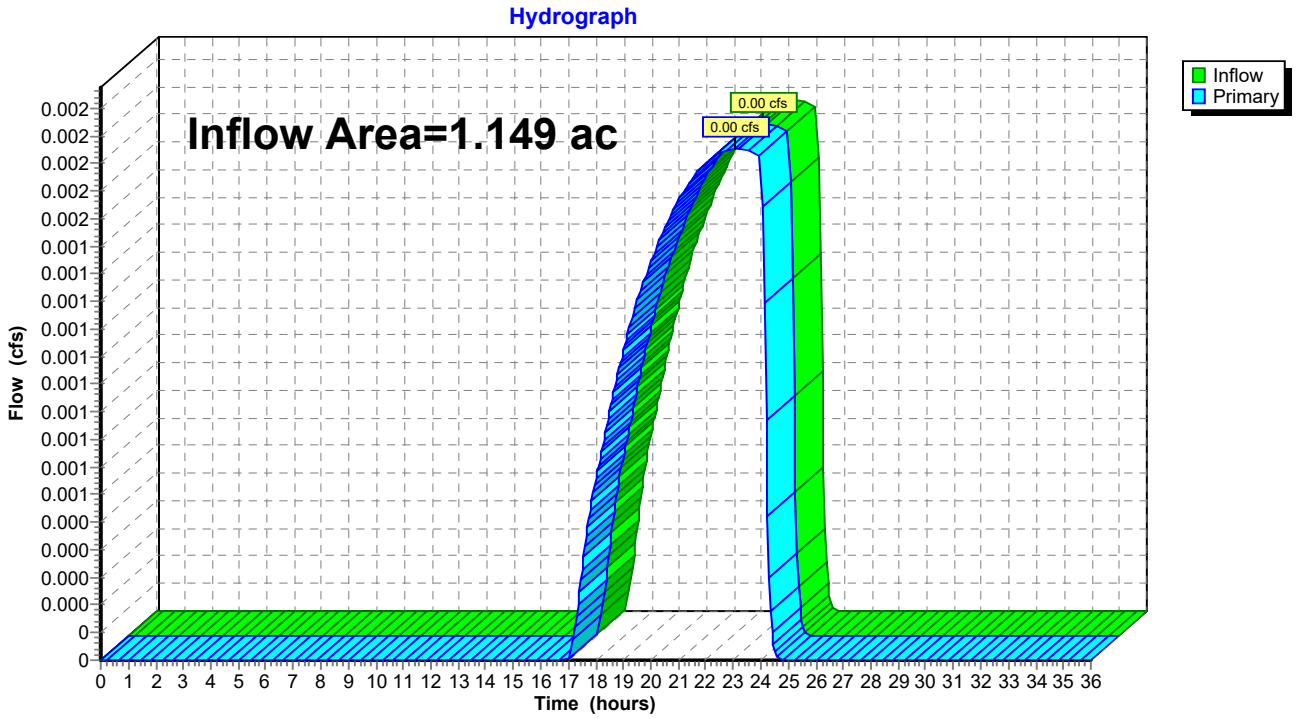


Summary for Link A: Patton Road Woods

Inflow Area = 1.149 ac, 0.00% Impervious, Inflow Depth = 0.01" for 10-Year event
Inflow = 0.00 cfs @ 23.07 hrs, Volume= 0.001 af
Primary = 0.00 cfs @ 23.07 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link A: Patton Road Woods

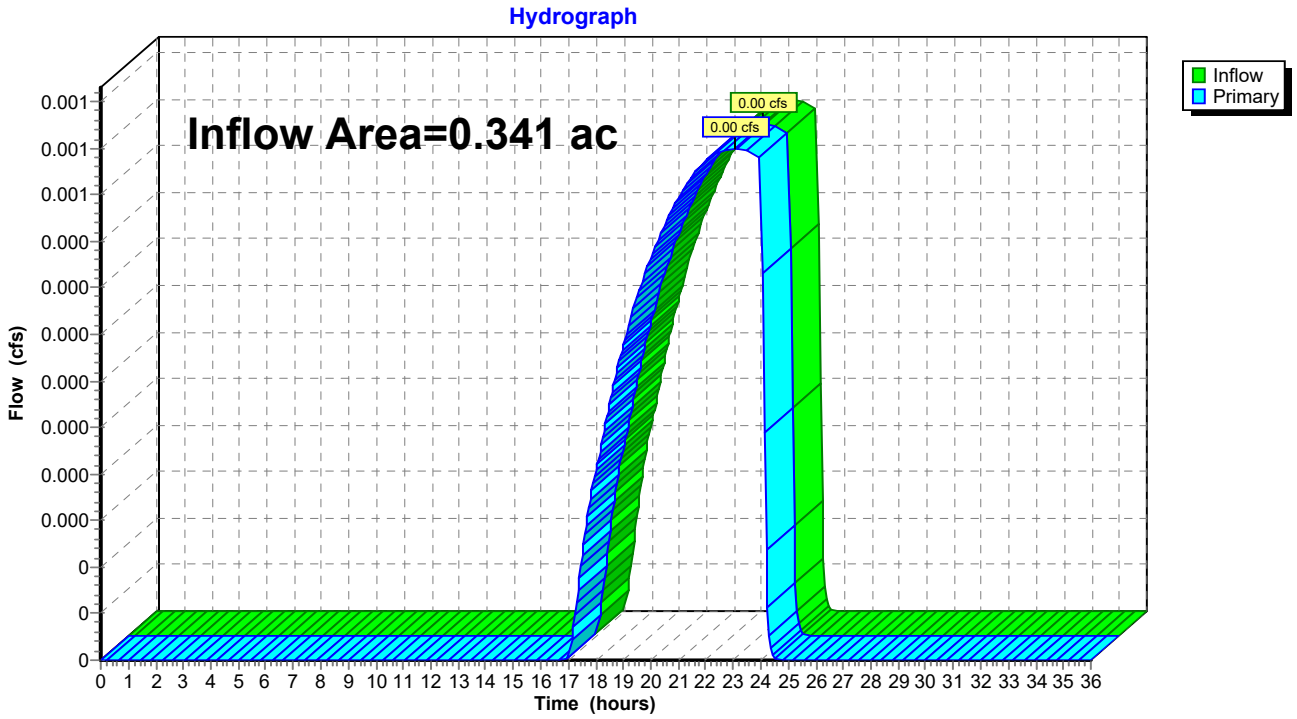


Summary for Link B: Mirror Lake

Inflow Area = 0.341 ac, 0.00% Impervious, Inflow Depth = 0.01" for 10-Year event
Inflow = 0.00 cfs @ 23.08 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 23.08 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link B: Mirror Lake



25-Year Storm Event – Existing

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1A: (new Subcat) Runoff Area=38,275 sf 0.00% Impervious Runoff Depth=0.12"
Flow Length=466' Tc=13.7 min CN=32 Runoff=0.01 cfs 0.009 af

Subcatchment1B: Runoff Area=11,255 sf 0.00% Impervious Runoff Depth=0.12"
Flow Length=143' Tc=10.0 min CN=32 Runoff=0.00 cfs 0.003 af

Subcatchment2A: (new Subcat) Runoff Area=11,790 sf 0.00% Impervious Runoff Depth=0.12"
Flow Length=619' Tc=14.0 min CN=32 Runoff=0.00 cfs 0.003 af

Subcatchment2B: (new Subcat) Runoff Area=3,587 sf 0.00% Impervious Runoff Depth=0.12"
Flow Length=107' Tc=10.3 min CN=32 Runoff=0.00 cfs 0.001 af

Link A: Patton Road Woods Inflow=0.02 cfs 0.011 af
Primary=0.02 cfs 0.011 af

Link B: Mirror Lake Inflow=0.01 cfs 0.003 af
Primary=0.01 cfs 0.003 af

Total Runoff Area = 1.490 ac Runoff Volume = 0.014 af Average Runoff Depth = 0.12"
100.00% Pervious = 1.490 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1A: (new Subcat)

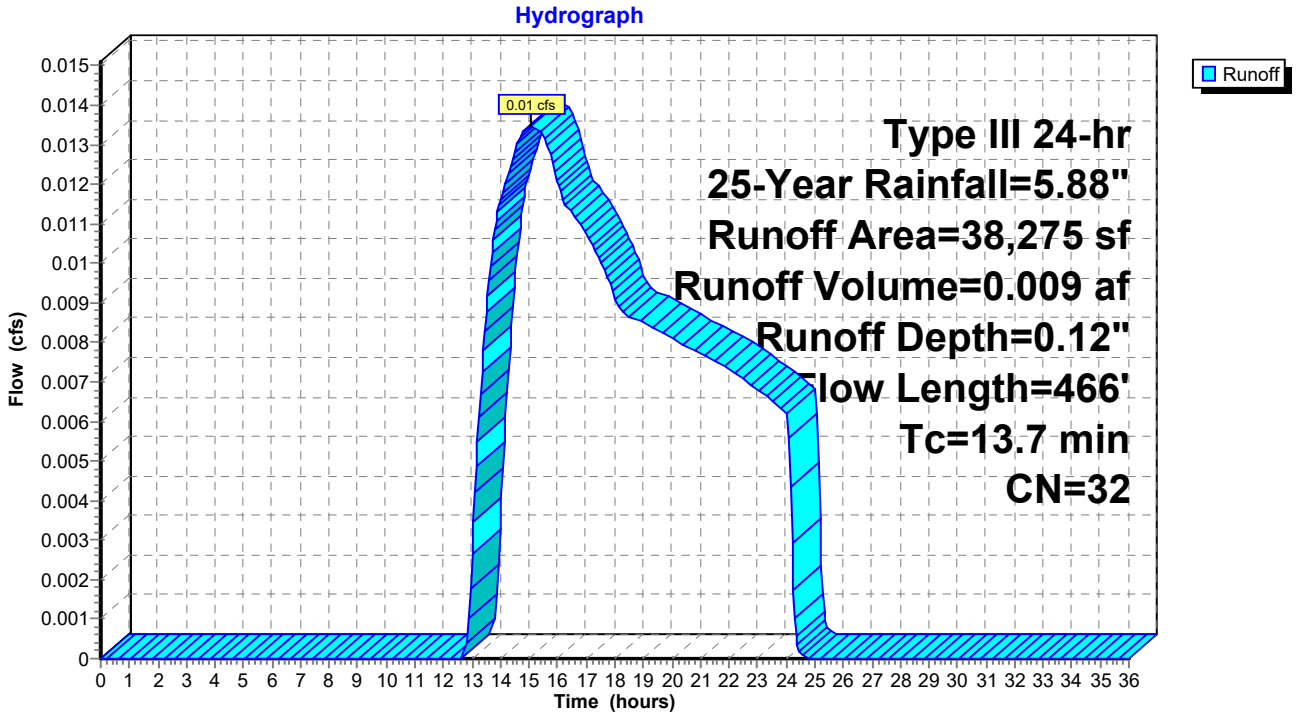
Runoff = 0.01 cfs @ 15.08 hrs, Volume= 0.009 af, Depth= 0.12"
Routed to Link A : Patton Road Woods

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.88"

Area (sf)	CN	Description
38,275	32	Woods/grass comb., Good, HSG A
38,275		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0190	0.14		**Sheet Flow, First 50 ft** Grass: Short n= 0.150 P2= 3.13"
3.2	200	0.0220	1.04		**Shallow Concentrated Flow, Next 200 ft** Short Grass Pasture Kv= 7.0 fps
4.7	216	0.0120	0.77		**Shallow Concentrated Flow, Next 200 Ft** Short Grass Pasture Kv= 7.0 fps
13.7	466	Total			

Subcatchment 1A: (new Subcat)



Summary for Subcatchment 1B:

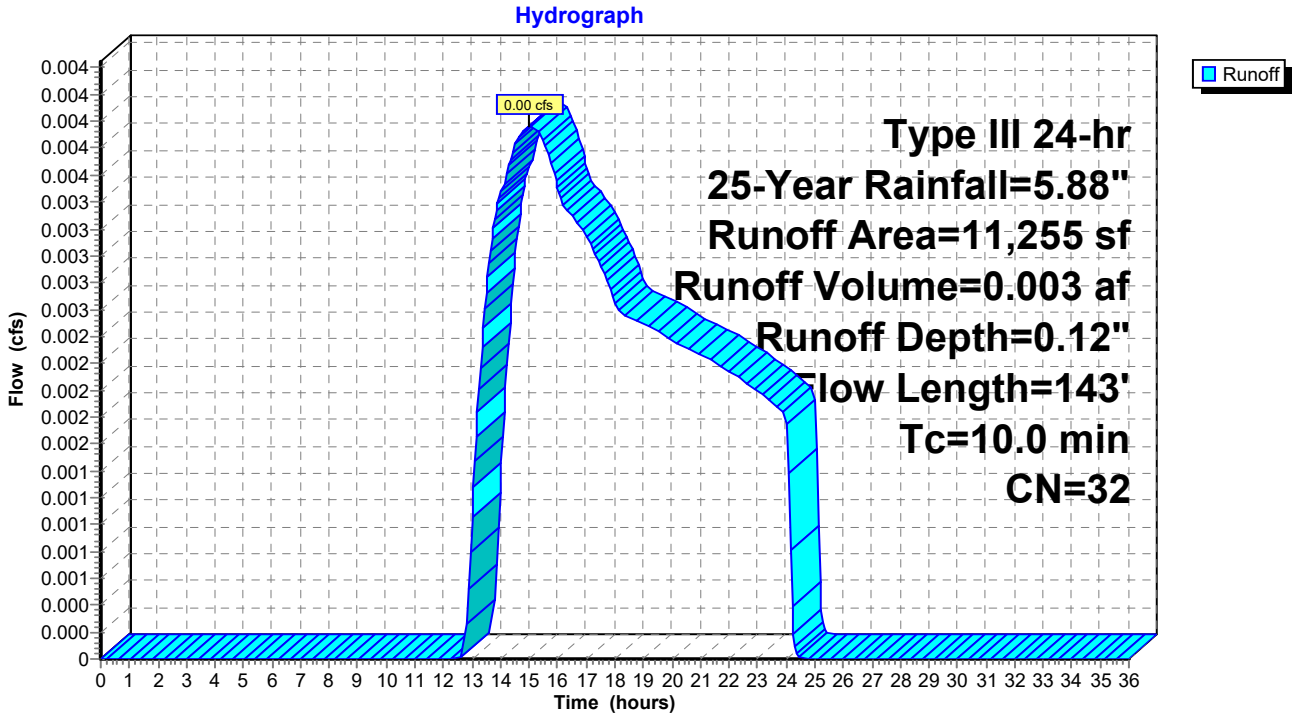
Runoff = 0.00 cfs @ 15.02 hrs, Volume= 0.003 af, Depth= 0.12"
Routed to Link B : Mirror Lake

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.88"

Area (sf)	CN	Description
11,255	32	Woods/grass comb., Good, HSG A
11,255		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0530	0.10		**Sheet Flow, First 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.13"
1.6	93	0.0190	0.96		**Shallow Concentrated Flow, Next 100 Ft** Short Grass Pasture Kv= 7.0 fps
10.0	143	Total			

Subcatchment 1B:



Summary for Subcatchment 2A: (new Subcat)

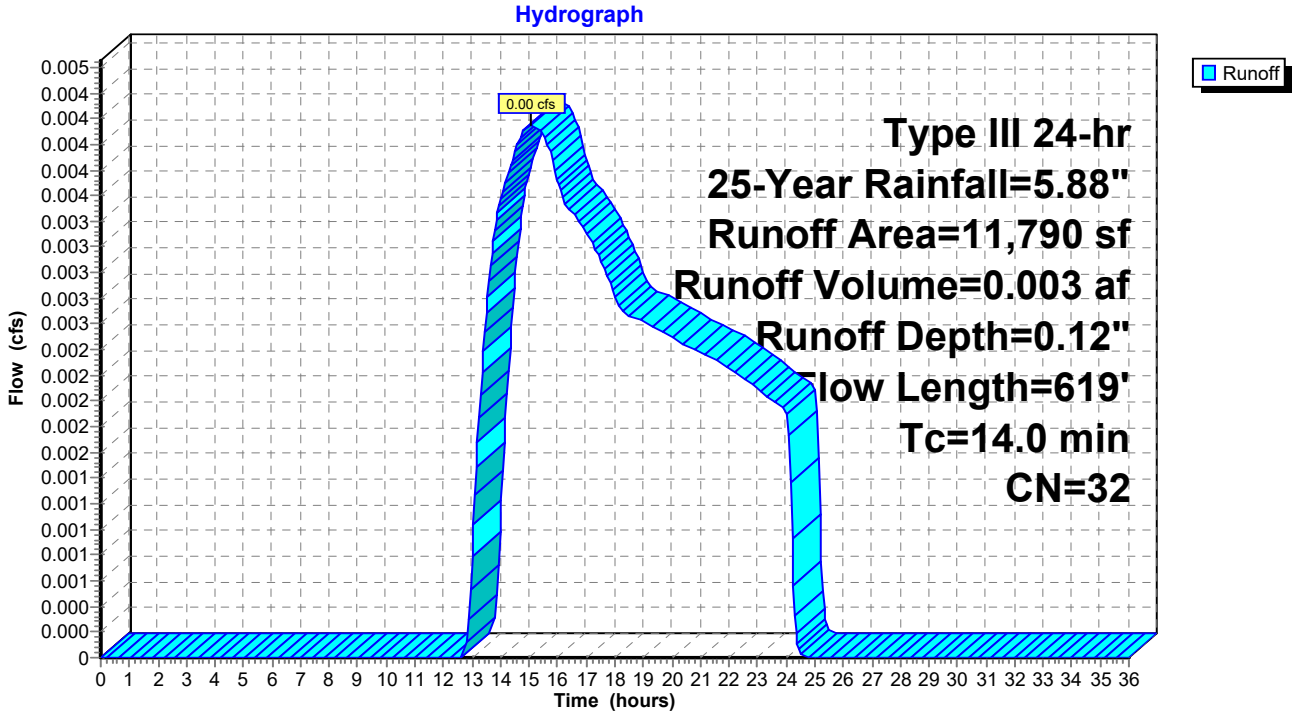
Runoff = 0.00 cfs @ 15.07 hrs, Volume= 0.003 af, Depth= 0.12"
Routed to Link A : Patton Road Woods

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.88"

Area (sf)	CN	Description
11,790	32	Woods/grass comb., Good, HSG A
11,790		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0480	0.21		**Sheet Flow, First 50 Ft** Grass: Short n= 0.150 P2= 3.13"
6.1	200	0.0060	0.54		**Shallow Concentrated Flow, Next 200 ft** Short Grass Pasture Kv= 7.0 fps
2.8	230	0.0047	1.39		**Shallow Concentrated Flow, Next 230 Ft** Paved Kv= 20.3 fps
1.1	139	0.0210	2.17		**Shallow Concentrated Flow, Next 140 Ft** Grassed Waterway Kv= 15.0 fps
14.0	619	Total			

Subcatchment 2A: (new Subcat)



Summary for Subcatchment 2B: (new Subcat)

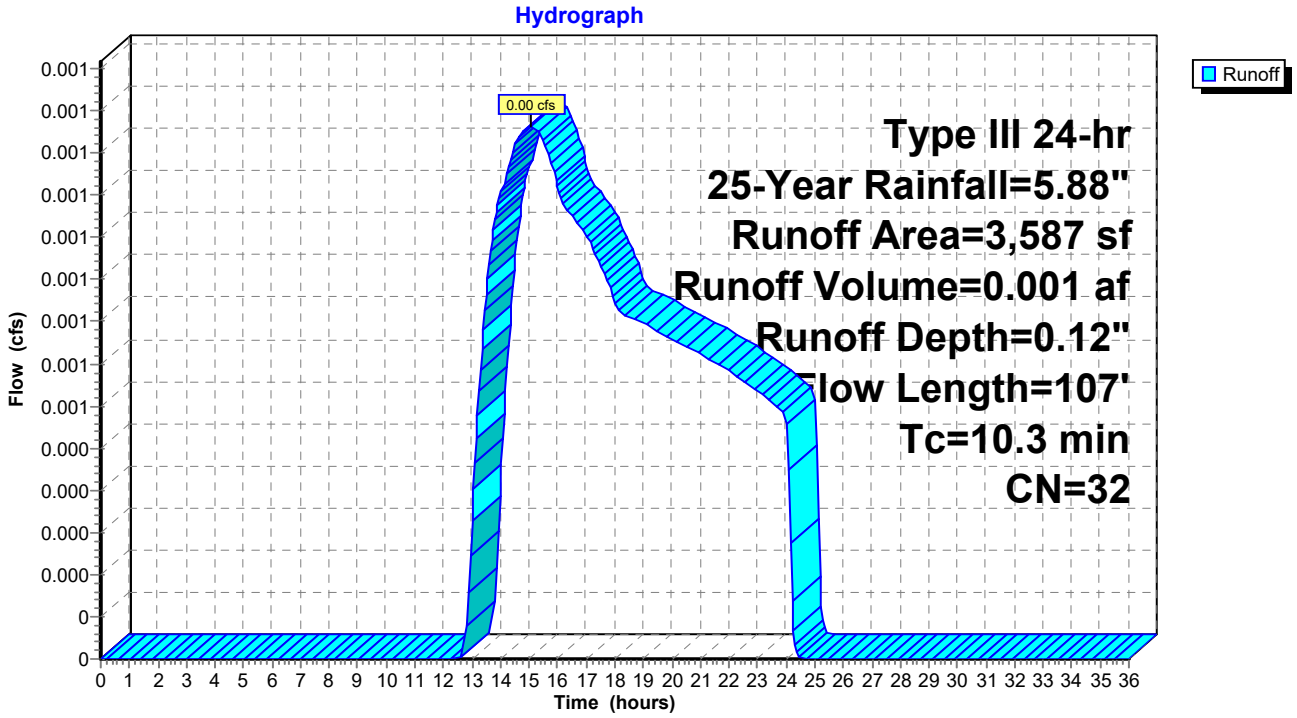
Runoff = 0.00 cfs @ 15.02 hrs, Volume= 0.001 af, Depth= 0.12"
Routed to Link B : Mirror Lake

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.88"

Area (sf)	CN	Description
3,587	32	Woods/grass comb., Good, HSG A
3,587		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0530	0.10		**Sheet Flow, First 50 ft** Woods: Light underbrush n= 0.400 P2= 3.13"
1.9	57	0.0050	0.49		**Shallow Concentrated Flow, Next 60 Ft** Short Grass Pasture Kv= 7.0 fps
10.3	107	Total			

Subcatchment 2B: (new Subcat)

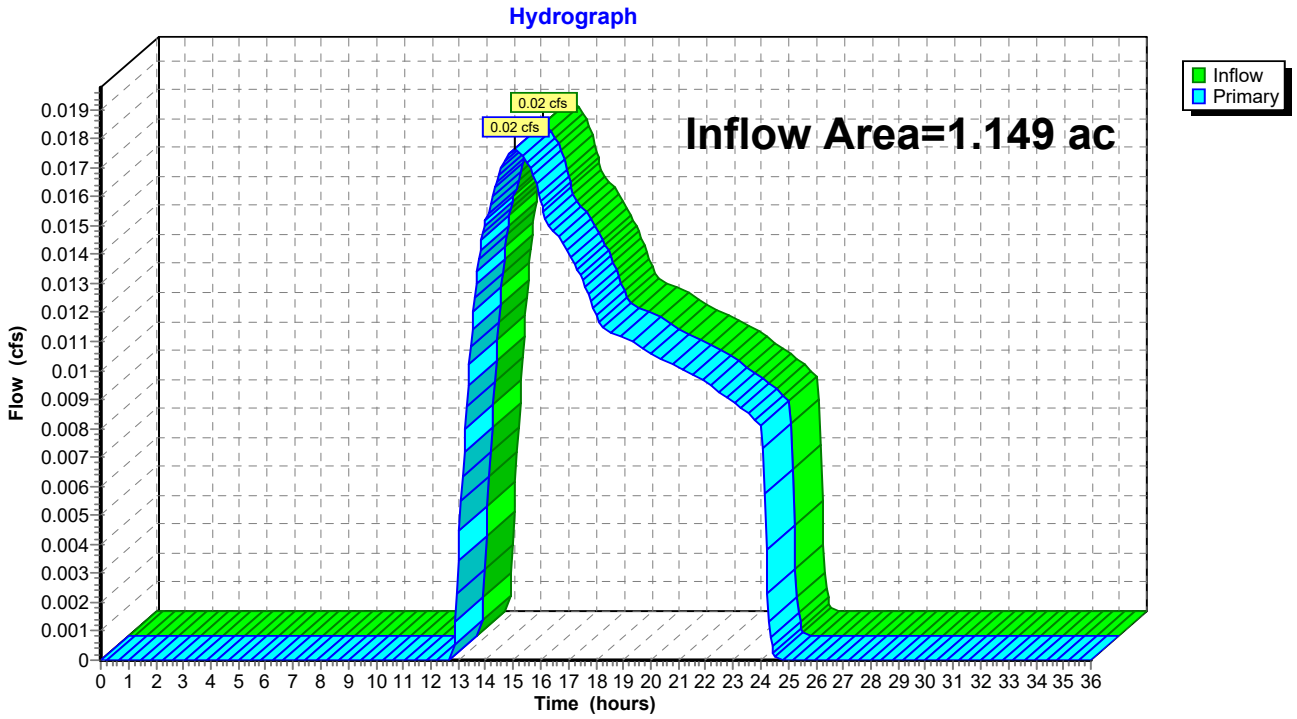


Summary for Link A: Patton Road Woods

Inflow Area = 1.149 ac, 0.00% Impervious, Inflow Depth = 0.12" for 25-Year event
Inflow = 0.02 cfs @ 15.08 hrs, Volume= 0.011 af
Primary = 0.02 cfs @ 15.08 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link A: Patton Road Woods

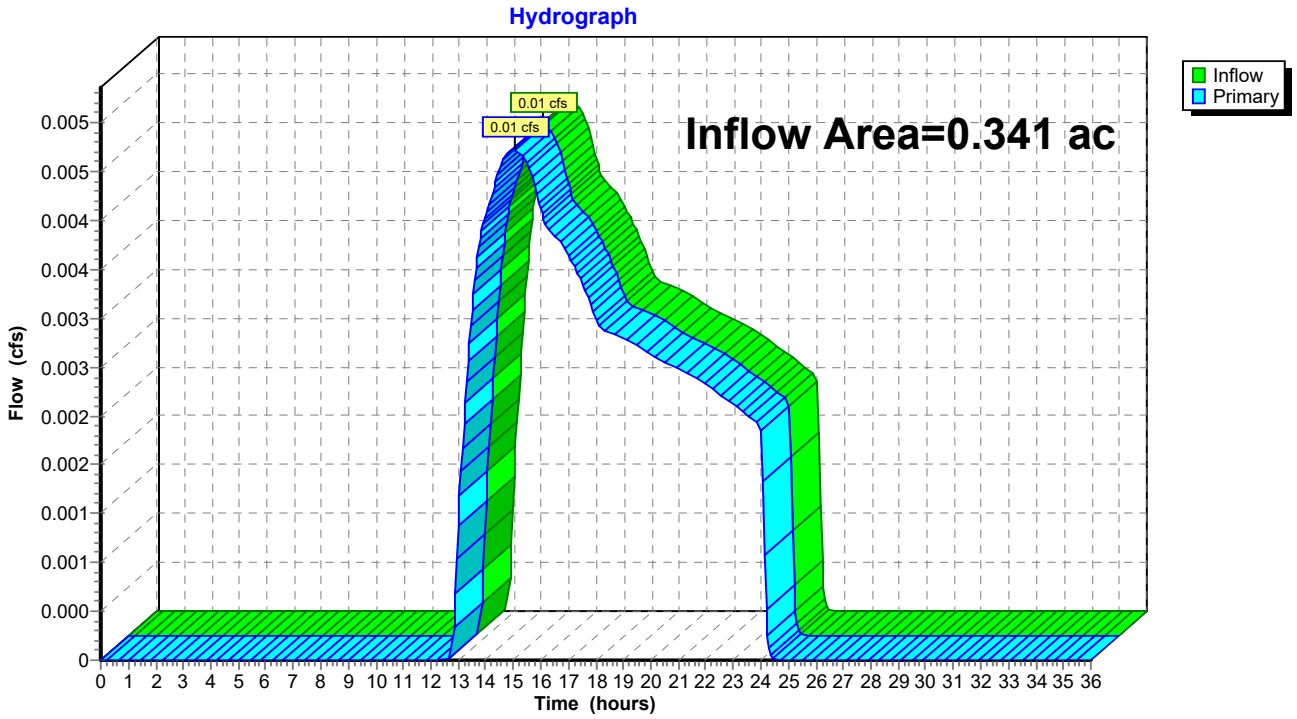


Summary for Link B: Mirror Lake

Inflow Area = 0.341 ac, 0.00% Impervious, Inflow Depth = 0.12" for 25-Year event
Inflow = 0.01 cfs @ 15.02 hrs, Volume= 0.003 af
Primary = 0.01 cfs @ 15.02 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Link B: Mirror Lake



HydroCAD Analysis: Proposed Conditions

2-Year Storm Event – Proposed

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1A: (new Subcat) Runoff Area=15,381 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=380' Tc=13.9 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment1B: Runoff Area=10,009 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=150' Tc=8.6 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment2A: (new Subcat) Runoff Area=11,157 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=551' Tc=17.4 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment3A: (new Subcat) Runoff Area=25,672 sf 91.24% Impervious Runoff Depth=2.38"
Tc=5.0 min CN=93 Runoff=1.65 cfs 0.117 af

Subcatchment4A: (new Subcat) Runoff Area=2,693 sf 100.00% Impervious Runoff Depth=2.90"
Tc=5.0 min CN=98 Runoff=0.19 cfs 0.015 af

Pond 1P: Permeable Pavement Peak Elev=292.50' Storage=5,089 cf Inflow=1.65 cfs 0.117 af
Outflow=0.00 cfs 0.000 af

Pond 2P: Permeable Pavement Peak Elev=289.80' Storage=650 cf Inflow=0.19 cfs 0.015 af
Outflow=0.00 cfs 0.000 af

Link A: Patton Road Woods Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link B: Mirror Lake Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 1.490 ac Runoff Volume = 0.132 af Average Runoff Depth = 1.06"
59.77% Pervious = 0.891 ac 40.23% Impervious = 0.600 ac

Summary for Subcatchment 1A: (new Subcat)

[45] Hint: Runoff=Zero

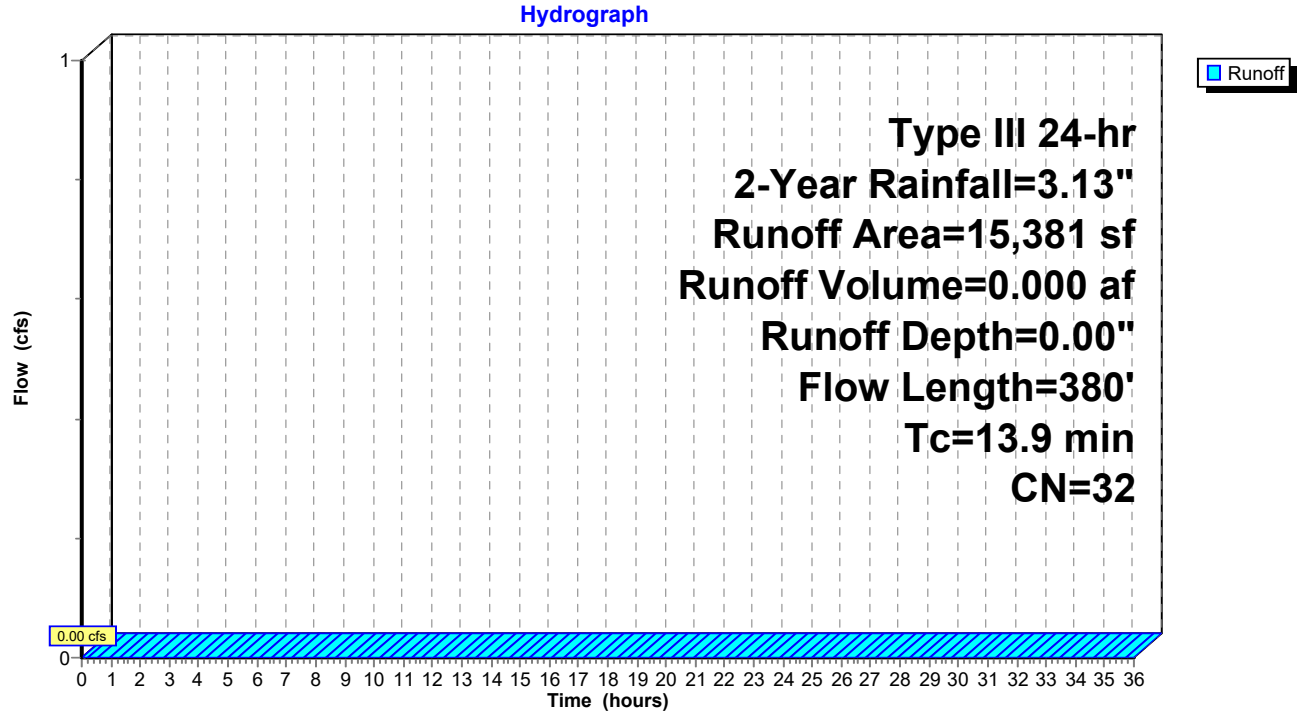
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link A : Patton Road Woods

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.13"

Area (sf)	CN	Description
15,381	32	Woods/grass comb., Good, HSG A
15,381		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.0160	0.09		**Sheet Flow, First 50** Grass: Dense n= 0.240 P2= 3.13"
0.2	25	0.0800	1.98		**Shallow Concentrated Flow, Next 25 Ft** Short Grass Pasture Kv= 7.0 fps
4.6	305	0.0250	1.11		**Shallow Concentrated Flow, Next 300 ft** Short Grass Pasture Kv= 7.0 fps
13.9	380	Total			

Subcatchment 1A: (new Subcat)



Summary for Subcatchment 1B:

[45] Hint: Runoff=Zero

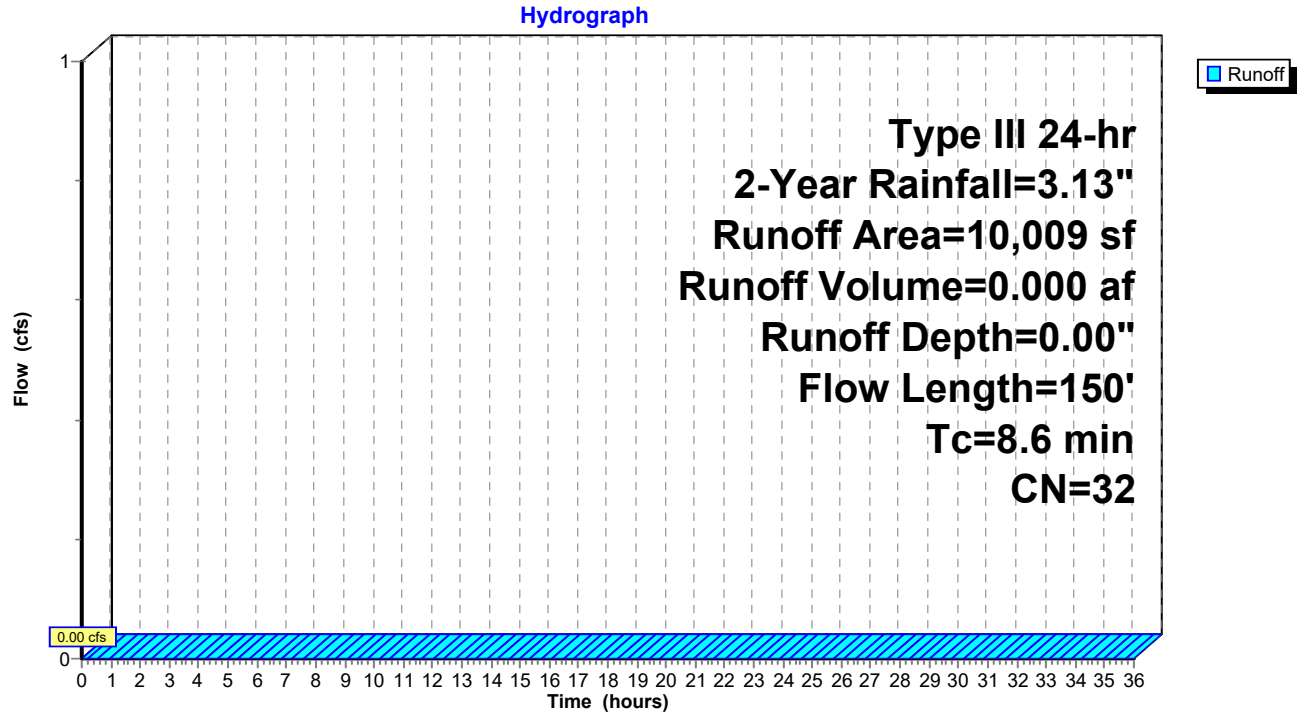
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link B : Mirror Lake

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.13"

Area (sf)	CN	Description
10,009	32	Woods/grass comb., Good, HSG A
10,009		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.0960	0.13		**Sheet Flow, First 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.13"
1.9	100	0.0320	0.89		**Shallow Concentrated Flow, Next 100 Ft** Woodland Kv= 5.0 fps
8.6	150	Total			

Subcatchment 1B:



Summary for Subcatchment 2A: (new Subcat)

[45] Hint: Runoff=Zero

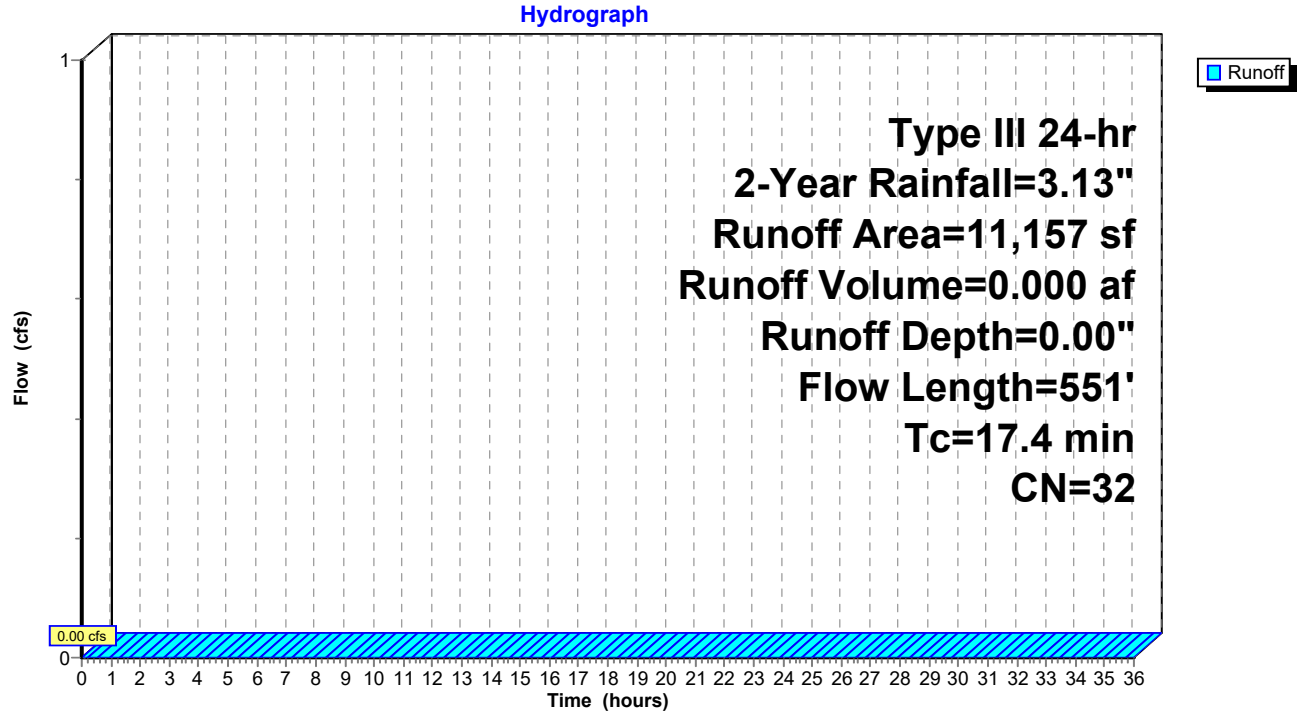
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link A : Patton Road Woods

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.13"

Area (sf)	CN	Description
11,157	32	Woods/grass comb., Good, HSG A
11,157		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0060	0.09		**Sheet Flow, First 50 ft** Grass: Short n= 0.150 P2= 3.13"
4.3	132	0.0053	0.51		**Shallow Concentrated Flow, Next 130 ft** Short Grass Pasture Kv= 7.0 fps
2.8	230	0.0047	1.39		**Shallow Concentrated Flow, Next 230 ft** Paved Kv= 20.3 fps
1.1	139	0.0210	2.17		**Shallow Concentrated Flow, Next 140 ft** Grassed Waterway Kv= 15.0 fps
17.4	551	Total			

Subcatchment 2A: (new Subcat)



Summary for Subcatchment 3A: (new Subcat)

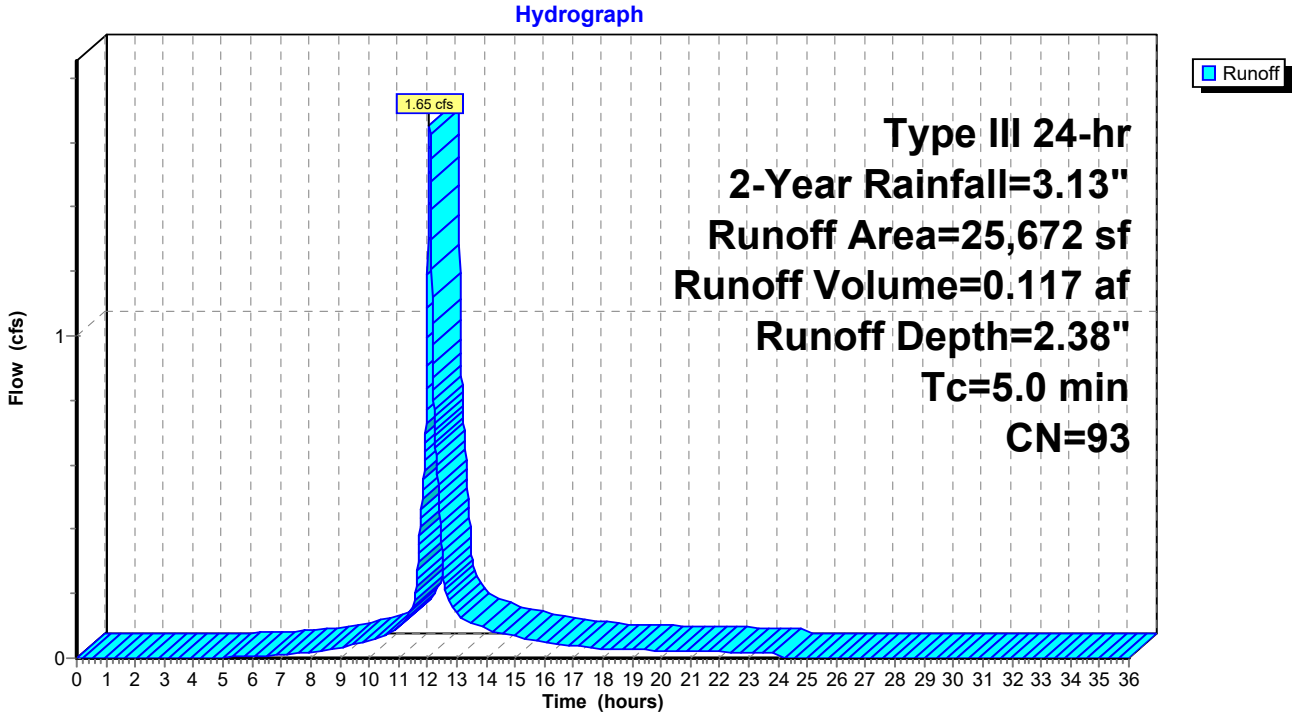
Runoff = 1.65 cfs @ 12.07 hrs, Volume= 0.117 af, Depth= 2.38"
Routed to Pond 1P : Permeable Pavement

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.13"

Area (sf)	CN	Description
23,423	98	Paved parking, HSG A
2,249	39	>75% Grass cover, Good, HSG A
25,672	93	Weighted Average
2,249		8.76% Pervious Area
23,423		91.24% Impervious Area

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

Subcatchment 3A: (new Subcat)



Summary for Subcatchment 4A: (new Subcat)

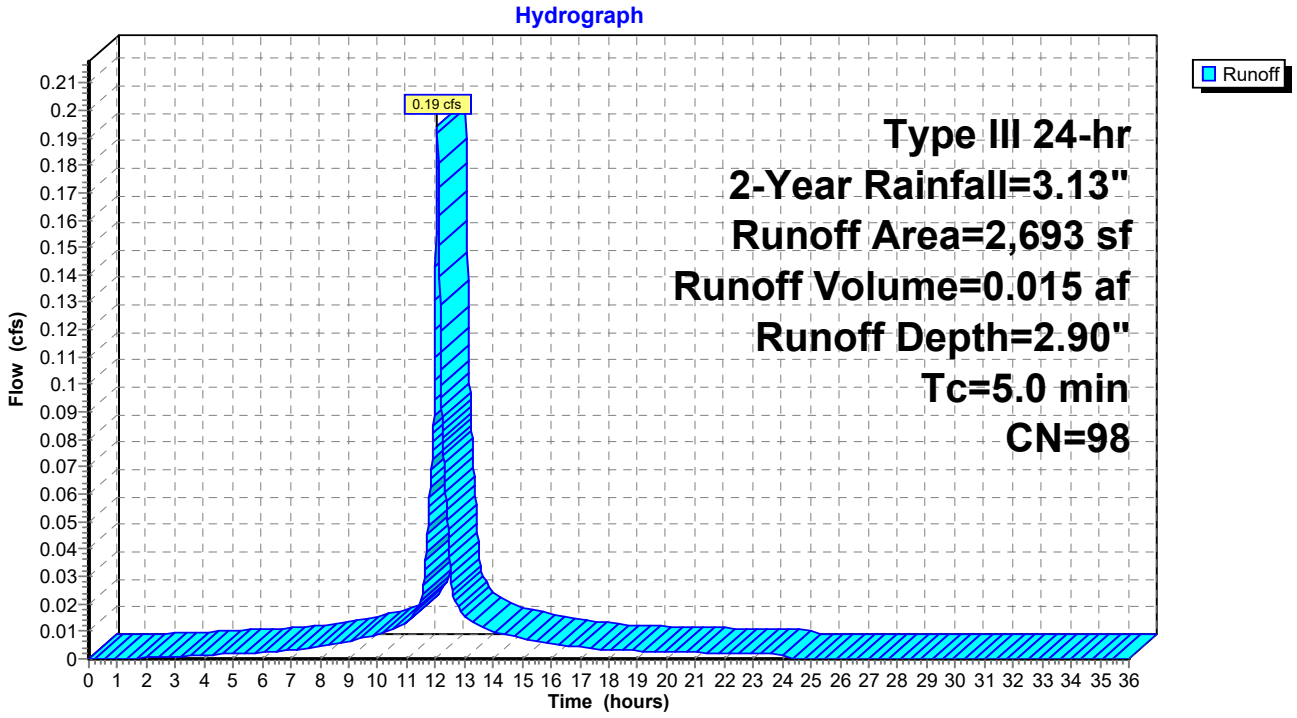
Runoff = 0.19 cfs @ 12.07 hrs, Volume= 0.015 af, Depth= 2.90"
Routed to Pond 2P : Permeable Pavement

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.13"

Area (sf)	CN	Description
2,693	98	Paved parking, HSG A
2,693		100.00% Impervious Area

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

Subcatchment 4A: (new Subcat)



Summary for Pond 1P: Permeable Pavement

Inflow Area = 0.589 ac, 91.24% Impervious, Inflow Depth = 2.38" for 2-Year event
Inflow = 1.65 cfs @ 12.07 hrs, Volume= 0.117 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link A : Patton Road Woods

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 292.50' @ 24.29 hrs Surf.Area= 43,000 sf Storage= 5,089 cf

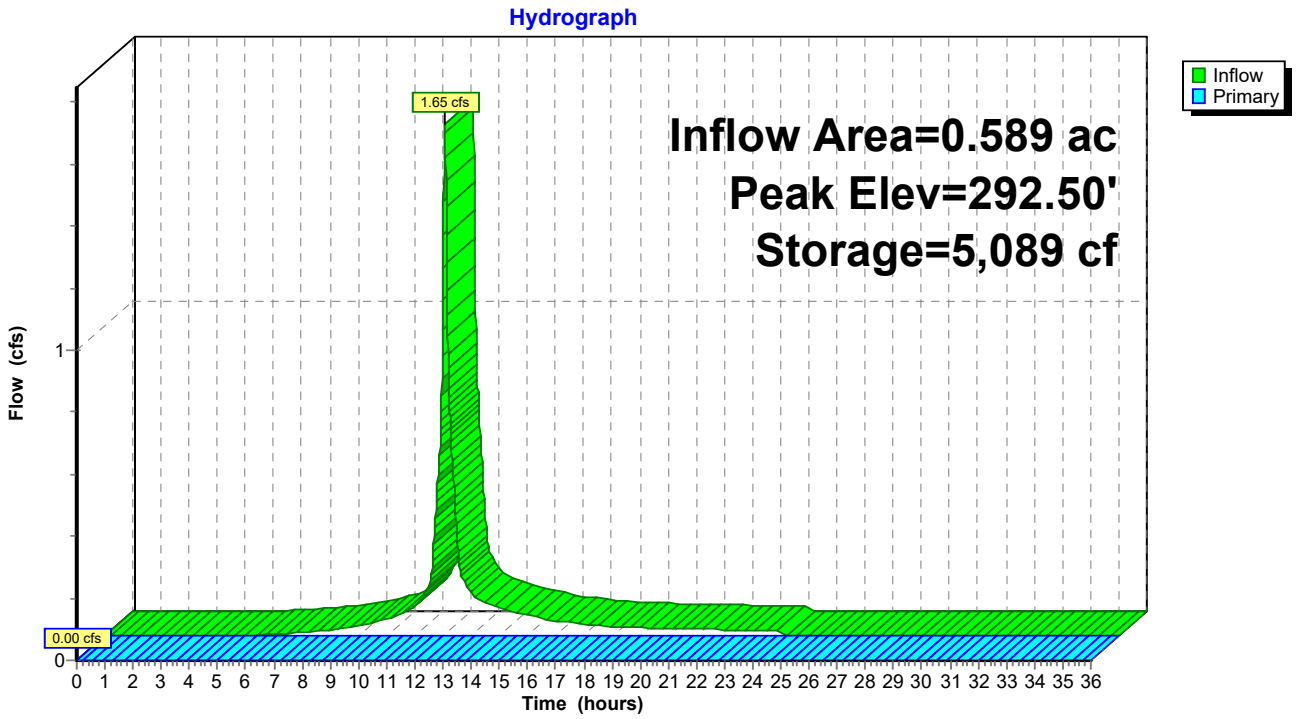
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	293.37'	355 cf	**100.00'W x 215.00'L x 0.33'H Permeable Paver - 5% Voids** 7,095 cf Overall x 5.0% Voids
#2	293.04'	2,128 cf	**100.00'W x 215.00'L x 0.33'H 30% Voids** 7,095 cf Overall x 30.0% Voids
#3	292.04'	8,600 cf	**100.00'W x 215.00'L x 1.00'H Open Graded - 40% Voids** 21,500 cf Overall x 40.0% Voids
#4	291.87'	1,097 cf	**100.00'W x 215.00'L x 0.17'H Double Washed Stone** 3,655 cf Overall x 30.0% Voids
		12,180 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	291.70'	**8.0" Round 8" pipe** L= 162.6' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 291.70' / 289.36' S= 0.0144 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf
#2	Device 1	293.69'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=291.87' (Free Discharge)
↑—**1=8" pipe** (Passes 0.00 cfs of 0.08 cfs potential flow)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: Permeable Pavement



Summary for Pond 2P: Permeable Pavement

Inflow Area = 0.062 ac,100.00% Impervious, Inflow Depth = 2.90" for 2-Year event
Inflow = 0.19 cfs @ 12.07 hrs, Volume= 0.015 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link A : Patton Road Woods

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 289.80' @ 24.29 hrs Surf.Area= 4,680 sf Storage= 650 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

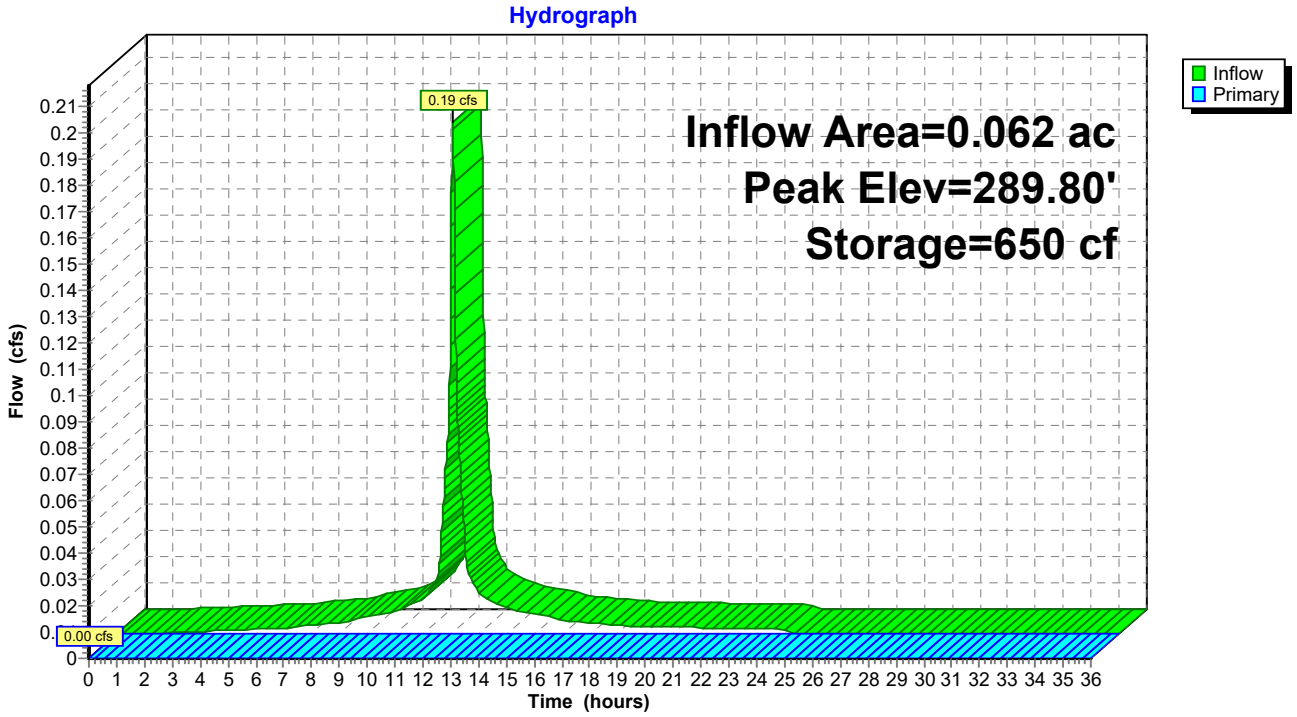
Volume	Invert	Avail.Storage	Storage Description
#1	290.56'	39 cf	**18.00'W x 130.00'L x 0.33'H Permeable Paver - 5% Voids** 772 cf Overall x 5.0% Voids
#2	290.23'	232 cf	**18.00'W x 130.00'L x 0.33'H 1/2" Stone - 30% Voids** 772 cf Overall x 30.0% Voids
#3	289.23'	936 cf	**18.00'W x 130.00'L x 1.00'H Open Graded - 40% Voids** 2,340 cf Overall x 40.0% Voids
#4	289.06'	119 cf	**18.00'W x 130.00'L x 0.17'H 3/8" Double Washed Stone** 398 cf Overall x 30.0% Voids
#5	290.89'	106 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		1,431 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
290.89	0	0	0
291.00	10	1	1
292.00	200	105	106

Device	Routing	Invert	Outlet Devices
#1	Primary	288.00'	**12.0" Round 12" RCP** L= 24.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 288.00' / 287.10' S= 0.0375 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	290.89'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=289.06' (Free Discharge)
↑—**1=12" RCP** (Passes 0.00 cfs of 2.83 cfs potential flow)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 2P: Permeable Pavement

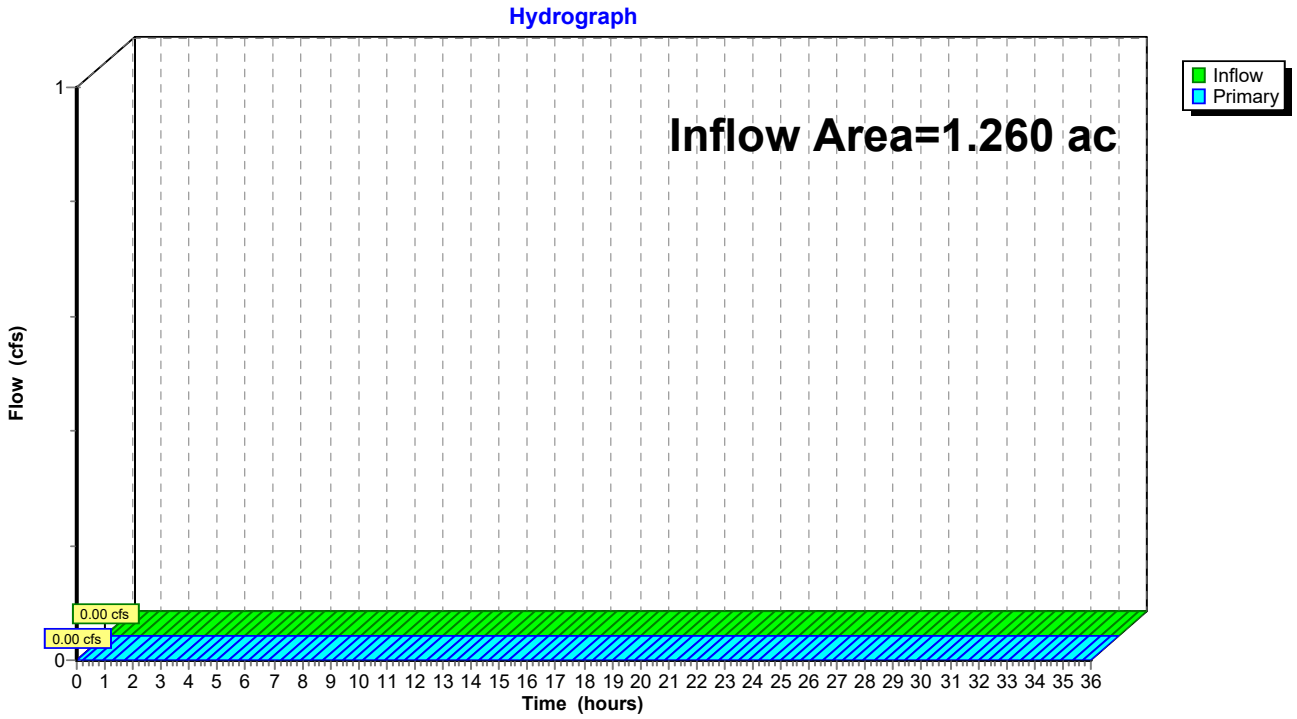


Summary for Link A: Patton Road Woods

Inflow Area = 1.260 ac, 47.57% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link A: Patton Road Woods

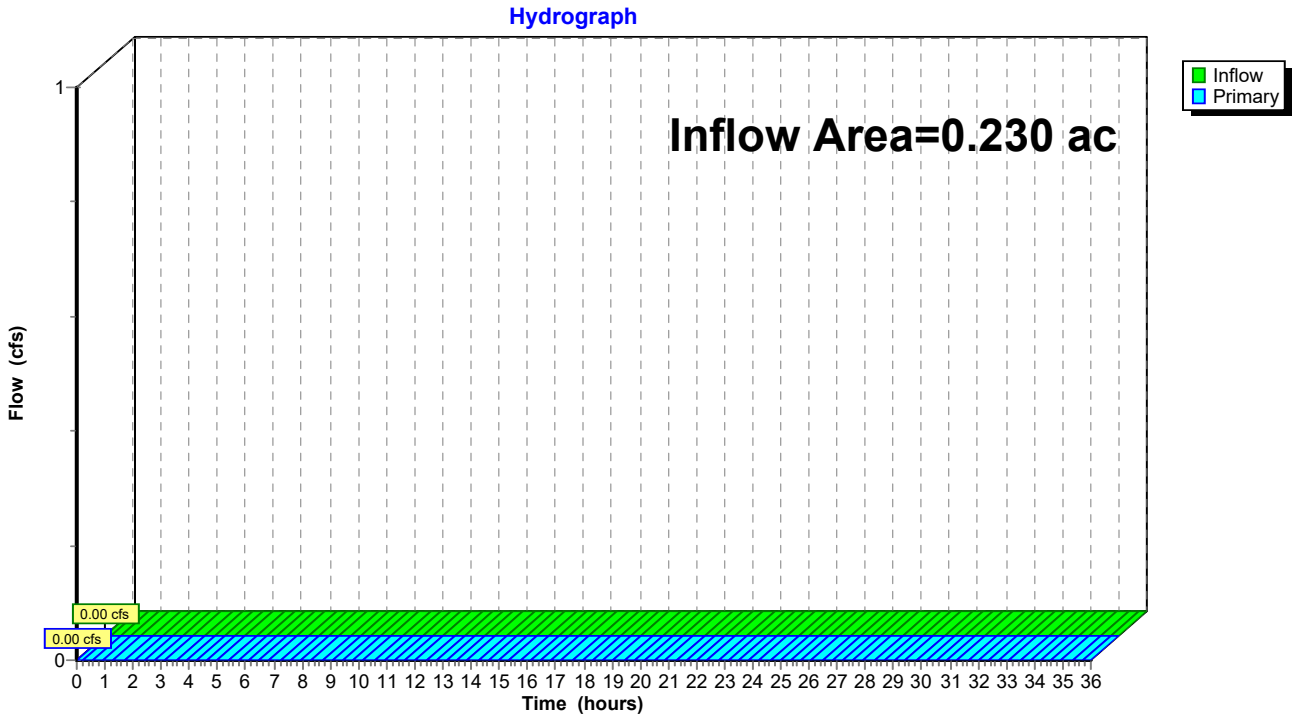


Summary for Link B: Mirror Lake

Inflow Area = 0.230 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link B: Mirror Lake



10-Year Storm Event – Proposed

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1A: (new Subcat) Runoff Area=15,381 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=380' Tc=13.9 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment1B: Runoff Area=10,009 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=150' Tc=8.6 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment2A: (new Subcat) Runoff Area=11,157 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=551' Tc=17.4 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment3A: (new Subcat) Runoff Area=25,672 sf 91.24% Impervious Runoff Depth=3.88"
Tc=5.0 min CN=93 Runoff=2.63 cfs 0.191 af

Subcatchment4A: (new Subcat) Runoff Area=2,693 sf 100.00% Impervious Runoff Depth=4.44"
Tc=5.0 min CN=98 Runoff=0.29 cfs 0.023 af

Pond 1P: Permeable Pavement Peak Elev=292.88' Storage=8,309 cf Inflow=2.63 cfs 0.191 af
Outflow=0.00 cfs 0.000 af

Pond 2P: Permeable Pavement Peak Elev=290.17' Storage=997 cf Inflow=0.29 cfs 0.023 af
Outflow=0.00 cfs 0.000 af

Link A: Patton Road Woods Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link B: Mirror Lake Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 1.490 ac Runoff Volume = 0.214 af Average Runoff Depth = 1.73"
59.77% Pervious = 0.891 ac 40.23% Impervious = 0.600 ac

Summary for Subcatchment 1A: (new Subcat)

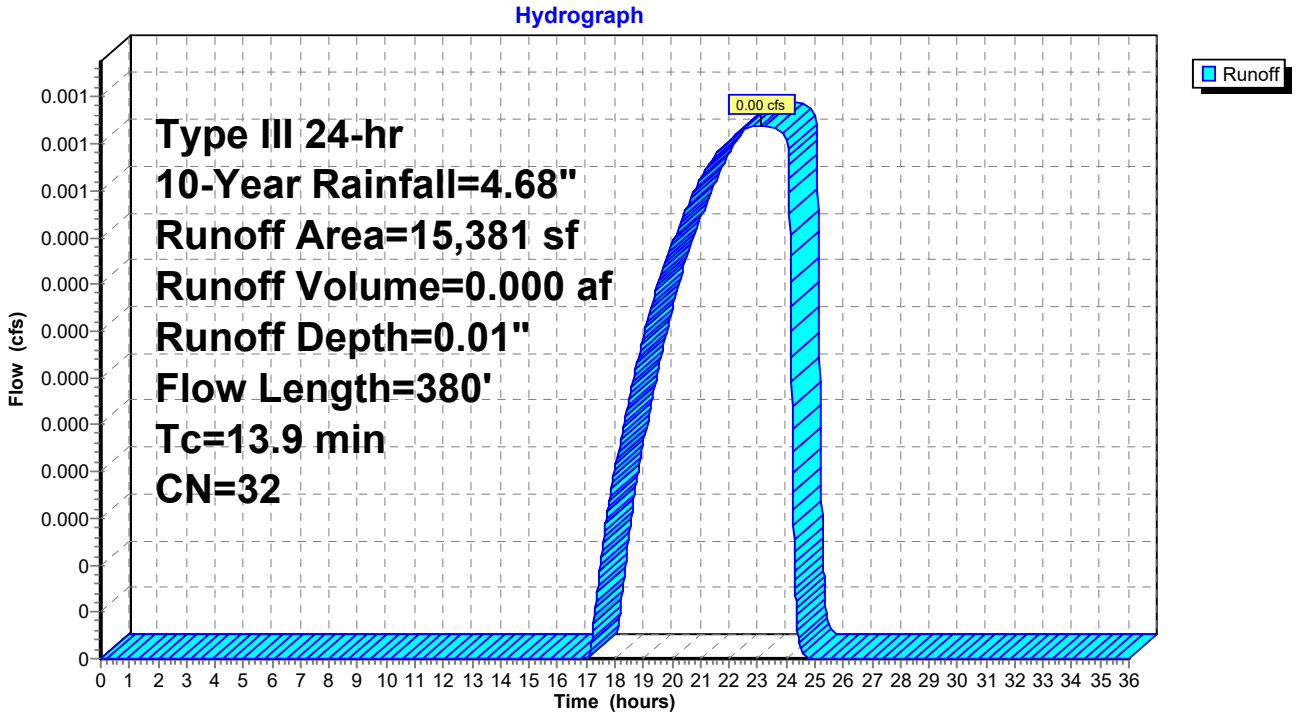
Runoff = 0.00 cfs @ 23.12 hrs, Volume= 0.000 af, Depth= 0.01"
Routed to Link A : Patton Road Woods

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.68"

Area (sf)	CN	Description
15,381	32	Woods/grass comb., Good, HSG A
15,381		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.0160	0.09		**Sheet Flow, First 50** Grass: Dense n= 0.240 P2= 3.13"
0.2	25	0.0800	1.98		**Shallow Concentrated Flow, Next 25 Ft** Short Grass Pasture Kv= 7.0 fps
4.6	305	0.0250	1.11		**Shallow Concentrated Flow, Next 300 ft** Short Grass Pasture Kv= 7.0 fps
13.9	380	Total			

Subcatchment 1A: (new Subcat)



Summary for Subcatchment 1B:

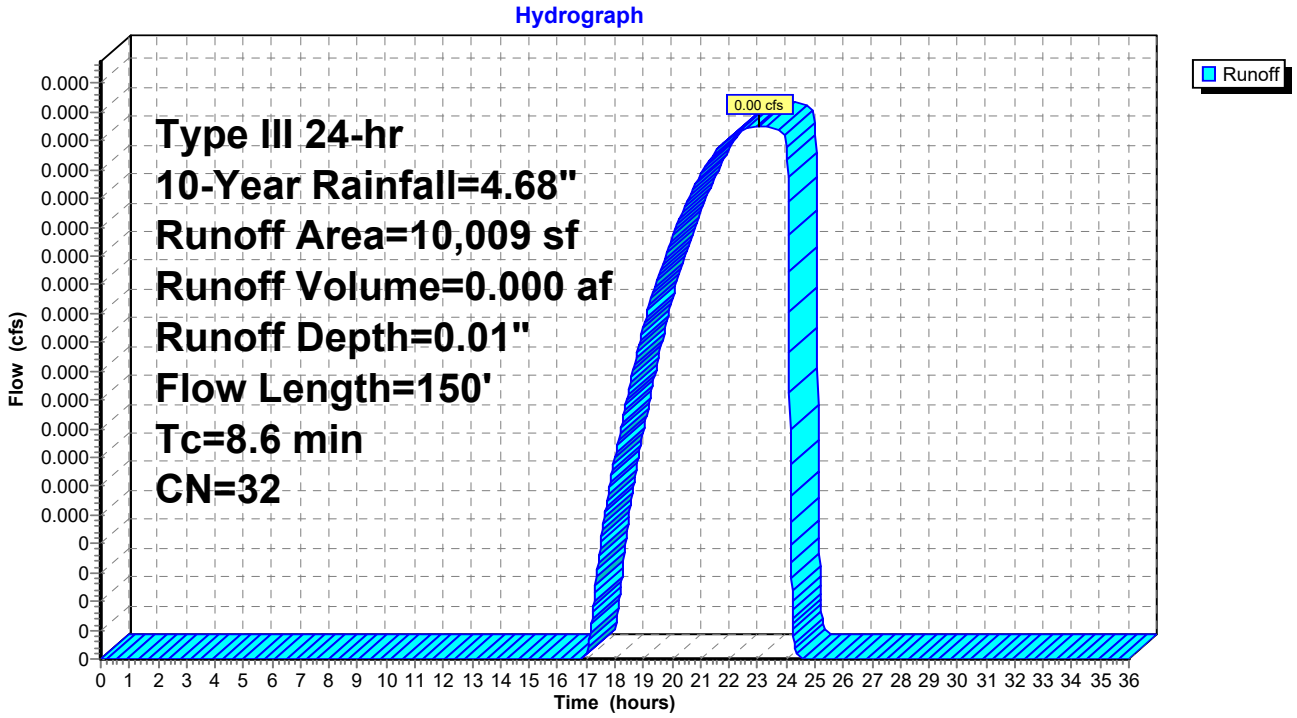
Runoff = 0.00 cfs @ 23.02 hrs, Volume= 0.000 af, Depth= 0.01"
Routed to Link B : Mirror Lake

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.68"

Area (sf)	CN	Description
10,009	32	Woods/grass comb., Good, HSG A
10,009		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.0960	0.13		**Sheet Flow, First 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.13"
1.9	100	0.0320	0.89		**Shallow Concentrated Flow, Next 100 Ft** Woodland Kv= 5.0 fps
8.6	150	Total			

Subcatchment 1B:



Summary for Subcatchment 2A: (new Subcat)

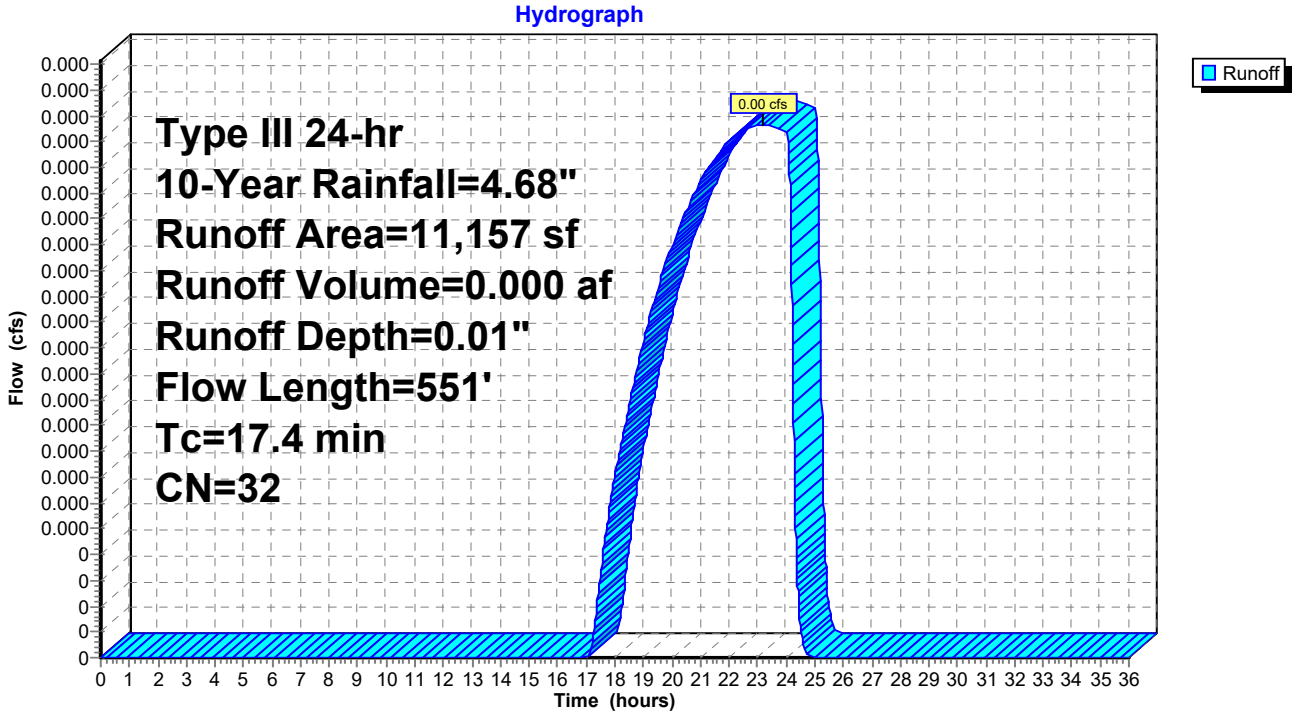
Runoff = 0.00 cfs @ 23.18 hrs, Volume= 0.000 af, Depth= 0.01"
Routed to Link A : Patton Road Woods

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.68"

Area (sf)	CN	Description
11,157	32	Woods/grass comb., Good, HSG A
11,157		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0060	0.09		**Sheet Flow, First 50 ft** Grass: Short n= 0.150 P2= 3.13"
4.3	132	0.0053	0.51		**Shallow Concentrated Flow, Next 130 ft** Short Grass Pasture Kv= 7.0 fps
2.8	230	0.0047	1.39		**Shallow Concentrated Flow, Next 230 ft** Paved Kv= 20.3 fps
1.1	139	0.0210	2.17		**Shallow Concentrated Flow, Next 140 ft** Grassed Waterway Kv= 15.0 fps
17.4	551	Total			

Subcatchment 2A: (new Subcat)



Summary for Subcatchment 3A: (new Subcat)

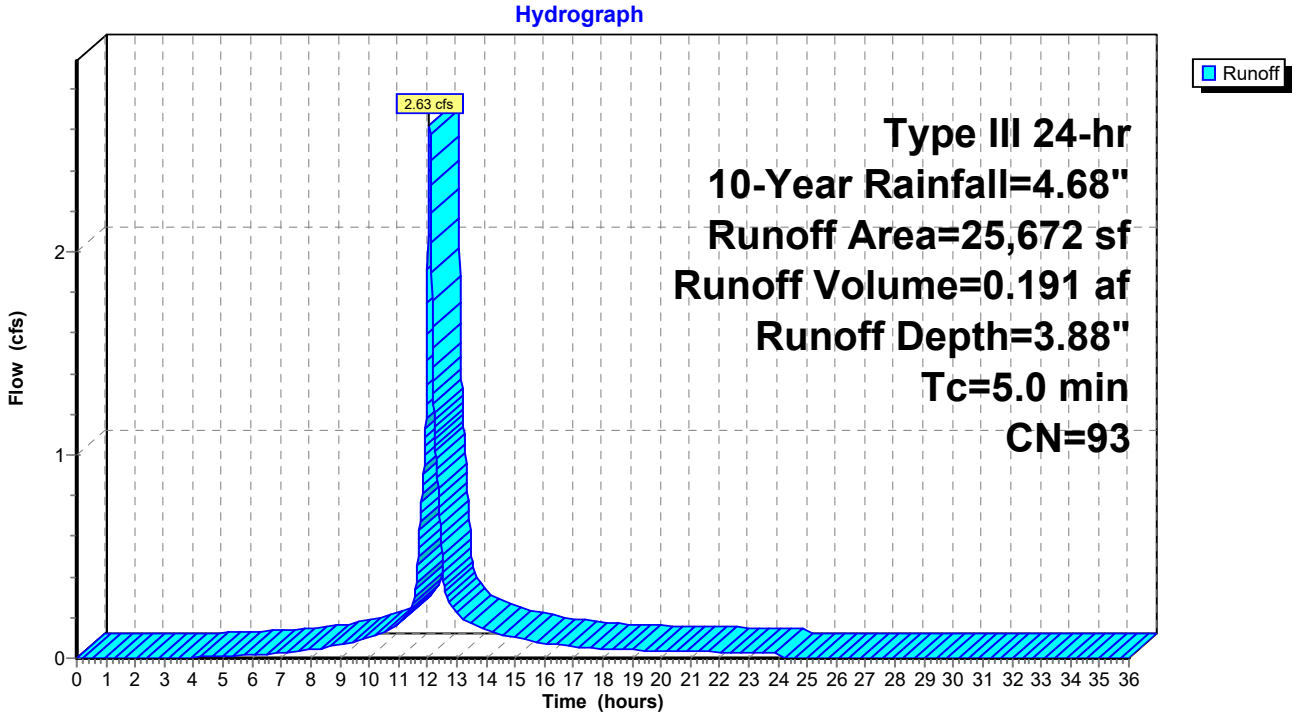
Runoff = 2.63 cfs @ 12.07 hrs, Volume= 0.191 af, Depth= 3.88"
Routed to Pond 1P : Permeable Pavement

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.68"

Area (sf)	CN	Description
23,423	98	Paved parking, HSG A
2,249	39	>75% Grass cover, Good, HSG A
25,672	93	Weighted Average
2,249		8.76% Pervious Area
23,423		91.24% Impervious Area

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

Subcatchment 3A: (new Subcat)



Summary for Subcatchment 4A: (new Subcat)

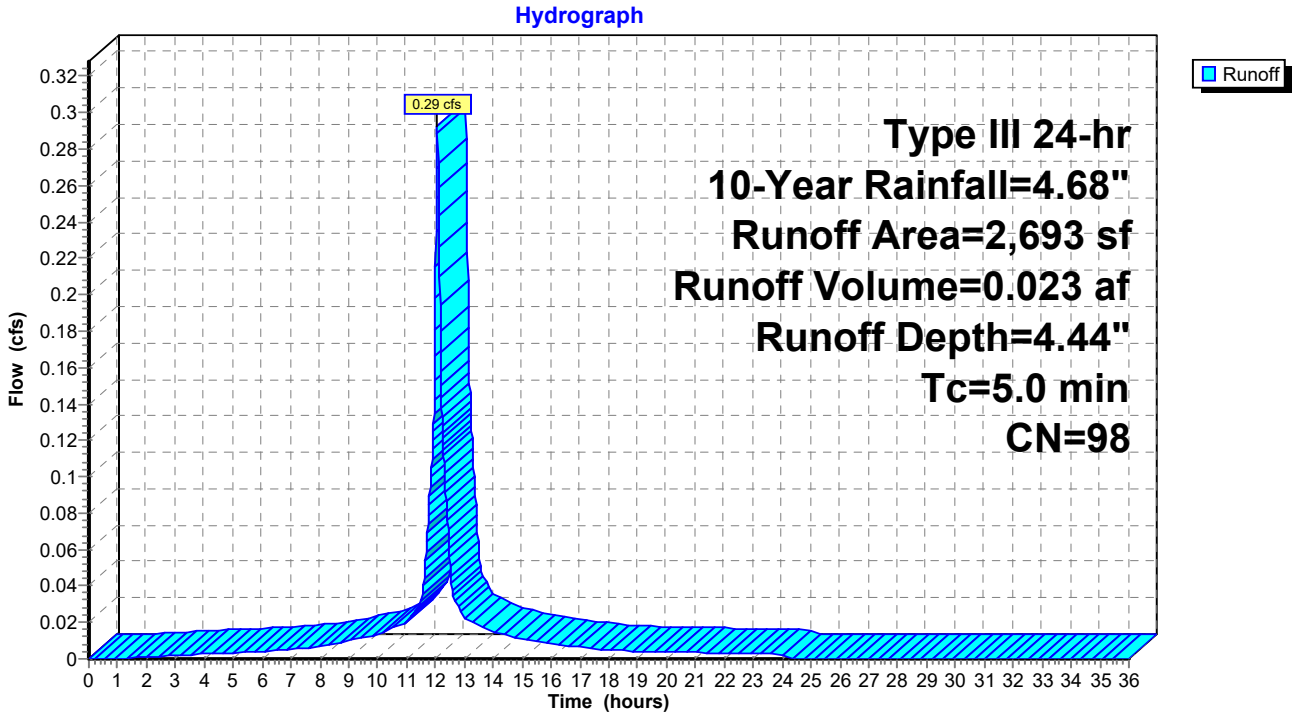
Runoff = 0.29 cfs @ 12.07 hrs, Volume= 0.023 af, Depth= 4.44"
Routed to Pond 2P : Permeable Pavement

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.68"

Area (sf)	CN	Description
2,693	98	Paved parking, HSG A
2,693		100.00% Impervious Area

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

Subcatchment 4A: (new Subcat)



Summary for Pond 1P: Permeable Pavement

Inflow Area = 0.589 ac, 91.24% Impervious, Inflow Depth = 3.88" for 10-Year event
Inflow = 2.63 cfs @ 12.07 hrs, Volume= 0.191 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link A : Patton Road Woods

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 292.88' @ 24.29 hrs Surf.Area= 43,000 sf Storage= 8,309 cf

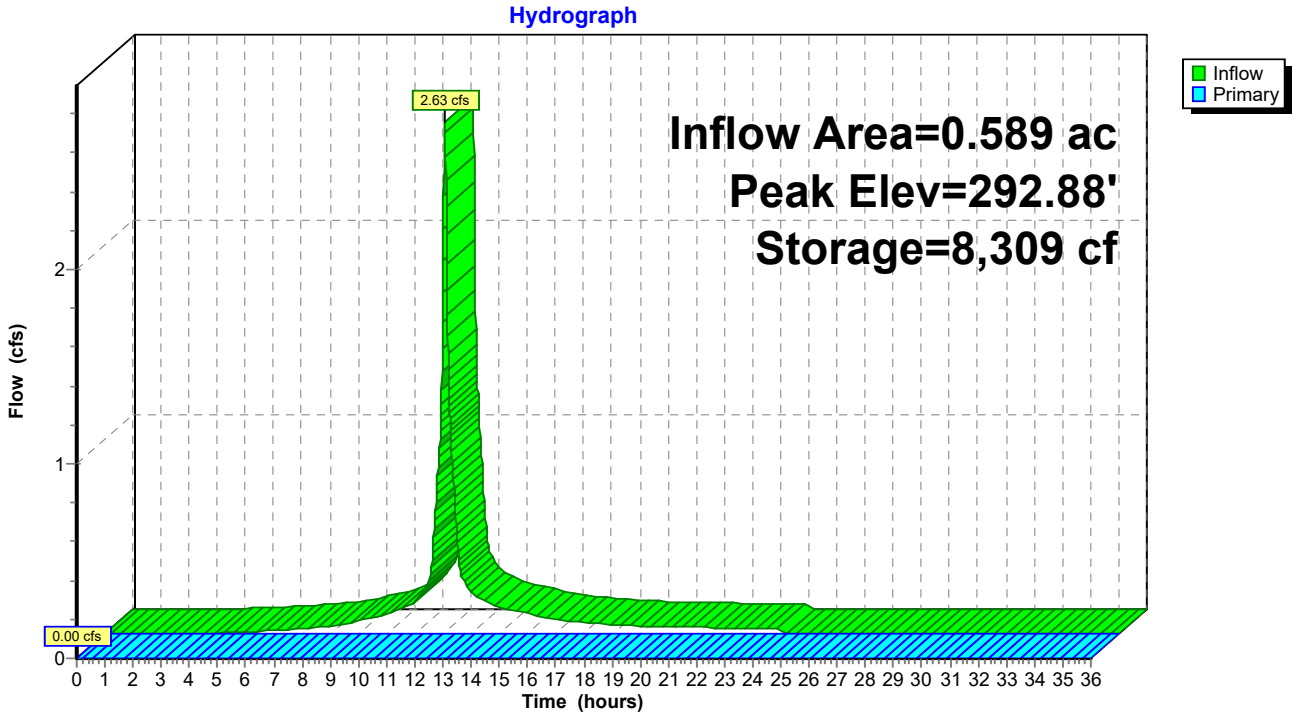
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	293.37'	355 cf	**100.00'W x 215.00'L x 0.33'H Permeable Paver - 5% Voids** 7,095 cf Overall x 5.0% Voids
#2	293.04'	2,128 cf	**100.00'W x 215.00'L x 0.33'H 30% Voids** 7,095 cf Overall x 30.0% Voids
#3	292.04'	8,600 cf	**100.00'W x 215.00'L x 1.00'H Open Graded - 40% Voids** 21,500 cf Overall x 40.0% Voids
#4	291.87'	1,097 cf	**100.00'W x 215.00'L x 0.17'H Double Washed Stone** 3,655 cf Overall x 30.0% Voids
		12,180 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	291.70'	**8.0" Round 8" pipe** L= 162.6' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 291.70' / 289.36' S= 0.0144 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf
#2	Device 1	293.69'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=291.87' (Free Discharge)
└**1=8" pipe** (Passes 0.00 cfs of 0.08 cfs potential flow)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: Permeable Pavement



Summary for Pond 2P: Permeable Pavement

Inflow Area = 0.062 ac,100.00% Impervious, Inflow Depth = 4.44" for 10-Year event
Inflow = 0.29 cfs @ 12.07 hrs, Volume= 0.023 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link A : Patton Road Woods

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 290.17' @ 24.29 hrs Surf.Area= 4,680 sf Storage= 997 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

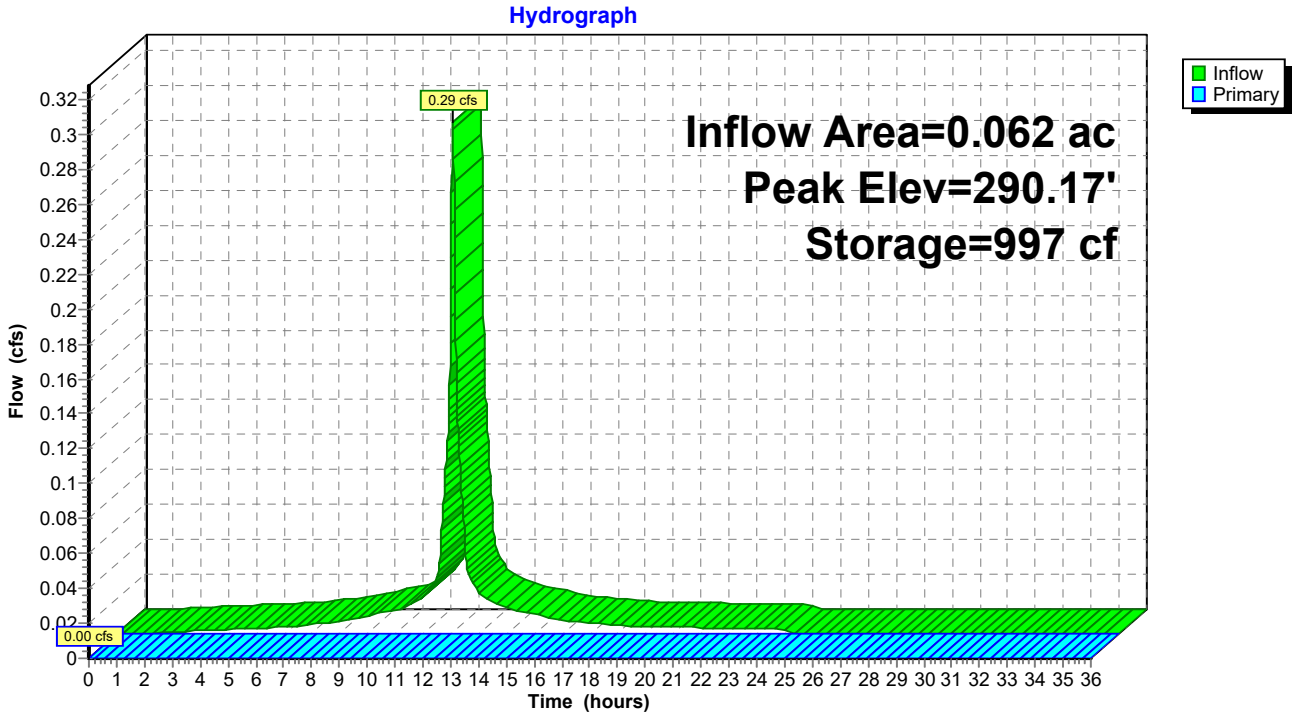
Volume	Invert	Avail.Storage	Storage Description
#1	290.56'	39 cf	**18.00'W x 130.00'L x 0.33'H Permeable Paver - 5% Voids** 772 cf Overall x 5.0% Voids
#2	290.23'	232 cf	**18.00'W x 130.00'L x 0.33'H 1/2" Stone - 30% Voids** 772 cf Overall x 30.0% Voids
#3	289.23'	936 cf	**18.00'W x 130.00'L x 1.00'H Open Graded - 40% Voids** 2,340 cf Overall x 40.0% Voids
#4	289.06'	119 cf	**18.00'W x 130.00'L x 0.17'H 3/8" Double Washed Stone** 398 cf Overall x 30.0% Voids
#5	290.89'	106 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		1,431 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
290.89	0	0	0
291.00	10	1	1
292.00	200	105	106

Device	Routing	Invert	Outlet Devices
#1	Primary	288.00'	**12.0" Round 12" RCP** L= 24.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 288.00' / 287.10' S= 0.0375 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	290.89'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=289.06' (Free Discharge)
↑—**1=12" RCP** (Passes 0.00 cfs of 2.83 cfs potential flow)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 2P: Permeable Pavement

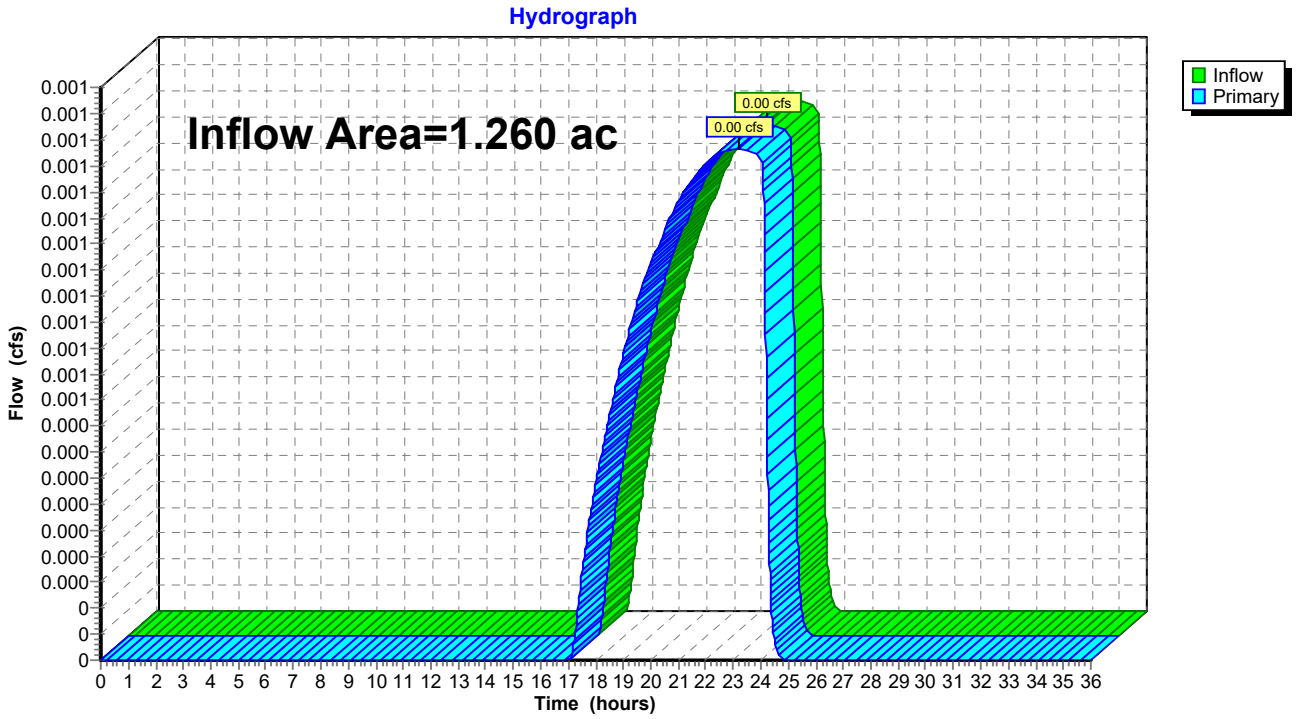


Summary for Link A: Patton Road Woods

Inflow Area = 1.260 ac, 47.57% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 23.18 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 23.18 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link A: Patton Road Woods

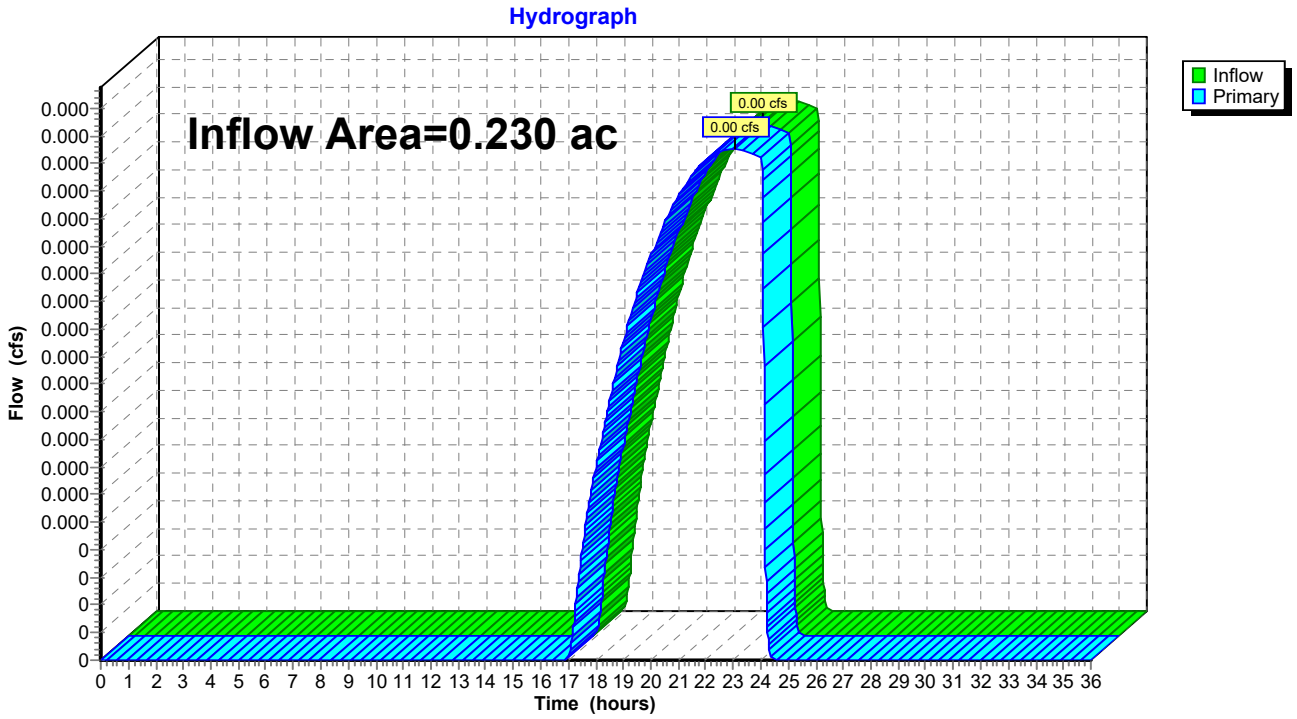


Summary for Link B: Mirror Lake

Inflow Area = 0.230 ac, 0.00% Impervious, Inflow Depth = 0.01" for 10-Year event
Inflow = 0.00 cfs @ 23.02 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 23.02 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link B: Mirror Lake



25-Year Storm Event – Proposed

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1A: (new Subcat) Runoff Area=15,381 sf 0.00% Impervious Runoff Depth=0.12"
Flow Length=380' Tc=13.9 min CN=32 Runoff=0.01 cfs 0.003 af

Subcatchment1B: Runoff Area=10,009 sf 0.00% Impervious Runoff Depth=0.12"
Flow Length=150' Tc=8.6 min CN=32 Runoff=0.00 cfs 0.002 af

Subcatchment2A: (new Subcat) Runoff Area=11,157 sf 0.00% Impervious Runoff Depth=0.12"
Flow Length=551' Tc=17.4 min CN=32 Runoff=0.00 cfs 0.002 af

Subcatchment3A: (new Subcat) Runoff Area=25,672 sf 91.24% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=93 Runoff=3.37 cfs 0.249 af

Subcatchment4A: (new Subcat) Runoff Area=2,693 sf 100.00% Impervious Runoff Depth=5.64"
Tc=5.0 min CN=98 Runoff=0.37 cfs 0.029 af

Pond 1P: Permeable Pavement Peak Elev=293.22' Storage=10,834 cf Inflow=3.37 cfs 0.249 af
Outflow=0.00 cfs 0.000 af

Pond 2P: Permeable Pavement Peak Elev=290.53' Storage=1,266 cf Inflow=0.37 cfs 0.029 af
Outflow=0.00 cfs 0.000 af

Link A: Patton Road Woods Inflow=0.01 cfs 0.006 af
Primary=0.01 cfs 0.006 af

Link B: Mirror Lake Inflow=0.00 cfs 0.002 af
Primary=0.00 cfs 0.002 af

Total Runoff Area = 1.490 ac Runoff Volume = 0.286 af Average Runoff Depth = 2.30"
59.77% Pervious = 0.891 ac 40.23% Impervious = 0.600 ac

Summary for Subcatchment 1A: (new Subcat)

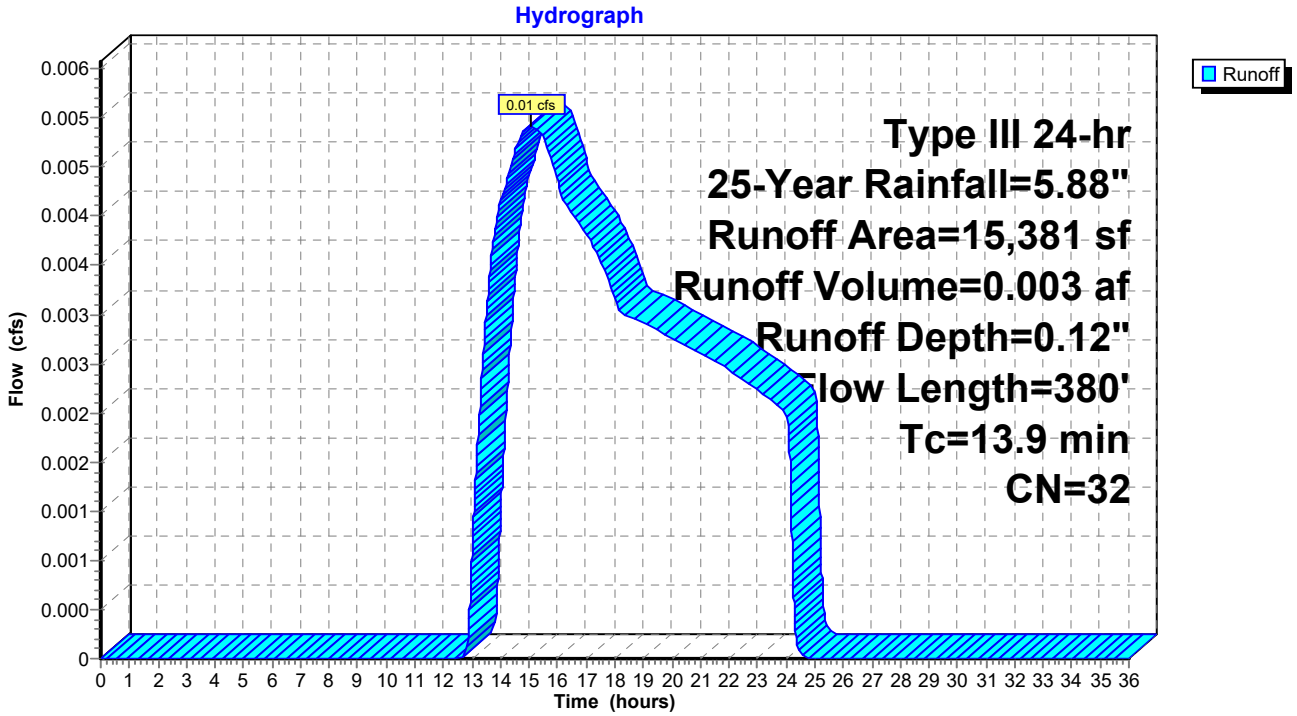
Runoff = 0.01 cfs @ 15.09 hrs, Volume= 0.003 af, Depth= 0.12"
Routed to Link A : Patton Road Woods

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.88"

Area (sf)	CN	Description
15,381	32	Woods/grass comb., Good, HSG A
15,381		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.0160	0.09		**Sheet Flow, First 50** Grass: Dense n= 0.240 P2= 3.13"
0.2	25	0.0800	1.98		**Shallow Concentrated Flow, Next 25 Ft** Short Grass Pasture Kv= 7.0 fps
4.6	305	0.0250	1.11		**Shallow Concentrated Flow, Next 300 ft** Short Grass Pasture Kv= 7.0 fps
13.9	380	Total			

Subcatchment 1A: (new Subcat)



Summary for Subcatchment 1B:

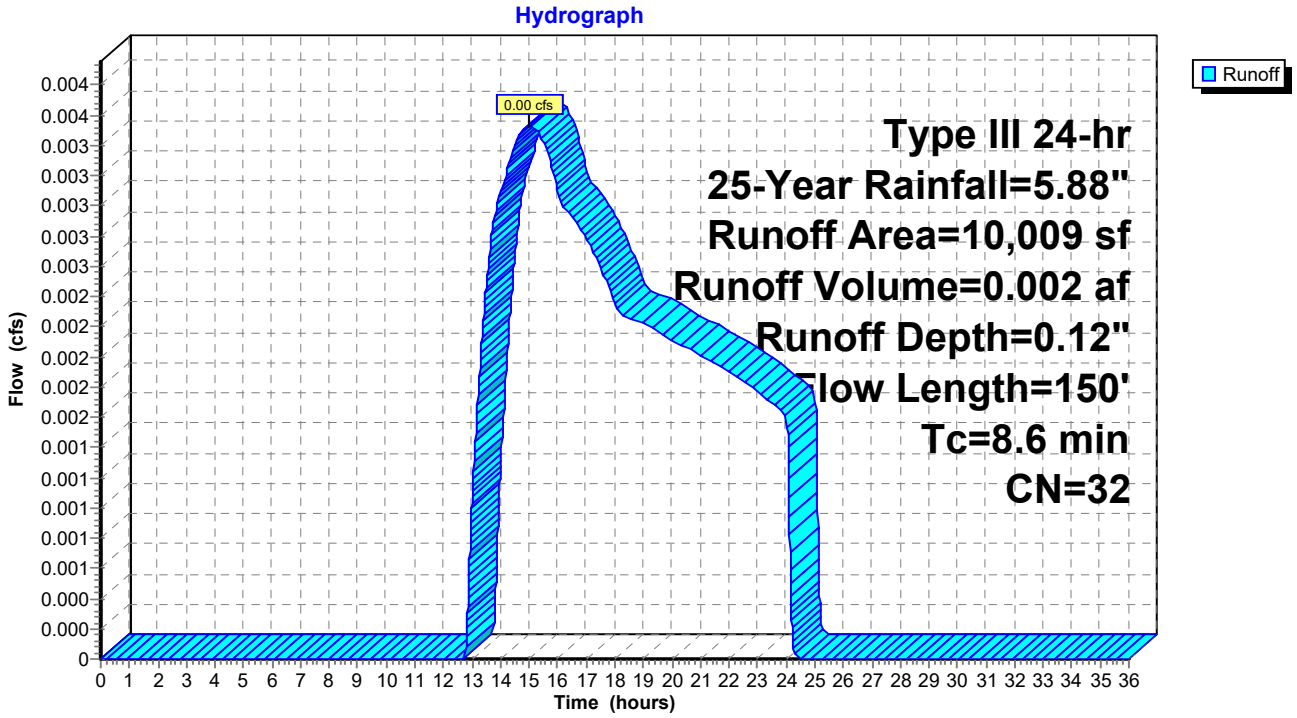
Runoff = 0.00 cfs @ 15.01 hrs, Volume= 0.002 af, Depth= 0.12"
Routed to Link B : Mirror Lake

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.88"

Area (sf)	CN	Description
10,009	32	Woods/grass comb., Good, HSG A
10,009		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.0960	0.13		**Sheet Flow, First 50 Ft** Woods: Light underbrush n= 0.400 P2= 3.13"
1.9	100	0.0320	0.89		**Shallow Concentrated Flow, Next 100 Ft** Woodland Kv= 5.0 fps
8.6	150	Total			

Subcatchment 1B:



Summary for Subcatchment 2A: (new Subcat)

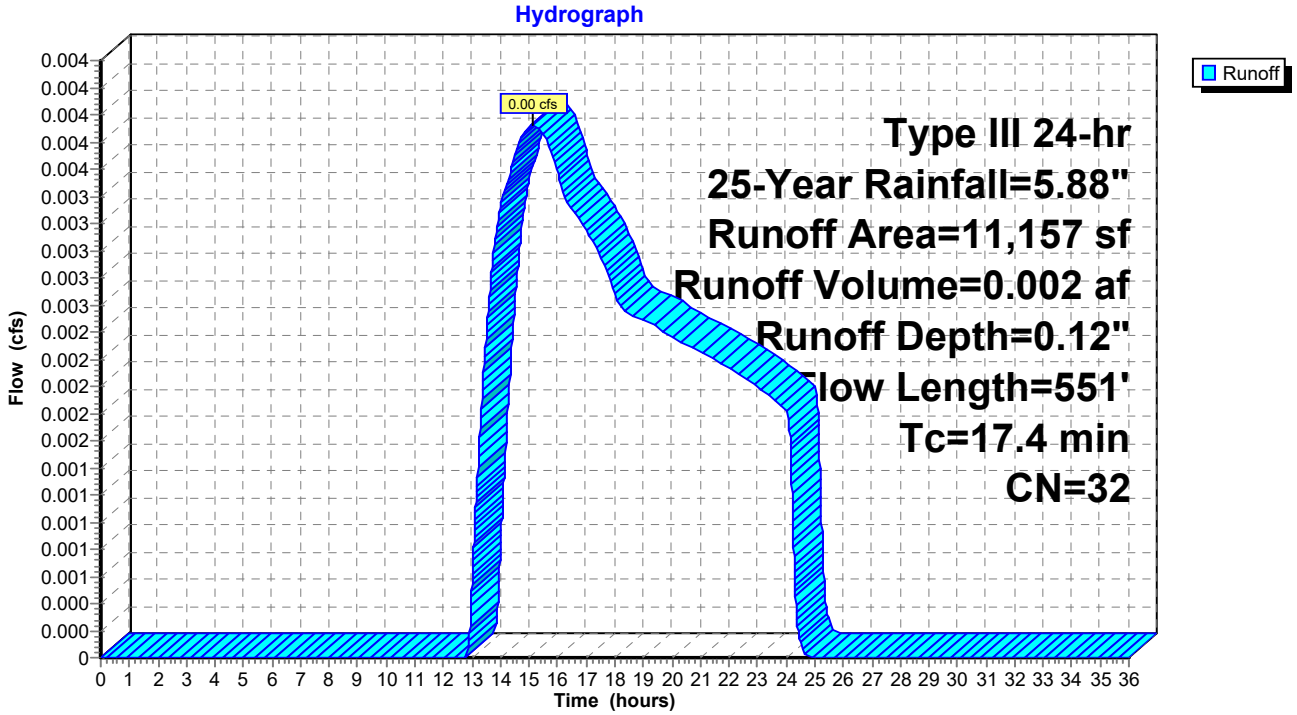
Runoff = 0.00 cfs @ 15.14 hrs, Volume= 0.002 af, Depth= 0.12"
Routed to Link A : Patton Road Woods

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.88"

Area (sf)	CN	Description
11,157	32	Woods/grass comb., Good, HSG A
11,157		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0060	0.09		**Sheet Flow, First 50 ft** Grass: Short n= 0.150 P2= 3.13"
4.3	132	0.0053	0.51		**Shallow Concentrated Flow, Next 130 ft** Short Grass Pasture Kv= 7.0 fps
2.8	230	0.0047	1.39		**Shallow Concentrated Flow, Next 230 ft** Paved Kv= 20.3 fps
1.1	139	0.0210	2.17		**Shallow Concentrated Flow, Next 140 ft** Grassed Waterway Kv= 15.0 fps
17.4	551	Total			

Subcatchment 2A: (new Subcat)



Summary for Subcatchment 3A: (new Subcat)

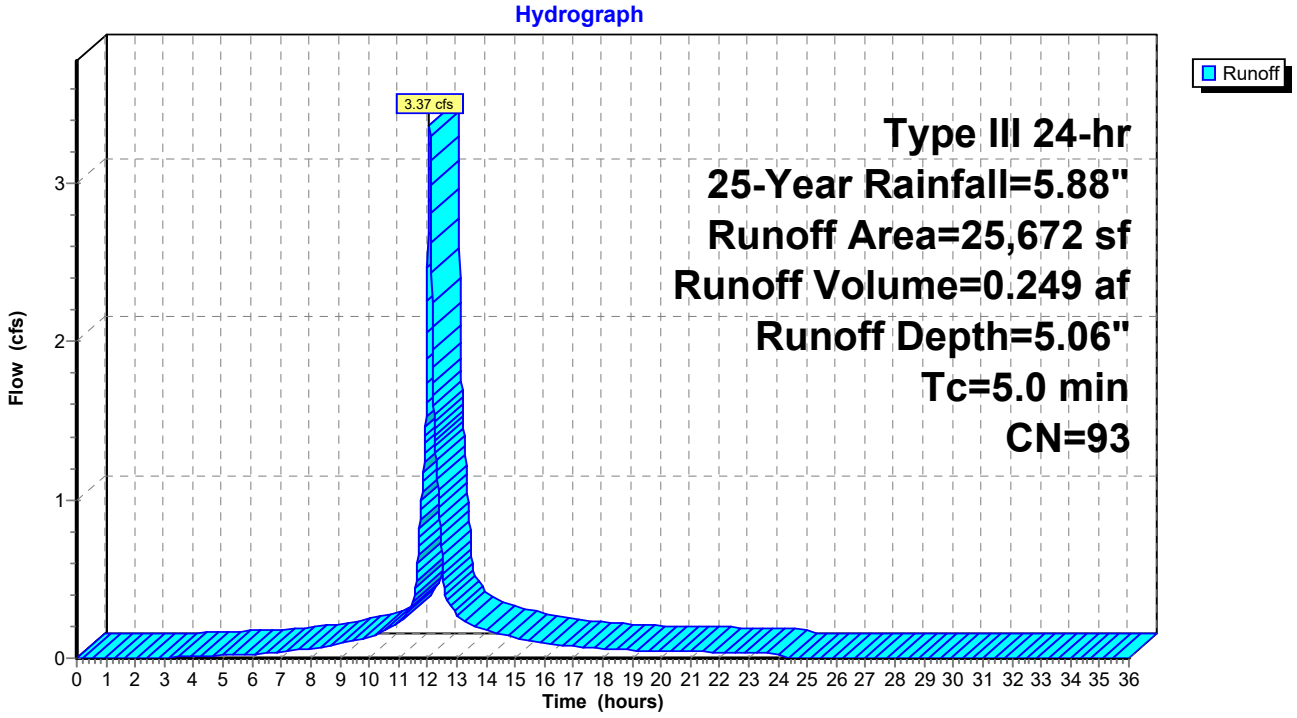
Runoff = 3.37 cfs @ 12.07 hrs, Volume= 0.249 af, Depth= 5.06"
Routed to Pond 1P : Permeable Pavement

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.88"

Area (sf)	CN	Description
23,423	98	Paved parking, HSG A
2,249	39	>75% Grass cover, Good, HSG A
25,672	93	Weighted Average
2,249		8.76% Pervious Area
23,423		91.24% Impervious Area

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

Subcatchment 3A: (new Subcat)



Summary for Subcatchment 4A: (new Subcat)

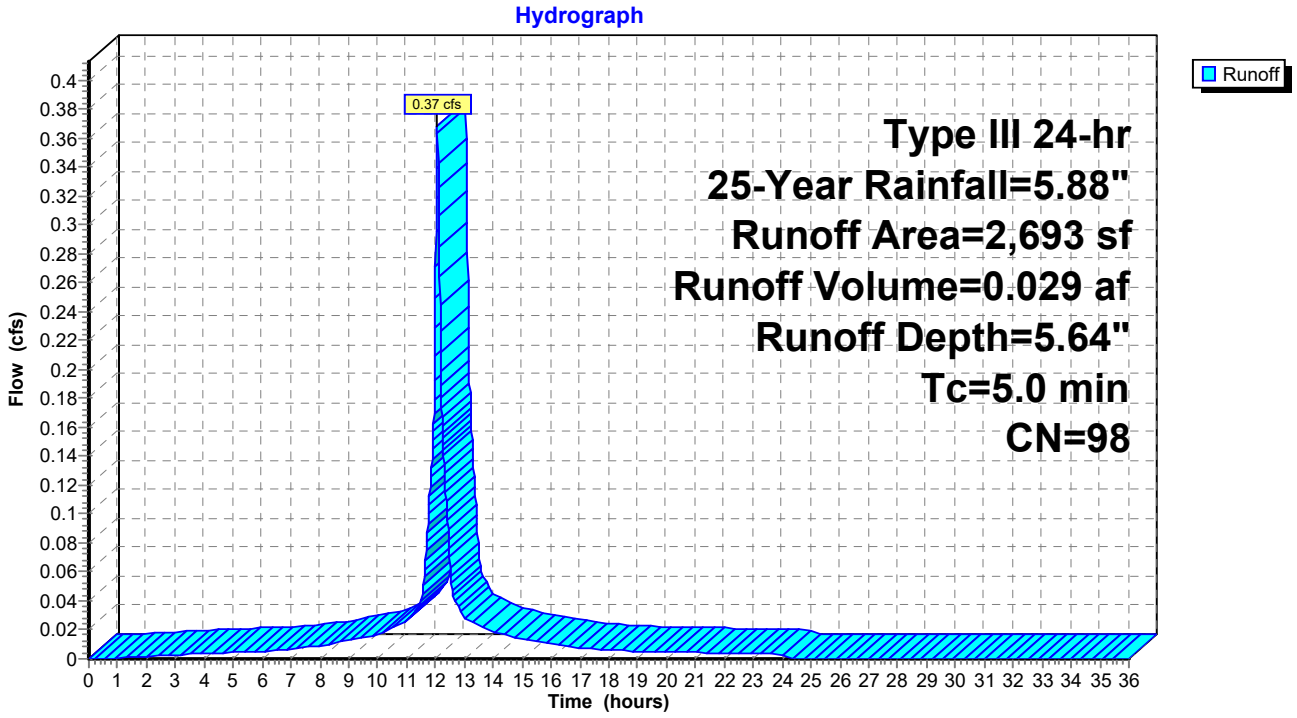
Runoff = 0.37 cfs @ 12.07 hrs, Volume= 0.029 af, Depth= 5.64"
Routed to Pond 2P : Permeable Pavement

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.88"

Area (sf)	CN	Description
2,693	98	Paved parking, HSG A
2,693		100.00% Impervious Area

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

Subcatchment 4A: (new Subcat)



Summary for Pond 1P: Permeable Pavement

Inflow Area = 0.589 ac, 91.24% Impervious, Inflow Depth = 5.06" for 25-Year event
Inflow = 3.37 cfs @ 12.07 hrs, Volume= 0.249 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link A : Patton Road Woods

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 293.22' @ 24.29 hrs Surf.Area= 64,500 sf Storage= 10,834 cf

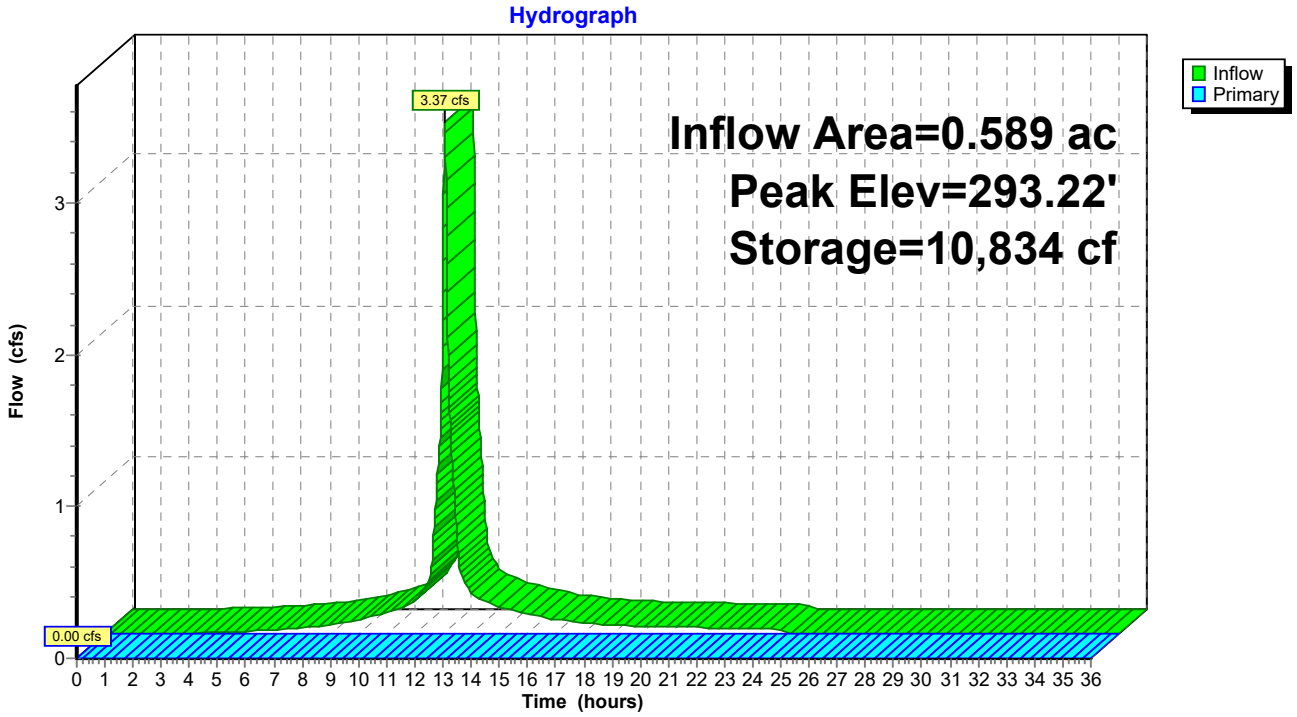
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	293.37'	355 cf	**100.00'W x 215.00'L x 0.33'H Permeable Paver - 5% Voids** 7,095 cf Overall x 5.0% Voids
#2	293.04'	2,128 cf	**100.00'W x 215.00'L x 0.33'H 30% Voids** 7,095 cf Overall x 30.0% Voids
#3	292.04'	8,600 cf	**100.00'W x 215.00'L x 1.00'H Open Graded - 40% Voids** 21,500 cf Overall x 40.0% Voids
#4	291.87'	1,097 cf	**100.00'W x 215.00'L x 0.17'H Double Washed Stone** 3,655 cf Overall x 30.0% Voids
		12,180 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	291.70'	**8.0" Round 8" pipe** L= 162.6' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 291.70' / 289.36' S= 0.0144 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf
#2	Device 1	293.69'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=291.87' (Free Discharge)
└**1=8" pipe** (Passes 0.00 cfs of 0.08 cfs potential flow)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: Permeable Pavement



Summary for Pond 2P: Permeable Pavement

Inflow Area = 0.062 ac,100.00% Impervious, Inflow Depth = 5.64" for 25-Year event
Inflow = 0.37 cfs @ 12.07 hrs, Volume= 0.029 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link A : Patton Road Woods

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 290.53' @ 24.29 hrs Surf.Area= 7,020 sf Storage= 1,266 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

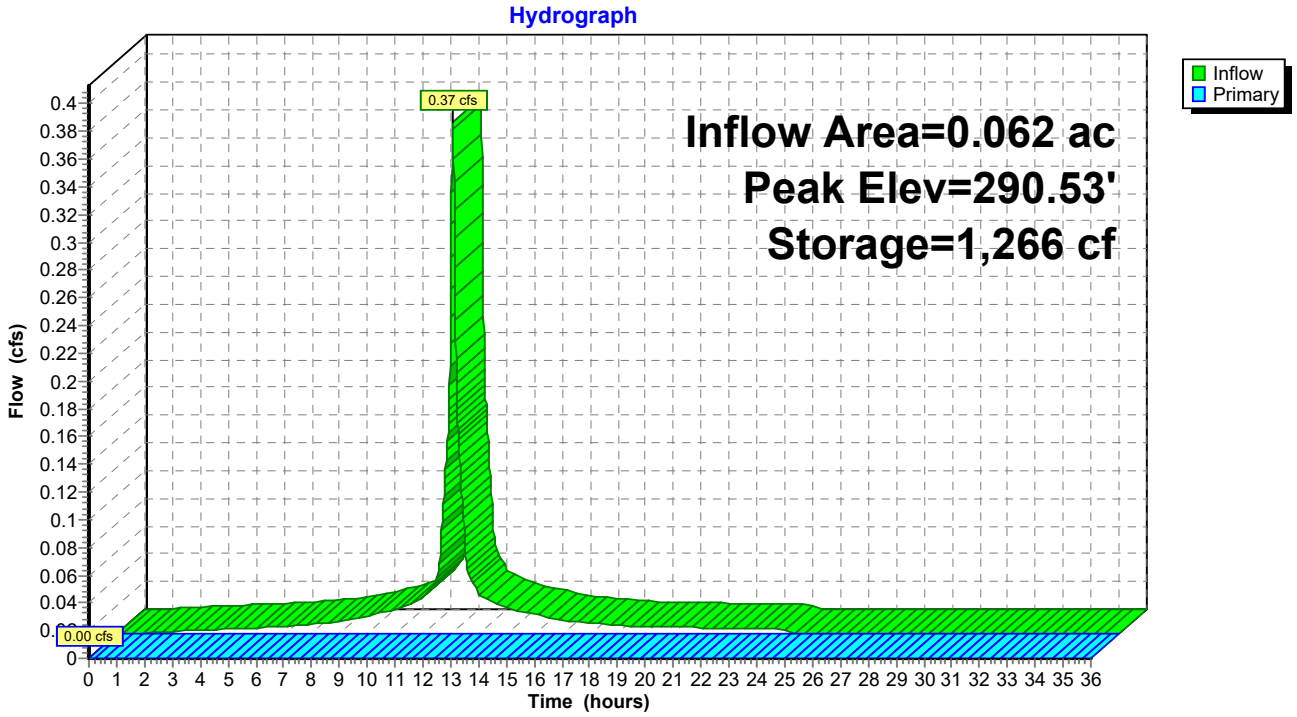
Volume	Invert	Avail.Storage	Storage Description
#1	290.56'	39 cf	**18.00'W x 130.00'L x 0.33'H Permeable Paver - 5% Voids** 772 cf Overall x 5.0% Voids
#2	290.23'	232 cf	**18.00'W x 130.00'L x 0.33'H 1/2" Stone - 30% Voids** 772 cf Overall x 30.0% Voids
#3	289.23'	936 cf	**18.00'W x 130.00'L x 1.00'H Open Graded - 40% Voids** 2,340 cf Overall x 40.0% Voids
#4	289.06'	119 cf	**18.00'W x 130.00'L x 0.17'H 3/8" Double Washed Stone** 398 cf Overall x 30.0% Voids
#5	290.89'	106 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		1,431 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
290.89	0	0	0
291.00	10	1	1
292.00	200	105	106

Device	Routing	Invert	Outlet Devices
#1	Primary	288.00'	**12.0" Round 12" RCP** L= 24.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 288.00' / 287.10' S= 0.0375 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	290.89'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=289.06' (Free Discharge)
↑—**1=12" RCP** (Passes 0.00 cfs of 2.83 cfs potential flow)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 2P: Permeable Pavement

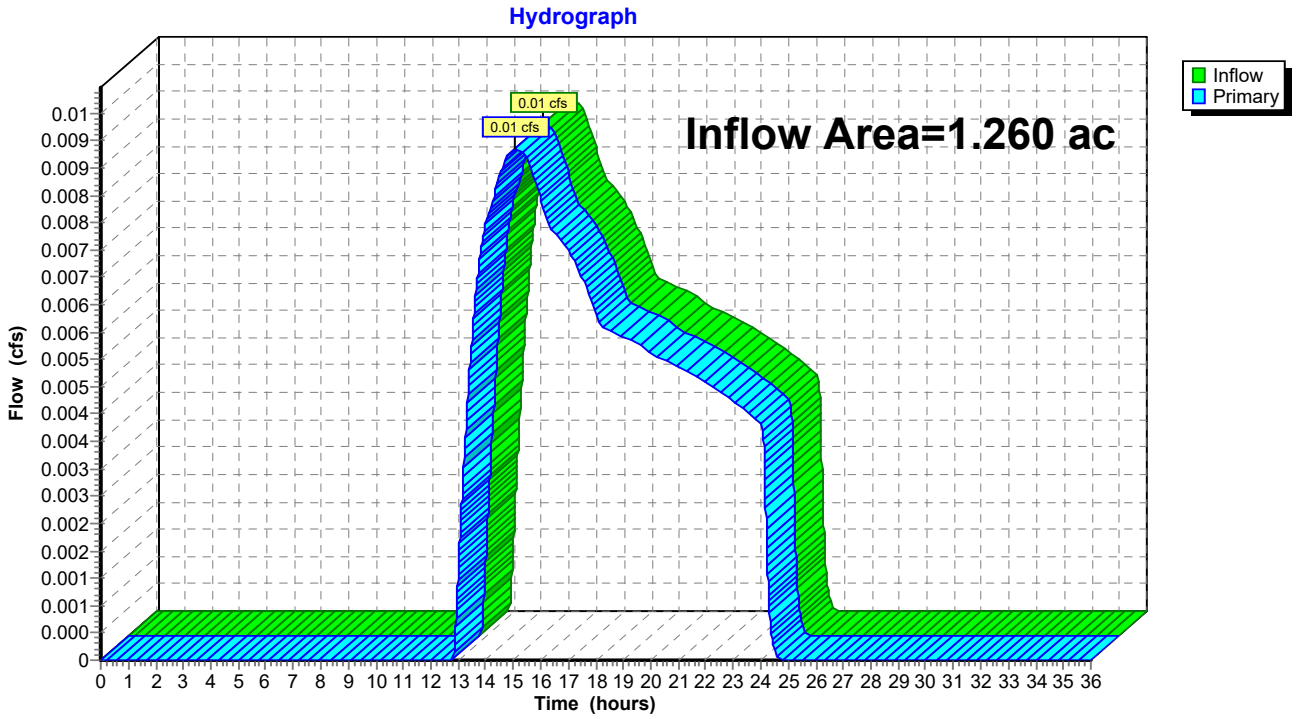


Summary for Link A: Patton Road Woods

Inflow Area = 1.260 ac, 47.57% Impervious, Inflow Depth = 0.06" for 25-Year event
Inflow = 0.01 cfs @ 15.06 hrs, Volume= 0.006 af
Primary = 0.01 cfs @ 15.06 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link A: Patton Road Woods

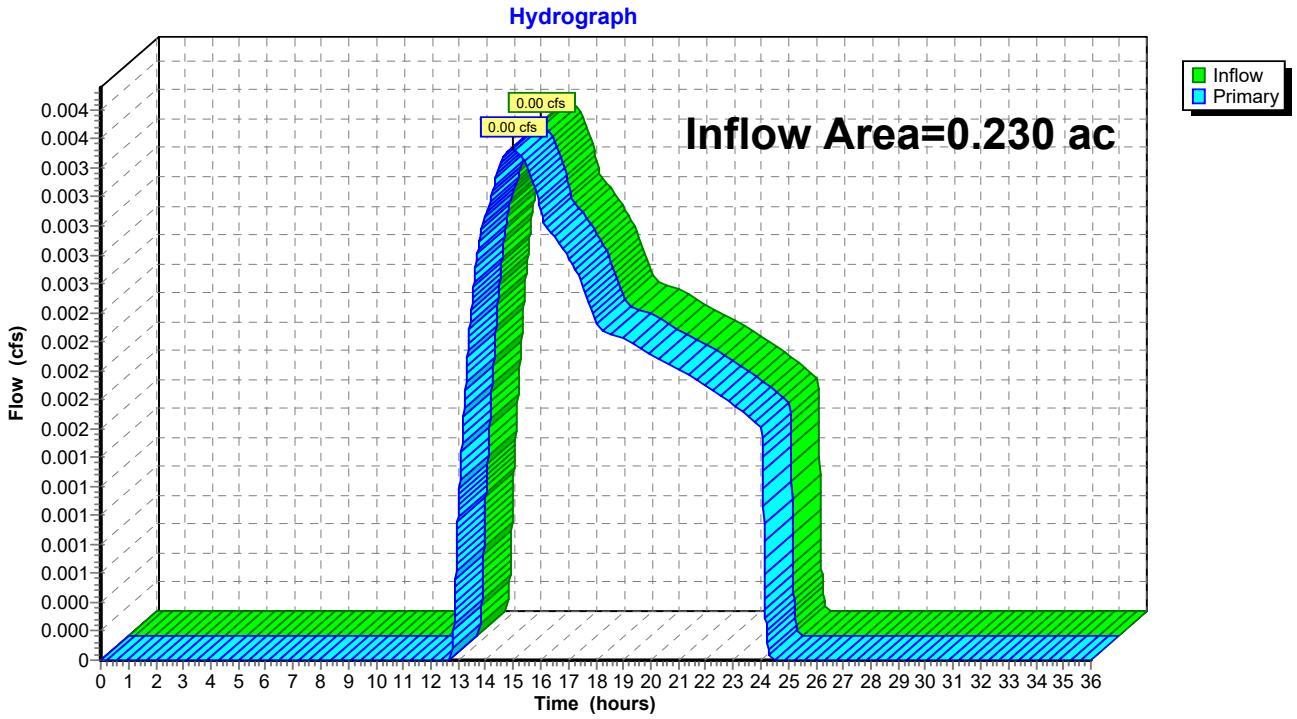


Summary for Link B: Mirror Lake

Inflow Area = 0.230 ac, 0.00% Impervious, Inflow Depth = 0.12" for 25-Year event
Inflow = 0.00 cfs @ 15.01 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 15.01 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link B: Mirror Lake



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Appendix B: Standard 3 Computations and Supporting Documentation

- Soil Evaluation in accordance with Volume 3, Chapter 1 of the Handbook
- Recharge Volume Calculations
- 72-hour drawdown analysis

Soil Evaluation and Analysis

July 18, 2025

ICON Architecture
141 Tremont Street, 7th Floor
Boston, MA 02111

Attention: Kendra Halliwell AIA, LEED AP

Reference: Mirror Lake Improvements; Devens, Massachusetts
Geotechnical Data Letter

This letter presents the results of a subsurface exploration program completed by McPhail Associates LLC (McPhail) and our evaluation of the infiltration rates of the subsurface soils associated with the proposed parking expansion phase (subject site) of the master plan improvements planned for the Mirror Lake Recreation Area located in Devens, Massachusetts. Refer to the Project Location Plan, **Figure 1**, for the general site locus.

The subsurface exploration program was conducted and geotechnical engineering services were performed in accordance with our proposal dated May 1, 2025 and the subsequent authorization of ICON Architecture. These services are subject to the limitations contained in **Appendix A**.

Background

The subject site is a portion of an approximately 147-acre property and is located south of Patton Road in Devens, Massachusetts. The property is generally bound by the Devens Federal Medical Center to the west, Sheridan Road to the south, and Salerno Circle and the Red Tail Golf Club to the east. Two bodies of water are present at the property: Mirror Lake and Little Mirror Lake. A north-south access road identified as Mirror Lake Road provides access from Patton Road to Mirror Lake Beach on the western perimeter of Mirror Lake with an existing parking lot present at the corner of Patton Road and Mirror Lake Road. An additional, unnamed access road bisects the parcel between Mirror Lake and Little Mirror Lake, connecting Patton Road and Sheridan Road. Outside of the parking area, roadways, and beach (which includes a single-story bathhouse) the property is generally undeveloped and wooded.

It is understood that the proposed master plan improvements for the subject site include an expansion of the existing parking area, the construction of a porous paved drop-off area, renovation (or potential replacement) of the bathhouse, the construction of an event pavilion, and numerous landscape and amenity improvements. Our scope of work associated with this letter is limited to the expansion of the existing parking area south of the existing parking area.

As part of the project development, the project Civil Engineer (VHB) requested McPhail to perform a subsurface exploration program to assess the site soils with regards to the design of pervious pavement associated with the proposed parking expansion. Explorations were performed at locations selected by VHB. The approximate location of the subsurface explorations is indicated on the attached **Figure 2,** Subsurface Exploration Plan.

Subsurface Explorations

The subsurface exploration program performed under contract to McPhail included four (4) borings (B-1 through B-4) performed by GeoSearch Inc. during the period of June 24 through 25, 2025. The approximate location of the subsurface explorations is indicated on the attached **Figure 2**. The locations of the explorations, and the ground surface elevation of the boring locations were determined via a GPS survey performed by McPhail.

The borings were performed using a truck-mounted drill-rig and advanced utilizing hollow-stem augers. Standard 2-inch O.D. split-spoon samples and standard penetration test results were generally obtained continuously within the upper ten to twelve feet of each boring, and then at five-foot intervals thereafter. The split-spoon sampling was performed in general accordance with the standard procedures described in ASTM D1586.

Subsurface Conditions

A detailed description of the subsurface conditions encountered in the explorations are documented on the attached boring logs. The generalized subsurface conditions across the sites were inferred primarily from the recent exploration programs, but also from our knowledge of the area geology.

Ground surface across the area of proposed parking expansion generally consists of grass areas and wooded areas. Gound surface at each of the borings was underlain by a 0.5 to 1-foot thickness of topsoil consisting of loose to very loose, dark brown, silty sand with trace gravel and organic material.

Within boring B-1, a 1.5-foot thickness of granular fill was encountered underlying the topsoil. This fill material was observed to consist of a compact, brown, sand with some silt and gravel. Further, a 0.5 to 1-foot thickness of subsoil was encountered below the topsoil in borings B-2 and B-3. The subsoil was observed to consist of a loose, brown to orange, sand with some gravel and trace silt.

Underlying the topsoil and fill or subsoil (where encountered) the borings encountered a compact to dense natural glacial outwash deposit at depths between 1 and 2 feet below existing ground surface. The results of grain size analyses performed on samples of the glacial outwash can be viewed in **Figure 3** and **Figure 4**. The results of this testing indicate the glacial outwash consists of a sand and gravel with trace to some silt to a gravelly sand with some silt. The borings were terminated within the glacial outwash deposit at a depth of approximately 32 feet below existing ground surface.

Groundwater was not encountered within the borings performed at the site which were advanced to depths of approximately 32 feet below existing ground surface. It is anticipated that future groundwater levels across the site may vary from those reported herein due to factors such as normal seasonal changes, runoff particularly during or following periods of

heavy precipitation, and alterations of existing drainage patterns. Further, it is noted that groundwater may become seasonally perched on the surface of the underlying bedrock.

Rawls Infiltration Rates

Based on the laboratory grain-size distributions of soil samples obtained from the explorations, the soil texture class was determined using the USDA textural triangle. The soil texture class was then used to determine the Rawls Infiltration Rates. It is understood that the Rawls Infiltration Rates are based on research performed by Rawls, Brakensiek, and Sexton in 1982 which used laboratory permeability testing to develop a relationship between texture class and saturated permeability.

As outlined above, samples of the glacial outwash that were collected from the completed explorations were selected for grain size distribution testing based upon the grading of the proposed areas of parking expansion. It is noted that the sieves indicated relatively low fines content (i.e. approximately 10% or less passing the number 200 sieve) of the tested soil, and that clay was not noted during the field and laboratory classification of the samples. As such, the performance of hydrometers on the tested samples was deemed unnecessary, and the Rawl's Rate assessment was performed utilizing a conservative assumption pertaining to the silt and clay fractions of the overall fines content.

The table below presents information regarding the soil texture class and corresponding Rawls Infiltration Rates.

Rawls Infiltration Rates					
Material	Exploration	Sample	Depth	Texture Class (NRCS HSG)	Infiltration Rate (in./hr.)
Glacial Outwash	B-1	S-2	2′ – 4′	Loamy Sand (A)	2.41
	B-1	S-3	4′ – 6′	Sand (A)	8.27
	B-2	S-2	2′ – 4′	Loamy Sand (A)	2.41
	B-2	S-3	4′ – 6′	Sand (A)	8.27
	B-3	S-2	2′ – 4′	Loamy Sand (A)	2.41
	B-4	S-2	2′ – 4′	Loamy Sand (A)	2.41
	B-4	S-3	4′ – 6′	Loamy Sand (A)	2.41

Based upon the above, it is recommended that the pervious pavement associated with the parking expansion be designed to infiltrate into the natural glacial outwash deposit utilizing a design Rawls Infiltration Rate of 2.41 inches per hour.

It is noted that portions of the proposed parking expansion are planned to involve filling above the existing ground surface to reach the proposed grading. In these areas, it is noted

that the existing topsoil, subsoil, and/or fill soils be removed prior to site filling for the above infiltration rate design parameters to be applicable.

Closing

We trust that the above is sufficient for your present requirements. Should you have any questions concerning the above, please do not hesitate to call us.

Sincerely,

McPHAIL ASSOCIATES, LLC

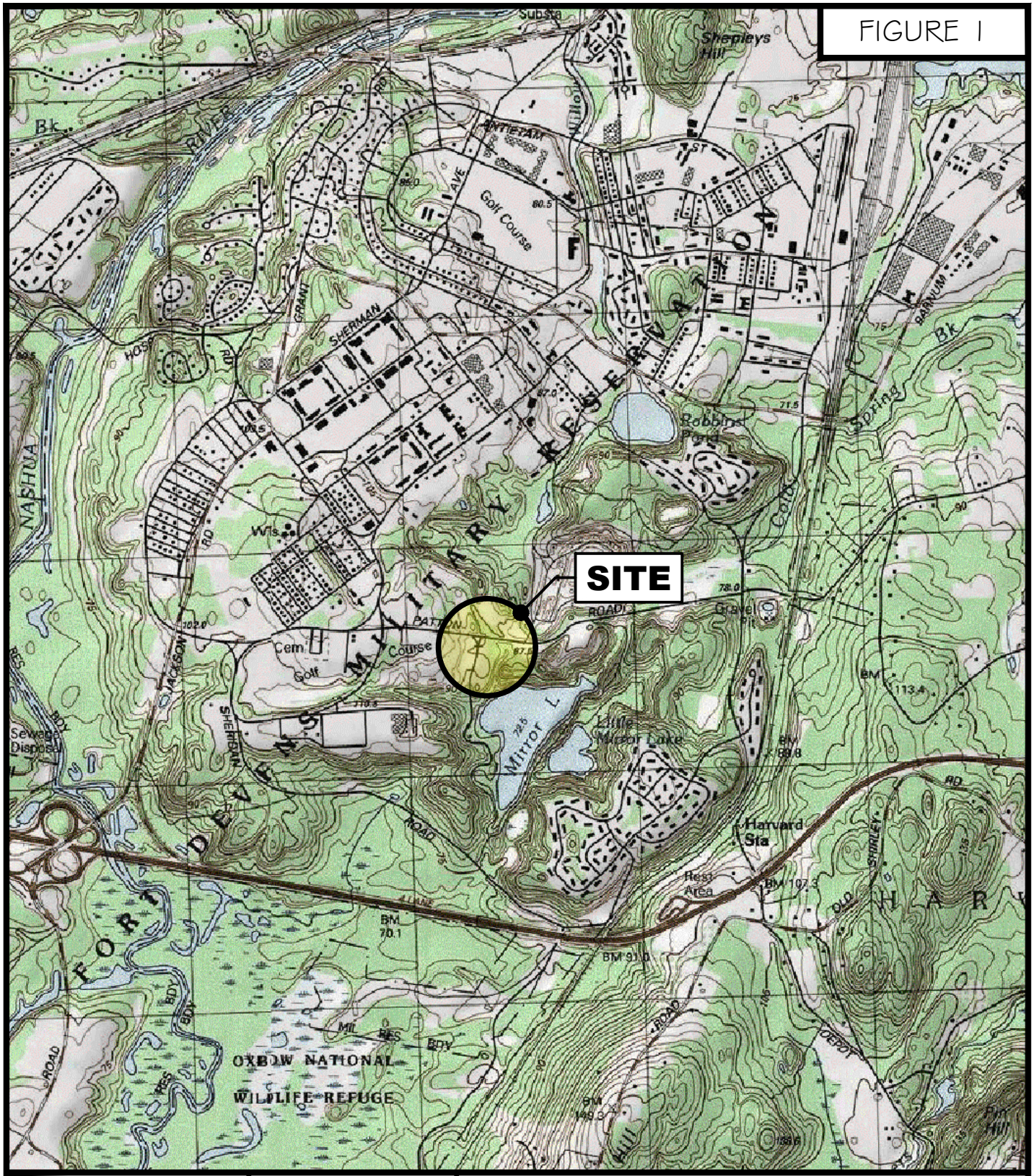
John A. Erikson, P.E.

Peter J. DeChaves, L.S.P.

\\McPhail-fs4\McPhail\Working Documents\Reports\8072_Mirror Lake - Devens_Geotechnical Data Letter_071825.docx

JAE/pjd

FIGURE 1



McPHAIL ASSOCIATES, LLC
42 3rd Avenue
Burlington, MA 01803
617-868-1420
www.mcphailgeo.com

N

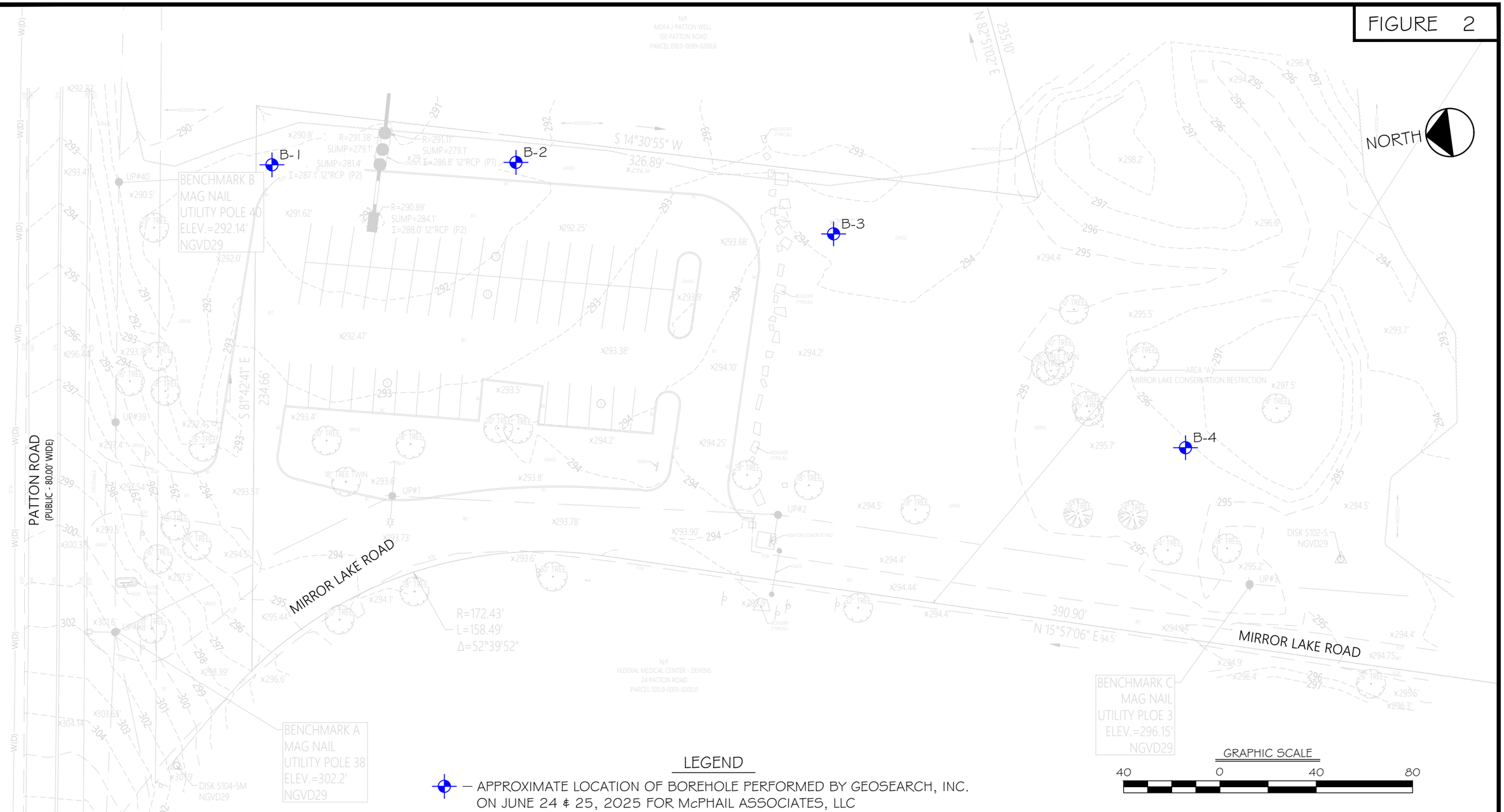
SCALE 1:25,000

PROJECT LOCATION PLAN

MIRROR LAKE IMPROVEMENTS

DEVENS MASSACHUSETTS

FIGURE 2



LEGEND

— APPROXIMATE LOCATION OF BOREHOLE PERFORMED BY GEOSEARCH, INC. ON JUNE 24 & 25, 2025 FOR McPHAIL ASSOCIATES, LLC

REFERENCE: THIS PLAN WAS PREPARED FROM A 20-SCALE DRAWING ENTITLED "EXISTING CONDITIONS PLAN OF LAND" DATED APRIL 18, 2025 BY VANASSE HANGEN BRUSTLIN, INC.

GRAPHIC SCALE

40 0 40 80

McPHAIL ASSOCIATES, LLC
42 3rd Avenue
Burlington, MA 01803
617-868-1420
www.mcphailgeo.com

MIRROR LAKE IMPROVEMENTS

DEVENS MASSACHUSETTS

SUBSURFACE EXPLORATION PLAN

FOR

ICON ARCHITECTURE

BY

McPHAIL ASSOCIATES, LLC

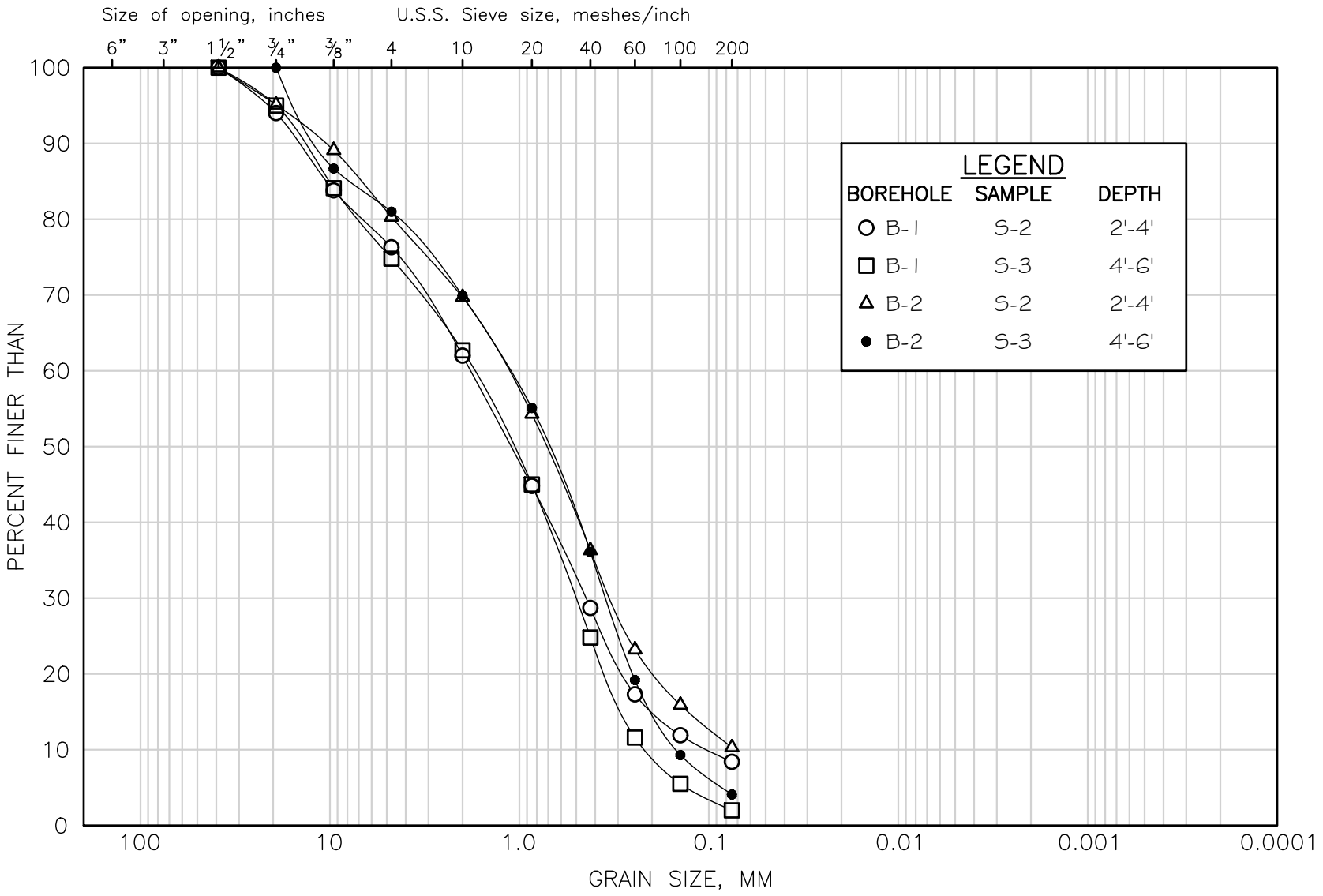
Date: JULY 2025	Dwn: I.J.M.	Chkd: J.A.E.	Scale: 1" = 40'
Project No: 8072			

FILE NAME: N:\Acad\JOBS\8072\8072-F02.dwg

FILE NAME: N:\Acad\JOBS\8072\8072-F03_Sieve.dwg

PROJECT No. 8072

M.I.T. GRAIN SIZE SCALE



McPHAIL ASSOCIATES, LLC

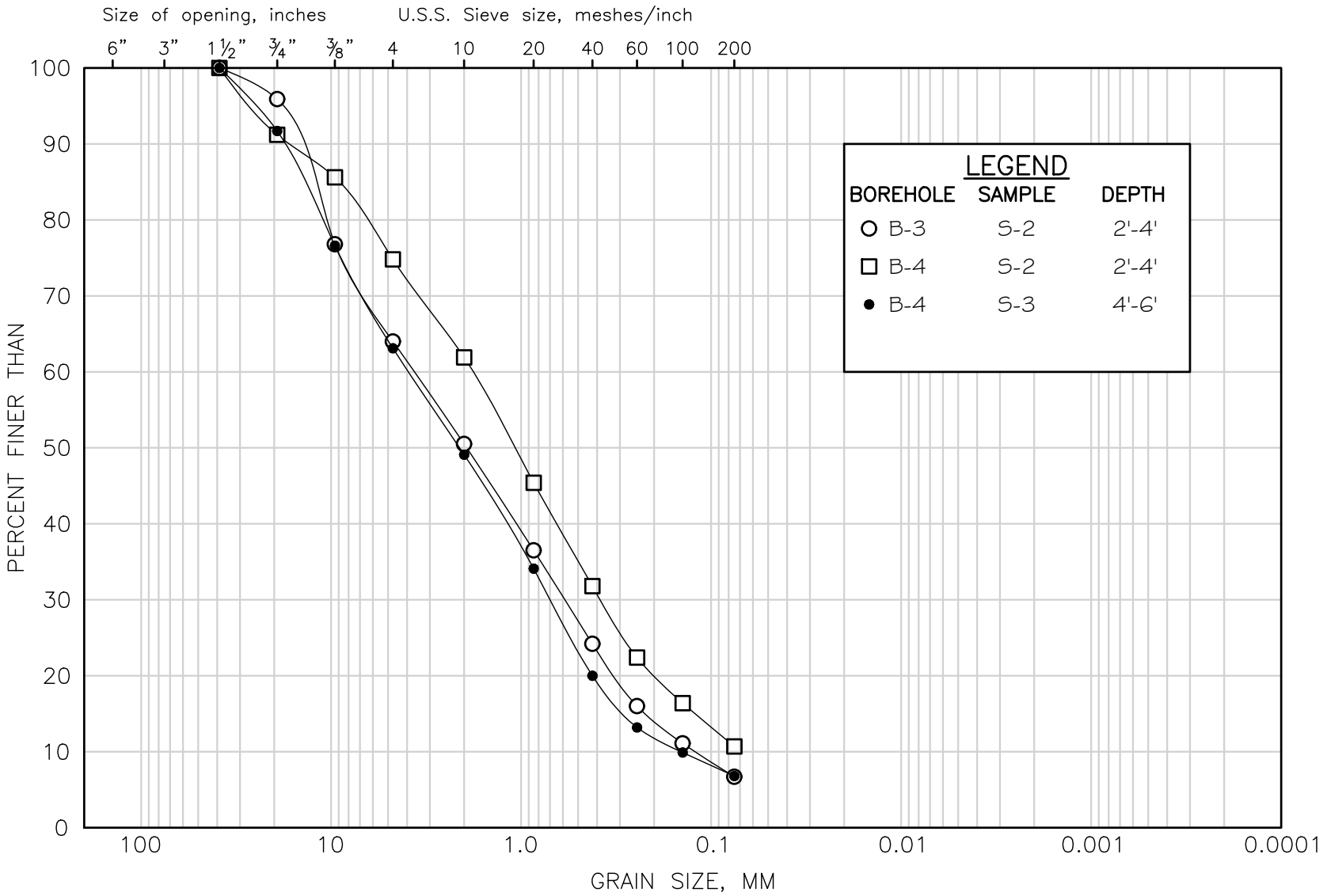
GRAIN SIZE DISTRIBUTION
GLACIAL OUTWASH

FIGURE 3

FILE NAME: N:\Acad\JOBS\8072\8072-F04_Sieve.dwg

PROJECT No. 8072

M.I.T. GRAIN SIZE SCALE



McPHAIL ASSOCIATES, LLC

GRAIN SIZE DISTRIBUTION
GLACIAL OUTWASH

FIGURE 4

APPENDIX A:

LIMITATIONS

LIMITATIONS

This report has been prepared in accordance with generally accepted soil and geotechnical engineering practices. No other warranty, expressed or implied, is made. If any changes in nature or design of the proposed construction are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and the conclusions of this report modified or verified in writing by McPhail.

The analyses and recommendations presented in this report are based upon the data obtained from the subsurface explorations performed at the approximate locations indicated on the enclosed plan. If variations in the nature and extent of subsurface conditions between the widely spaced explorations become evident during construction, it will be necessary for a re-evaluation of the recommendations of this report to be made after performing on-site observations during the construction period and noting the characteristics of any variations.

APPENDIX B:

BORING LOGS PREPARED BY MCPHAIL ASSOCIATES, LLC

Project:	Mirror Lake	**Job #:**	8072.2.00
Location:	Mirror Lake Rd	**Date Started:**	06-24-2025
City/State:	Devens, MA	**Date Finished:**	06-24-2025

Boring No. B-1

Contractor:	Geosearch Drilling, Inc.	**Casing Type:**	HSA
Driller/Helper:	Brian/Luis	**Casing Hammer/Drop:**	300lbs/24in
Logged By/Reviewed By:	K. O'Callaghan	**Sampler Size/Type:**	3/8" ID Split Spoon
Surface Elevation (ft):	291.8 ft	**Sampler Hammer/Drop:**	140lbs/30in

Groundwater Observations

Groundwater Not Encountered.

Depth (ft)	Elev. (ft)	Symbol	Stratum	N-Value / RQD	Sample No.	Pen/Rec (in)	Depth (ft)	Blows/6" / Min/ft	Sample Description and Boring Notes
	291.8		Ground surface at EL 291.8 ft						
0			TOPSOIL 0.5 ft	2	S-1a	6/3	0 - 0.5	1	Loose, dark brown, silty SAND, trace gravel, with organic material. (TOPSOIL)
1	291		FILL EL 291.3 ft	9	S-1b	18/10	0.5 - 2	5 4 7	Compact, brown, SAND, some gravel, trace silt. (FILL)
2	290		2 ft EL 289.8 ft GLACIAL OUTWASH	25	S-2	24/18	2 - 4	14 13 12 17	Compact, tan to brown, SAND, some gravel, trace silt. (GLACIAL OUTWASH)
3	289								
4	288			22	S-3	24/14	4 - 6	4 10 12 13	Compact, tan to brown, SAND, some gravel, trace silt. (GLACIAL OUTWASH)
5	287								
6	286			32	S-4	24/16	6 - 8	14 16 16 14	Dense, tan to brown, gravelly SAND, trace silt, with weathered rock fragments. (GLACIAL OUTWASH)
7	285								
8	284			30	S-5	24/16	8 - 10	13 15 15 10	Compact to dense, SAND and GRAVEL, trace silt, with weathered rock fragments. (GLACIAL OUTWASH)
9	283								
10	282								
11	281								
12	280								
13	279								
14	278								
15	277			34	S-6	24/15	15 - 17	18 17 17 17	Dense, tan to brown, gravelly SAND, trace silt, with weathered rock fragments. (GLACIAL OUTWASH)
16	276								
17	275								
18	274								
19	273								
20	272								
21	271			11	S-7	24/13	20 - 22	5 5 6 13	Compact, tan to brown, gravelly SAND, trace silt, with weathered rock fragments. (GLACIAL OUTWASH)
22	270								
23	269								

Granular Soils

Blows/ft.	Density
0-4	V. Loose
4-10	Loose
10-30	Compact
30-50	Dense
>50	V. Dense

Cohesive Soils

Blows/ft.	Consistency
<2	V. Soft
2-4	Soft
4-8	Firm
8-15	Stiff
15-30	V. Stiff
>30	Hard

Soil Component

Descriptive Term	Proportion of Total
"Trace"	0-10%
"Some"	10-20%
Adjective (e.g. Sandy, Silty)	20-35%
"And"	35-50%

Soil containing three components each of which comprise at least 25% of the total are classified as "A Well-Graded Mixture Of"

Notes:

McPHAIL

McPhail Associates, LLC
42 3rd Avenue
Burlington, MA 01803
TEL: 617-868-1420

Project:	Mirror Lake	**Job #:**	8072.2.00
Location:	Mirror Lake Rd	**Date Started:**	06-24-2025
City/State:	Devens, MA	**Date Finished:**	06-24-2025

Boring No.
B-1

Contractor:	Geosearch Drilling, Inc.	**Casing Type:**	HSA
Driller/Helper:	Brian/Luis	**Casing Hammer/Drop:**	300lbs/24in
Logged By/Reviewed By:	K. O'Callaghan	**Sampler Size/Type:**	3/8" ID Split Spoon
Surface Elevation (ft):	291.8 ft	**Sampler Hammer/Drop:**	140lbs/30in

Groundwater Observations

Groundwater Not Encountered.

Depth (ft)	Elev. (ft)	Symbol	Stratum	N-Value / RQD	Sample No.	Pen/Rec (in)	Depth (ft)	Blows/6" / Min/ft	Sample Description and Boring Notes
23			*(continued)* GLACIAL OUTWASH						
24	268								
25	267			73	S-8	24/16	25 - 27	10 22 51 20	Very dense, brown, gravelly SAND, trace silt, with weathered rock fragments. (GLACIAL OUTWASH)
26	266								
27	265								
28	264								
29	263								
30	262			24	S-9a	18/16	30 - 31.5	8 11 13	Compact, light brown, SAND, trace silt, trace gravel. (GLACIAL OUTWASH)
31	261								
32	260		32 ft EL 259.8 ft Bottom of exploration at 32 ft below ground surface.	34	S-9b	6/4	31.5 - 32	18	Dense, light brown, silty SAND, trace gravel. (GLACIAL OUTWASH)
33	259								
34	258								
35	257								
36	256								
37	255								
38	254								
39	253								
40	252								
41	251								
42	250								
43	249								
44	248								
45	247								
46	246								

Granular Soils

Blows/ft.	Density
0-4	V. Loose
4-10	Loose
10-30	Compact
30-50	Dense
>50	V. Dense

Cohesive Soils

Blows/ft.	Consistency
<2	V. Soft
2-4	Soft
4-8	Firm
8-15	Stiff
15-30	V. Stiff
>30	Hard

Soil Component

Descriptive Term	Proportion of Total
"Trace"	0-10%
"Some"	10-20%
Adjective (e.g. Sandy, Silty)	20-35%
"And"	35-50%

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Location:	Mirror Lake Rd	**Date Started:**	06-24-2025
City/State:	Devens, MA	**Date Finished:**	06-24-2025

Boring No. B-2

Contractor:	Geosearch Drilling, Inc.	**Casing Type:**	HSA
Driller/Helper:	Brian/Luis	**Casing Hammer/Drop:**	300lbs/24in
Logged By/Reviewed By:	K. O'Callaghan	**Sampler Size/Type:**	3/8" ID Split Spoon
Surface Elevation (ft):	292.4 ft	**Sampler Hammer/Drop:**	140lbs/30in

Groundwater Observations

Groundwater Not Encountered.

Depth (ft)	Elev. (ft)	Symbol	Stratum	N-Value RQD	Sample No.	Pen/Rec (in)	Depth (ft)	Blows/6" Min/ft	Sample Description and Boring Notes
	292.4		Ground surface at EL 292.4 ft						
0	292		TOPSOIL 1 ft	6	S-1a	12/10	0 - 1	3 3	Loose, dark brown, silty SAND, trace gravel, with organic material. (TOPSOIL)
1	291		SUBSOIL EL 291.4 ft 1.5 ft	8	S-1b	6/5	1 - 1.5	4	Loose, brown to orange, SAND, some gravel, trace silt. (SUBSOIL)
			EL 290.9 ft	6	S-1c	6/5	1.5 - 2	3	Loose, tan, SAND, some gravel, trace silt. (GLACIAL OUTWASH)
2	290		GLACIAL OUTWASH	22	S-2	24/8	2 - 4	5 11 11 13	Compact, tan to brown, SAND, some gravel, trace silt. (GLACIAL OUTWASH)
3	289								
4	288			27	S-3	24/16	4 - 6	5 17 10 11	Compact, tan to brown, SAND, some gravel, trace silt, with weathered rock fragments. (GLACIAL OUTWASH)
5	287								
6	286			26	S-4	24/19	6 - 8	16 14 12 17	Compact, tan to brown, SAND, trace gravel, trace silt, with weathered rock fragments. (GLACIAL OUTWASH)
7	285								
8	284			23	S-5	24/16	8 - 10	7 11 12 11	Compact, tan to brown, SAND, some gravel, trace silt, with weathered rock fragments. (GLACIAL OUTWASH)
9	283								
10	282			42	S-6	24/14	10 - 12	7 13 29 19	Dense, tan to brown, SAND, trace gravel, trace silt. (GLACIAL OUTWASH)
11	281								
12	280								
13	279								
14	278								
15	277			30	S-7	24/16	15 - 17	17 16 14 9	Compact to dense, tan to brown, SAND, some gravel, trace silt, with weathered rock fragments. (GLACIAL OUTWASH)
16	276								
17	275								
18	274								
19	273								
20	272			32	S-8	24/18	20 - 22	6 13 19 36	Dense, brown, SAND, some silt, trace gravel. (GLACIAL OUTWASH)
21	271								
22	270								
23									

Granular Soils

Blows/ft.	Density
0-4	V. Loose
4-10	Loose
10-30	Compact
30-50	Dense
>50	V. Dense

Cohesive Soils

Blows/ft.	Consistency
<2	V. Soft
2-4	Soft
4-8	Firm
8-15	Stiff
15-30	V. Stiff
>30	Hard

Soil Component

Descriptive Term	Proportion of Total
"Trace"	0-10%
"Some"	10-20%
Adjective (e.g. Sandy, Silty)	20-35%
"And"	35-50%

Soil containing three components each of which comprise at least 25% of the total are classified as "A Well-Graded Mixture Of"

Notes:

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TEL: 617-868-1420

Project:	Mirror Lake	**Job #:**	8072.2.00
Location:	Mirror Lake Rd	**Date Started:**	06-24-2025
City/State:	Devens, MA	**Date Finished:**	06-24-2025

Boring No.
B-2

Contractor:	Geosearch Drilling, Inc.	**Casing Type:**	HSA
Driller/Helper:	Brian/Luis	**Casing Hammer/Drop:**	300lbs/24in
Logged By/Reviewed By:	K. O'Callaghan	**Sampler Size/Type:**	3/8" ID Split Spoon
Surface Elevation (ft):	292.4 ft	**Sampler Hammer/Drop:**	140lbs/30in

Groundwater Observations

Groundwater Not Encountered.

Depth (ft)	Elev. (ft)	Symbol	Stratum	N-Value / RQD	Sample No.	Pen/Rec (in)	Depth (ft)	Blows/6" / Min/ft	Sample Description and Boring Notes
23	269		*(continued)* GLACIAL OUTWASH						
24	268								
25	267			32	S-9	24/15	25 - 27	8 15 17 17	Dense, tan to brown, SAND, some silt, trace gravel, with weathered rock fragments. (GLACIAL OUTWASH)
26	266								
27	265								
28	264								
29	263								
30	262			34	S-10	24/24	30 - 32	12 15 19 17	Dense, tan, silty SAND, trace gravel. (GLACIAL OUTWASH)
31	261		32 ft						
32	260		EL 260.4 ft Bottom of exploration at 32 ft below ground surface.						
33	259								
34	258								
35	257								
36	256								
37	255								
38	254								
39	253								
40	252								
41	251								
42	250								
43	249								
44	248								
45	247								
46									

Granular Soils

Blows/ft.	Density
0-4	V. Loose
4-10	Loose
10-30	Compact
30-50	Dense
>50	V. Dense

Cohesive Soils

Blows/ft.	Consistency
<2	V. Soft
2-4	Soft
4-8	Firm
8-15	Stiff
15-30	V. Stiff
>30	Hard

Soil Component

Descriptive Term	Proportion of Total
"Trace"	0-10%
"Some"	10-20%
Adjective (e.g. Sandy, Silty)	20-35%
"And"	35-50%

Soil containing three components each of which comprise at least 25% of the total are classified as "A Well-Graded Mixture Of"

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Project:	Mirror Lake	**Job #:**	8072.2.00
Location:	Mirror Lake Rd	**Date Started:**	06-25-2025
City/State:	Devens, MA	**Date Finished:**	06-25-2025

Boring No. B-3

Contractor:	Geosearch Drilling, Inc.	**Casing Type:**	HSA
Driller/Helper:	Brian/Luis	**Casing Hammer/Drop:**	300lbs/24in
Logged By/Reviewed By:	K. O'Callaghan	**Sampler Size/Type:**	3/8" ID Split Spoon
Surface Elevation (ft):	293.8 ft	**Sampler Hammer/Drop:**	140lbs/30in

Groundwater Observations

Groundwater Not Encountered.

Depth (ft)	Elev. (ft)	Symbol	Stratum	N-Value RQD	Sample No.	Pen/Rec (in)	Depth (ft)	Blows/6" Min/ft	Sample Description and Boring Notes
	293.8		Ground surface at EL 293.8 ft						
0	293		TOPSOIL 1 ft	5	S-1a	12/7	0 - 1	1 4	Loose, dark brown, silty SAND, trace gravel, with organic material. (TOPSOIL)
1	292		SUBSOIL EL 292.8 ft 2 ft	14	S-1b	12/7	1 - 2	7 7	Compact, orange to brown, SAND, some gravel, trace silt, with organic material and cobbles. (SUBSOIL)
2	291		GLACIAL OUTWASH EL 291.8 ft	22	S-2	24/12	2 - 4	9 12 10 14	Compact, tan to brown, SAND and GRAVEL, trace silt, with cobbles. (GLACIAL OUTWASH)
3	290			22	S-3	24/15	4 - 6	4 10 12 14	Compact, tan to brown, gravelly SAND, trace silt, with cobbles and weathered rock fragments. (GLACIAL OUTWASH)
4	289			31	S-4	24/13	6 - 8	14 13 18 19	Dense, tan to brown, SAND, some gravel, trace silt, with cobbles. (GLACIAL OUTWASH)
5	288			26	S-5	24/10	8 - 10	12 15 11 13	Compact, tan to brown, gravelly SAND, trace silt, with cobbles. (GLACIAL OUTWASH)
6	287			24	S-6	24/15	10 - 12	4 10 14 14	Compact, tan to brown, SAND, some gravel, trace silt, with cobbles and weathered rock fragments. (GLACIAL OUTWASH)
7	286								
8	285			35	S-7	24/14	15 - 17	9 13 22 19	Dense, tan to brown, gravelly SAND, trace silt, with weathered rock fragments. (GLACIAL OUTWASH)
9	284								
10	283								
11	282								
12	281								
13	280								
14	279								
15	278			22	S-8	24/21	20 - 22	6 9 13 31	Compact, tan, SAND, trace silt, trace gravel. (GLACIAL OUTWASH)
16	277								
17	276								
18	275								
19	274								
20	273								
21	272								
22	271								
23									

Granular Soils

Blows/ft.	Density
0-4	V. Loose
4-10	Loose
10-30	Compact
30-50	Dense
>50	V. Dense

Cohesive Soils

Blows/ft.	Consistency
<2	V. Soft
2-4	Soft
4-8	Firm
8-15	Stiff
15-30	V. Stiff
>30	Hard

Soil Component

Descriptive Term	Proportion of Total
"Trace"	0-10%
"Some"	10-20%
Adjective (e.g. Sandy, Silty)	20-35%
"And"	35-50%

Soil containing three components each of which comprise at least 25% of the total are classified as "A Well-Graded Mixture Of"

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Location:	Mirror Lake Rd	**Date Started:**	06-25-2025
City/State:	Devens, MA	**Date Finished:**	06-25-2025

Boring No.
B-3

Contractor:	Geosearch Drilling, Inc.	**Casing Type:**	HSA
Driller/Helper:	Brian/Luis	**Casing Hammer/Drop:**	300lbs/24in
Logged By/Reviewed By:	K. O'Callaghan	**Sampler Size/Type:**	3/8" ID Split Spoon
Surface Elevation (ft):	293.8 ft	**Sampler Hammer/Drop:**	140lbs/30in

Groundwater Observations

Groundwater Not Encountered.

Depth (ft)	Elev. (ft)	Symbol	Stratum	N-Value / RQD	Sample No.	Pen/Rec (in)	Depth (ft)	Blows/6" / Min/ft	Sample Description and Boring Notes
23	270		*(continued)* GLACIAL OUTWASH						
25	269			36	S-9	24/24	25 - 27	9 17 19 24	Dense, tan, SAND, some silt, trace gravel. (GLACIAL OUTWASH)
28	266								
30	264			34	S-10	24/24	30 - 32	13 15 19 20	Dense, tan, SAND, some silt, trace gravel. (GLACIAL OUTWASH)
32	262		32 ft EL 261.8 ft Bottom of exploration at 32 ft below ground surface.						
46	248								

Granular Soils

Blows/ft.	Density
0-4	V. Loose
4-10	Loose
10-30	Compact
30-50	Dense
>50	V. Dense

Cohesive Soils

Blows/ft.	Consistency
<2	V. Soft
2-4	Soft
4-8	Firm
8-15	Stiff
15-30	V. Stiff
>30	Hard

Soil Component

Descriptive Term	Proportion of Total
"Trace"	0-10%
"Some"	10-20%
Adjective (e.g. Sandy, Silty)	20-35%
"And"	35-50%

Soil containing three components each of which comprise at least 25% of the total are classified as "A Well-Graded Mixture Of"

Notes:

McPHAIL

McPhail Associates, LLC
42 3rd Avenue
Burlington, MA 01803
TEL: 617-868-1420

Project:	Mirror Lake	**Job #:**	8072.2.00
Location:	Mirror Lake Rd	**Date Started:**	06-25-2025
City/State:	Devens, MA	**Date Finished:**	06-25-2025

Boring No. B-4

Contractor:	Geosearch Drilling, Inc.	**Casing Type:**	HSA
Driller/Helper:	Brian/Luis	**Casing Hammer/Drop:**	300lbs/24in
Logged By/Reviewed By:	K. O'Callaghan	**Sampler Size/Type:**	3/8" ID Split Spoon
Surface Elevation (ft):	298.9 ft	**Sampler Hammer/Drop:**	140lbs/30in

Groundwater Observations

Groundwater Not Encountered.

Depth (ft)	Elev. (ft)	Symbol	Stratum	N-Value RQD	Sample No.	Pen/Rec (in)	Depth (ft)	Blows/6" Min/ft	Sample Description and Boring Notes
	298.9		Ground surface at EL 298.9 ft						
0	298		TOPSOIL 1 ft	3	S-1a	12/8	0 - 1	1 2	Very loose, dark brown, silty SAND, trace gravel, with organic material. (FILL)
1			EL 297.9 ft						
2	297		GLACIAL OUTWASH	12	S-1b	12/8	1 - 2	6 6	Compact, tan, SAND, some gravel, trace silt. (GLACIAL OUTWASH)
3	296			29	S-2	24/12	2 - 4	9 19 10 5	Compact, tan to brown, SAND, some gravel, trace silt. (GLACIAL OUTWASH)
4	295								
5	294			23	S-3	24/13	4 - 6	10 11 12 12	Compact, tan to brown, gravelly SAND, trace silt, with cobbles and weathered rock fragments. GLACIAL OUTWASH)
6	293								
7	292			43	S-4	24/8	6 - 8	17 19 24 19	Dense, tan to brown, SAND, some gravel, trace silt, with cobbles. (GLACIAL OUTWASH)
8	291								
9	290			17	S-5	24/16	8 - 10	3 8 9 9	Compact, tan to brown, SAND, trace silt, trace gravel. (GLACIAL OUTWASH)
10	289			15	S-6a	12/10	10 - 11	3 12	Compact, tan to brown, SAND, trace silt, trace gravel. (GLACIAL OUTWASH)
11	288			18	S-6b	12/10	11 - 12	10 8	Compact, tan, silty SAND, trace gravel. (GLACIAL OUTWASH)
12	287								
13	286								
14	285								
15	284			26	S-7	24/24	15 - 17	9 13 13 15	Compact, tan, SAND, some silt, trace gravel. (GLACIAL OUTWASH)
16	283								
17	282								
18	281								
19	280								
20	279								
21	278			24	S-8	24/24	20 - 22	7 11 13 14	Compact, tan, SAND, some silt, trace gravel. (GLACIAL OUTWASH)
22	277								
23	276								

Granular Soils

Blows/ft.	Density
0-4	V. Loose
4-10	Loose
10-30	Compact
30-50	Dense
>50	V. Dense

Cohesive Soils

Blows/ft.	Consistency
<2	V. Soft
2-4	Soft
4-8	Firm
8-15	Stiff
15-30	V. Stiff
>30	Hard

Soil Component

Descriptive Term	Proportion of Total
"Trace"	0-10%
"Some"	10-20%
Adjective (e.g. Sandy, Silty)	20-35%
"And"	35-50%

Soil containing three components each of which comprise at least 25% of the total are classified as "A Well-Graded Mixture Of"

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Groundwater Observations

Groundwater Not Encountered.

Depth (ft)	Elev. (ft)	Symbol	Stratum	N-Value / RQD	Sample No.	Pen/Rec (in)	Depth (ft)	Blows/6" / Min/ft	Sample Description and Boring Notes
23			*(continued)* GLACIAL OUTWASH						
24	275								
25	274								
26	273			26	S-9	24/19	25 - 27	9 11 15 15	Compact, tan, SAND, some silt, trace gravel. (GLACIAL OUTWASH)
27	272								
28	271								
29	270								
30	269								
31	268			28	S-10	24/21	30 - 32	10 12 16 21	Compact, tan, SAND, some silt, trace gravel. (GLACIAL OUTWASH)
32	267		32 ft EL 266.9 ft Bottom of exploration at 32 ft below ground surface.						
33	266								
34	265								
35	264								
36	263								
37	262								
38	261								
39	260								
40	259								
41	258								
42	257								
43	256								
44	255								
45	254								
46	253								

Granular Soils	
Blows/ft.	**Density**
0-4	V. Loose
4-10	Loose
10-30	Compact
30-50	Dense
>50	V. Dense

Cohesive Soils	
Blows/ft.	**Consistency**
<2	V. Soft
2-4	Soft
4-8	Firm
8-15	Stiff
15-30	V. Stiff
>30	Hard

Soil Component

Descriptive Term	Proportion of Total
"Trace"	0-10%
"Some"	10-20%
Adjective (e.g. Sandy, Silty)	20-35%
"And"	35-50%

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Worcester County, Massachusetts, Northeastern Part

May 19, 2025

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

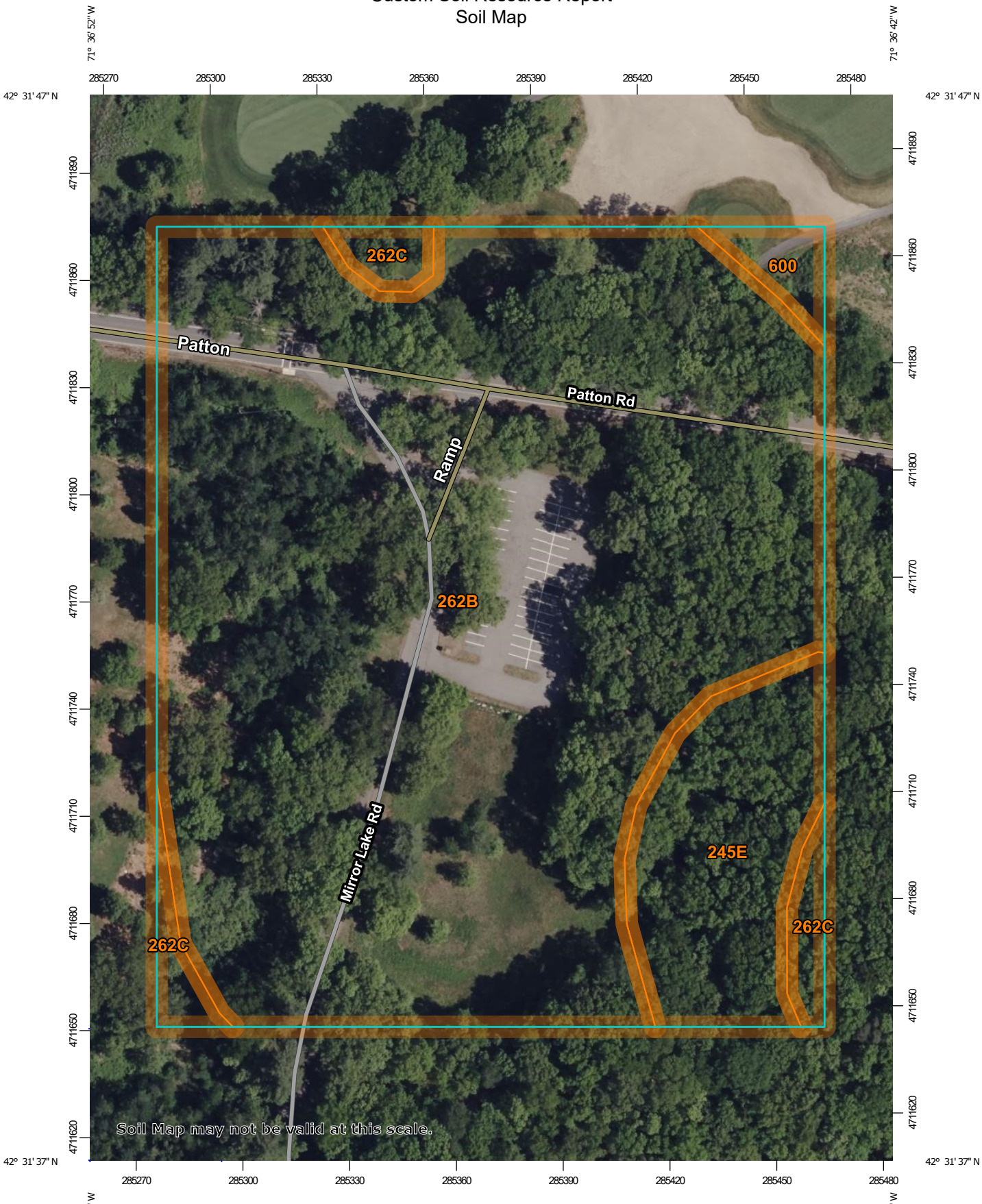
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:1,450 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Worcester County, Massachusetts, Northeastern Part
Survey Area Data: Version 19, Aug 27, 2024

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

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
245E	Hinckley loamy sand, 25 to 35 percent slopes	1.1	10.4%
262B	Quonset loamy sand, 3 to 8 percent slopes	8.9	84.9%
262C	Quonset loamy sand, 8 to 15 percent slopes	0.3	3.3%
600	Pits, gravel	0.1	1.4%
Totals for Area of Interest		**10.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate

pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Worcester County, Massachusetts, Northeastern Part

245E—Hinckley loamy sand, 25 to 35 percent slopes

Map Unit Setting

National map unit symbol: 2svmf
Elevation: 0 to 1,200 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Hinckley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 25 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A

Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Windsor
Percent of map unit: 10 percent
Landform: Moraines, eskers, kames, outwash deltas, outwash terraces, outwash plains, kame terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Merrimac
Percent of map unit: 3 percent
Landform: Kame terraces, outwash terraces, kames, outwash plains, moraines, eskers
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury
Percent of map unit: 2 percent
Landform: Outwash deltas, moraines, outwash plains, kame terraces, outwash terraces
Landform position (two-dimensional): Backslope, footslope, toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

262B—Quonset loamy sand, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: w3m8
Elevation: 0 to 1,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Quonset and similar soils: 80 percent
Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Quonset

Setting

Landform: Terraces
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loose sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 3 inches: loamy sand
H2 - 3 to 6 inches: channery loamy sand
H3 - 6 to 18 inches: very channery loamy sand
H4 - 18 to 60 inches: stratified very channery coarse sand to very channery sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (2.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Hinckley

Percent of map unit: 10 percent
Hydric soil rating: No

Deerfield

Percent of map unit: 5 percent
Landform: Terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent
Hydric soil rating: No

262C—Quonset loamy sand, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: w3mw
Elevation: 210 to 440 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Quonset and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Quonset

Setting

Landform: Eskers, terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loose sandy and gravelly glaciofluvial deposits

Typical profile

H1 - 0 to 3 inches: loamy sand
H2 - 3 to 6 inches: channery loamy sand
H3 - 6 to 18 inches: very channery loamy sand
H4 - 18 to 60 inches: stratified very channery coarse sand to very channery sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (2.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 10 percent
Hydric soil rating: No

Hinckley

Percent of map unit: 10 percent
Hydric soil rating: No

600—Pits, gravel

Map Unit Setting

National map unit symbol: w3g6
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Pits, gravel: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pits, Gravel

Setting

Landform position (three-dimensional): Base slope
Parent material: Loose sandy and gravelly glaciofluvial deposits

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Required and Provided Recharge Volumes

Recharge Calculations

Project	Mirror Lake	**Project #**	16702
Calculated by	LEH	**Date**	8/5/2025
Checked by	KCW	**Date**	8/5/2025

REQUIRED RECHARGE VOLUME

Hydrologic Soil Group (HSG)	Area (ft^2)	Inches of Runoff (in)	Volume (ft^3)
A	25,104	0.60	1,255
B	0	0.35	0
C	0	0.25	0
D	0	0.10	0
TOTAL			**1,255**

CAPTURE AREA ADJUSTMENT

Required Recharge Volume (ft^3)	1,255
Total Site Net Impervious Area (ft^2)	25,104
Total Site Impervious Area Draining to Recharge Facilities (ft^2)	25,104
Capture Area Adjustment Factor	1.00
Adjusted Required Recharge Volume (ft^3)	**1,255**

PROVIDED RECHARGE VOLUME

Permeable Pavement Reservoir

Permeable Pavement

Volumes provided below the lowest outlet at elevation: 293.7

Provided Volume:	Area (ft^2)	*Volume (ft^3)
	25,104	**13,182**

* Volume = Area X Voids X Depth

Drawdown: $(V_{Infiltration}/A_{Bottom})$/Rawl's Rate

Rawls Recharge Rate:	2.41	(in/hr)
Drawdown Time:	2.61	(hours)

RECHARGE VOLUME SUMMARY

Required Recharge Volume:	1,255	(ft^3)
Total Recharge Volume Provided:	13,182	(ft^3)

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Appendix C: Standard 4 Computations and Supporting Information

- Operation and Maintenance Plan
- Water Quality Volume Calculations
- TSS Removal Worksheets

Operations and Maintenance Plan

Mirror Lake Parking Lot Expansion

89-150 Patton Road
Devens, MA

PREPARED FOR

MassDevelopment
99 Buena Vista Street
Devens, MA 01434
Hillary Clark
978.772.8876

PREPARED BY

99 High Street
Boston, MA 02110
617.728.7777

July, 2025

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Project Information

Site

Mirror Lake Parking Lot Expansion
89-150 Patton Road
Devens, MA

Developer

MassDevelopment
99 Buena Vista Street
Devens, MA 01434
978.772.8876

Site Supervisor

TBD
TBD
TBD
TBD

Site Contact

Name:	TBD
Telephone:	TBD
Cell phone:	TBD
Email:	TBD

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Section A: Source Control

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A Source Control

A comprehensive source control program will be implemented at Mirror Lake, which includes the following components:

- Regular pavement sweeping in the public way
- Pavement vacuuming in the private way
- Catch basin cleaning
- Clearing litter from the parking area, islands, and perimeter landscape areas
- Enclosure and regular maintenance of all dumpsters
- Spill Prevention training

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Section B: Spill Prevention

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B Spill Prevention

Spill prevention equipment and training will be provided by the property management company.

B.1 Initial Notification

In the event of a spill the facility and/or construction manager or supervisor will be notified immediately.

Facility Manager (name):	Hillary Clark
Facility Manager (phone):	978.772.8876
Construction Manager (name) :	TBD
Construction Manager (phone):	TBD

The supervisor will first contact the Fire Department and then notify the Police Department, the Public Health Commission and the Conservation Commission. The Fire Department is ultimately responsible for matters of public health and safety and should be notified immediately.

B.2 Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the main construction/facility office and readily accessible to all employees. A hazardous waste spill report shall be completed as necessary using the attached form.

Emergency Notification Phone Numbers

1. FACILITY MANAGER		
Name:	Phone:	
	Beeper/Cell:	
	Home Phone:	
Alternate Contact:	Phone:	
	Beeper/Cell:	
	Home Phone:	
2. FIRE & POLICE DEPARTMENT	Emergency:	911
3. CLEANUP CONTRACTOR		
Address:	Phone:	
4. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION	Emergency:	(800) 304-1133
5. NATIONAL RESPONSE CENTER	Phone:	(800) 424-8802
Alternate: U.S. Environmental Protection Agency	Emergency:	(###) ###-####
	Business:	(###) ###-####
6. DEVENS DEPARTMENT OF PUBLIC WORKS	Phone:	(978) 772-1864
Devens Enterprise Commission:	Phone:	(978) 772-8831

Hazardous Waste & Oil Spill Report

Date: _____ **Time:** _____ **AM / PM**

Exact location (Transformer #): _____

Type of equipment: _____ **Make:** _____ **Size:** _____

S / N: _____ **Weather Conditions:** _____

On or near water? ☐ Yes ☐ No **If yes, name of body of water:** _____

Type of chemical / oil spilled: _____

Amount of chemical / oil spilled: _____

Cause of spill: _____

Measures taken to contain or clean up spill: _____

Amount of chemical / oil recovered: _____ **Method:** _____

Material collected as a result of cleanup:

_____ drums containing _____

_____ drums containing _____

_____ drums containing _____

Location and method of debris disposal: _____

Name and address of any person, firm, or corporation suffering charges: _____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring: _____

Spill reported by General Office by: _____ **Time:** _____ **AM / PM**

Spill reported to DEP / National Response Center by: _____

DEP Date: _____ **Time:** _____ **AM / PM** **Inspector:** _____

NRC Date: _____ **Time:** _____ **AM / PM** **Inspector:** _____

Additional comments: _____

B.3 Assessment – Initial Containment

The supervisor or manager will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. A list of recommended spill equipment to be kept on site is included on the following page.

Fire / Police Department: 911

Devens Department of Public Works: (978) 772-1864

Devens Enterprise Commission: (978) 772-8831

Emergency Response Equipment

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

Supplies	Quantity	Recommended Suppliers
› Sorbent Pillows/"Pigs"	2	http://www.newpig.com Item # KIT276 — mobile container with two pigs
› Sorbent Boom/Sock	25 feet	http://www.forestry-suppliers.com
› Sorbent Pads	50	
› Lite-Dri® Absorbent	5 pounds	
› Shovel	1	Item # 33934 — Shovel (or equivalent)
› Pry Bar	1	Item # 43210 — Manhole cover pick (or equivalent)
› Goggles	1 pair	Item # 23334 — Goggles (or equivalent)
› Gloves – Heavy	1 pair	Item # 90926 — Gloves (or equivalent)

Section C: Snow Management

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C Snow Management

Snow storage areas are shown on the attached Map.

- Snow storage areas will be managed to prevent blockage of storm drain catch basins and stormwater drainage swales. Snow combined with sand and debris may block a storm drainage system, diminishing the infiltration capacity of the system and causing localized flooding.
- Sand and debris deposited on vegetated or paved areas shall be cleared from the site and properly disposed of at the end of the snow season, no later than May 15.
- Snow shall not be dumped into any waterbody, pond, or wetland resource area.
- No sand or grit shall be used on porous pavement systems and other deicers are to be used only to the extent necessary to protect public safety. Operators shall be instructed to monitor deicer application rates, as porous pavements tend to require less deicer due to their operational characteristics.
- Removal of sediments tracked onto porous pavement surfaces is a high-priority maintenance item and will protect the pavement from premature clogging.
- Parking areas paved with permeable asphalt pavement should be plowed carefully. Plow blades should be set approximately 1" higher than usual to avoid scarring the pavement and loosening material that could potentially clog surface pores.

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Section D: Maintenance of Stormwater Management Systems

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D Maintenance of Stormwater Management Systems

D.1 Pavement Systems

D.1.1 Standard Asphalt Pavement

- Sweep or vacuum standard asphalt pavement areas at least four times per year with a rotary brush sweeper, vacuum or regenerative air sweeper and properly dispose of removed material.
- Recommended sweeping schedule:
- Oct/Nov
- Feb/Mar
- Apr/May
- Aug/Sep
- More frequent sweeping of paved surfaces will result in less accumulation in catch basins, less cleaning of subsurface structures, and less disposal costs.
- Check loading docks and dumpster areas frequently for spillage and/or pavement staining and clean as necessary.

D.1.2 Permeable Asphalt Pavement

Regular maintenance of the porous pavement will prevent premature failure of the drainage and water quality treatment benefits of the system. Any areas that drain to the porous pavement must be free from erosion. Heavy sediment loads in these areas can clog the pavement surface and result in premature failure.

Preventing Clogging of Permeable Pavement Surfaces

- Vacuum pavement at least four times per year with a commercial cleaning unit (Schwarze Industries "A" series regenerative air sweeper or equivalent) and properly dispose of removed material.
- The use of pavement washing systems or compressed air units is not recommended as it may result in diminished permeability.

- Maintain vegetated areas adjacent to permeable asphalt pavement to prevent washout of soil onto surface.
- Do not allow construction staging, soil/mulch storage, etc. on unprotected pavement surface. If necessary, place tarp or other impermeable material beneath the stockpiled materials and do not allow to runoff onto pavement.
- Do not apply any type of sealant to porous asphalt pavement.

Snow and Ice Removal

- Do not stockpile snow on pavement surface. Sand and grit in snow will clog pavement.
- Plow parking areas paved with permeable asphalt pavement carefully. Plow blades should be set approximately 1" higher than usual to avoid scarring the pavement and loosening material that could potentially clog surface pores.
- Do not apply abrasives such as sand or grit on or adjacent to porous asphalt pavement.
- Monitor application rates of deicing materials and reduce application rate accordingly. Porous pavements tend to require less deicer per unit area because the water is not required to remain liquid over the entire parking surface area before discharge.

Inspecting the System

- Inspect areas paved with permeable asphalt pavement monthly during the first three months following installation and annually thereafter.
- Inspect the porous pavement surface annually for deterioration or spalling. Annual inspections should take place after large storms, when puddles will make any clogging obvious

Repairing Damages

- Do not apply any type of sealant to porous asphalt pavement.
- Spot-clogging may be fixed by drilling 1.3 centimeter (half-inch) holes through the porous pavement layer every few feet.
- Damaged areas less than 50 square feet may be patched with porous or standard asphalt.
- Larger areas will be patched with approved porous asphalt.
- Repairs of drainage structures shall be completed promptly to ensure continued proper functioning of the system.

D.1.3 Permeable Pavers

The primary maintenance requirement for permeable pavers is to clean the surface drainage voids. Fine debris and dirt accumulate in the drainage openings and reduce the pavement's flow capacity. Even though some irreplaceable loss in permeability should be expected over the paver's lifetime, you can increase the longevity of the system by following the maintenance schedule for vacuum sweeping and high-pressure washing, restricting the area's use by heavy vehicles, limiting the use of de-icing chemicals and sand, and implementing a stringent sediment control plan.

Preventing Clogging of Permeable Paver Surface Areas

- Patio areas and/or other areas with permeable pavers shall be cleaned annually with vacuums or washed with high pressure washers.
- Do not allow construction staging, soil/mulch storage, etc. on unprotected pavement surface.
- Maintain vegetated areas adjacent to areas with permeable pavers to prevent washout of soil onto surface.
- Do not apply any type of sealant to permeable pavers.

Removing Snow and Ice

- Shovel snow off permeable pavers as necessary.
- Do not apply abrasives such as sand or grit on or adjacent to permeable pavers.
- Avoid plowing of areas with permeable pavers.

Inspecting the System

- Inspect areas paved with permeable pavers monthly for the first three months after construction to ensure proper functioning and correct any areas that have settled or experienced washouts.
- Inspect areas paved with permeable pavers annually after initial three-month period. Annual inspections should take place after large storms, when puddles will make any clogging obvious.

Repairing Damages

- Do not apply any type of sealant to permeable pavers.
- If necessary, add additional aggregate fill material made up of clean sand or gravel.
- Damaged interlocking paving blocks should be replaced.

D.2 Structural Stormwater Management Devices

D.2.1 Catch Basins

The proper removal of sediments and associated pollutants and trash occurs only when catch basin inlets and sumps are cleaned out regularly. The more frequent the cleaning, the less likely sediments will be re-suspended and subsequently discharged. In addition, frequent cleaning also results in more volume available for future deposition and enhances the overall performance. As noted in the pavement Operation and Maintenance (O&M) section, more frequent sweeping of paved surfaces will result in less accumulation in catch basins, less cleaning of subsurface structures, and less disposal costs.

There is 1 catch basin at Mirror Lake. These catch basins are constructed with sumps (minimum 4 feet) and hooded outlets to trap debris, sediments, and floating contaminants. Disposal of all sediments must be in accordance with applicable local, state, and federal guidelines. A map of the catch basin locations is included in Section E.5 Maintenance Checklists and Device Location Maps.

Inspections and Cleaning

- All catch basins shall be inspected at least four times per year and cleaned a minimum of at least once per year.
- Sediment (if more than six inches deep) and/or floatable pollutants shall be pumped from the basin and disposed of at an approved offsite facility in accordance with all applicable regulations.
- Any structural damage or other indication of malfunction will be reported to the site manager and repaired as necessary
- During colder periods, the catch basin grates must be kept free of snow and ice.
- During warmer periods, the catch basin grates must be kept free of leaves, litter, sand, and debris.

functionality, this sediment removal row requires regular inspection and cleaning. A map of the infiltration basin locations is included in Section E.5 Maintenance Checklists and Device Location Maps.

Inspections and Cleaning

- The subsurface infiltration systems will be inspected at least once each year by removing the manhole/access port covers and determining the thickness of sediment that has accumulated in the sediment removal row.
- If sediment is more than six inches deep, it must be suspended via flushing with clean water and removed using a vactor truck.
- Manufacturer's specifications and instructions for cleaning the sediment removal row are provided as an attachment to this section.
- Emergency overflow pipes will be examined at least once each year and verified that no blockage has occurred.
- System will be observed after rainfalls to see if it is properly draining.

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Section E: Operations and Maintenance Plan Summary

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E Operations and Maintenance Plan Summary

This Operation and Maintenance Plan has been prepared in accordance with the Stormwater Management Policy developed by the DEP as applicable. It specifies operational practices and drainage system maintenance requirements for the Mirror Lake parking lot expansion. Requirements should be adjusted by the site manager as necessary to ensure successful functioning of system components.

E.1 Routine Maintenance Checklists

Routine required maintenance is described in Sections A – D. The following checklists are to be used by the property manager to implement and document the required maintenance and inspection tasks.

E.2 Reporting and Documentation

The site supervisor shall be responsible for ensuring that the scheduled tasks as described in this plan are appropriately completed and recorded in the Maintenance Log. Accurate records of all inspections, routine maintenance and repairs shall be documented and these records shall be available for inspection by members of the Devens Enterprise Commission, or their designated agent, upon request.

The Maintenance Log shall:

- Document the completion of required maintenance tasks.
- Identify the person responsible for the completion of tasks.
- Identify any outstanding problems, malfunctions or inconsistencies identified during the course of routine maintenance.
- Document specific repairs or replacements.

E.3 Long-term Maintenance/Evaluation Checklist

Mirror Lake Parking Lot Expansion – Devens, MA

Best Management Practice	Minimum Maintenance and Key Items to Check	Inspection Frequency	Date Inspected	Inspector Initials	Cleaning Frequency	Cleaning or Repair Needed ☐Yes/No	Date of Cleaning or Repair	Performed by:
Street Sweeping	Vacuum sweeper	4X per year			4X per year* minimum			
Permeable Pavement	Vacuum sweeper	4X per year			4X per year* minimum			
Permeable Pavers	Vacuum sweep or pressure wash	1X per year			as necessary			
Outfall Structures	Remove debris and excess vegetation, replace any dislodged riprap	1X per year			1X per year			
Deep Sump and Hooded Catch basins	Remove sediment 1X per year or if >6 inches	4X per year			1X per year or as necessary			
Subsurface Infiltration Basins	Remove sediment 1X per year or if >6 inches	1X per year			1X per year			
Rain Gardens/ Bioretention Basins	Inspect inlets, vegetation, overflow discharge pipes, drain time less than 4 days	2X per year first year, annually thereafter			2X per year first year, annually thereafter			
Roof Drains	Remove debris, clean inlets draining to subsurface bed	4x per year roof inspection			2x per year inlet cleaning, roof debris as necessary			

* Recommend sweeping Oct/Nov, Feb/Mar, Apr/May Jul/Aug with late winter most important

Stormwater Control Manager: _____

E.4 Maintenance Checklists and Device Location Maps

These checklists are provided for the maintenance crew to photocopy and use when conducting inspections and cleaning activities to the stormwater management systems.

Maintenance Checklists

Catchbasins – Inspect 4 times per year, clean when sediment depth >6 inches or at least once per year.

Catch Basin	Inspected (Y/N)	Sediment Depth (inches)	Cleaning needed (Y/N)	Date Cleaned	Comments (Trash, Oil, Pet waste, Lawn Debris, Damage)
CB 1				/ /	
CB 2				/ /	

Permeable Asphalt Pavement Areas – Vacuum pavement as needed up to four times per year with a commercial cleaning unit and dispose of removed materials, inspect once per year, remove sediment if more than 6 inches has accumulated in sediment forebay or sediment collection row

Street Name	Inspected (Y/N)	Sediment Depth (inches)	Cleaning needed (Y/N)	Date Cleaned	Comments (Trash, Oil, Pet waste, Lawn Debris, Damage)
Main Street				/ /	
				/ /	

Device Location Maps

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MAINTENANCE REQUIREMENTS

OVERFLOW PIPES WILL BE EXAMINED AT LEAST ONCE EACH YEAR AND VERIFIED THAT NO BLOCKAGE HAS OCCURRED.

SYSTEMS WILL BE OBSERVED AFTER RAINFALL EVENTS TO SEE IF IT IS PROPERLY DRAINING.

SEDIMENT (IF MORE THAN 6 INCHES DEEP) AND/OR FLOATABLE POLLUTANTS SHALL BE PUMPED FROM DRAINAGE STRUCTURES AND DISPOSED OF AT AN APPROVED OFFSITE FACILITY IN ACCORDANCE WITH ALL APPLICABLE REGULATIONS

ANY STRUCTURAL DAMAGE OR OTHER INDICATION OF MALFUNCTION WILL BE REPORTED TO THE SITE MANAGER AND REPAIRED AS NECESSARY.

0 25 50 100 Feet

O&M Plan
Mirror Lake Parking Lot Expansion
Devens, MA

Source: **VHB**
Prepared for: **DPW**
Date: **07/2025**

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Snow Storage Areas Map

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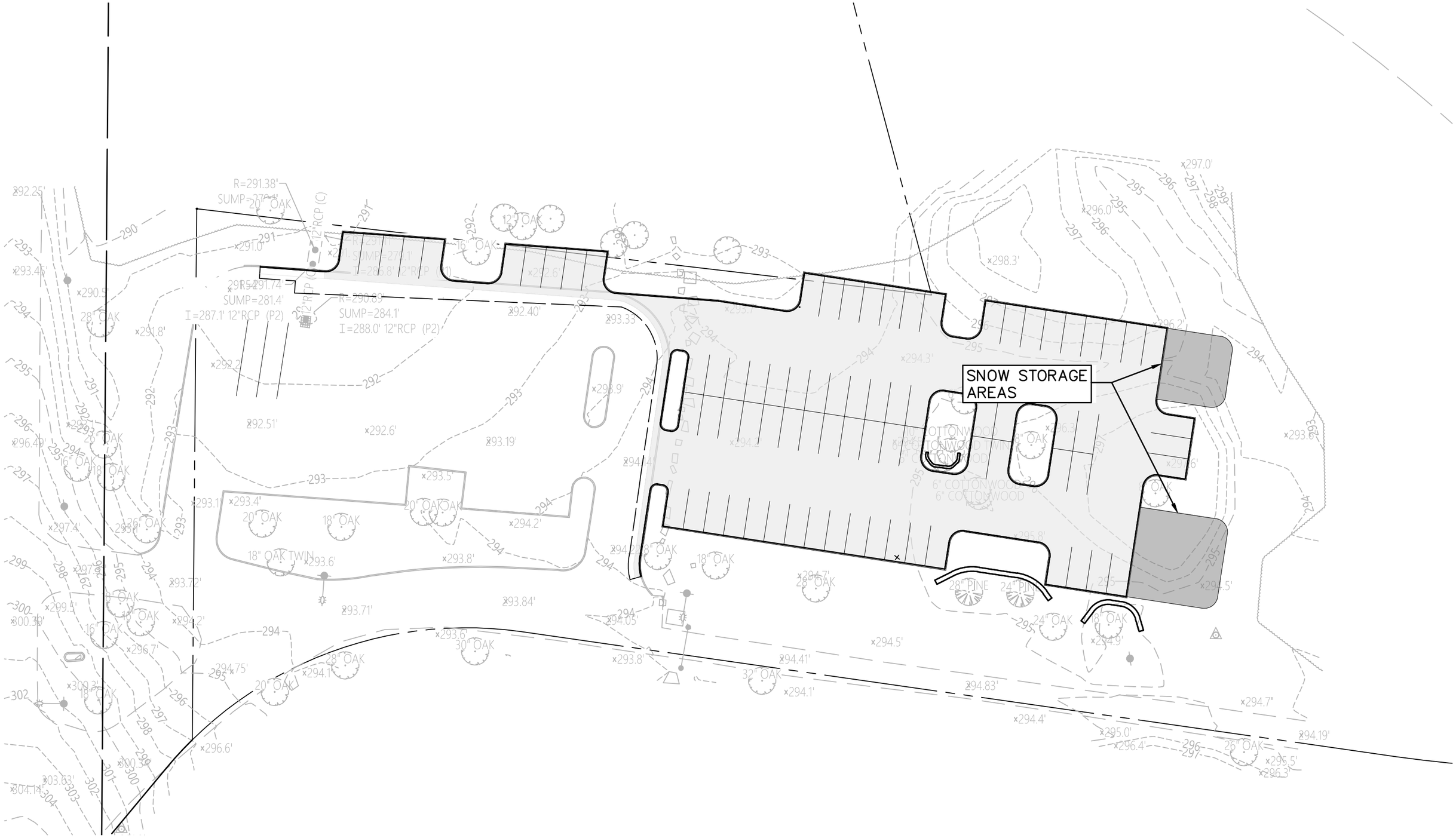

Snow Storage Plan

Mirror Lake
Devens, Massachusetts

July, 2025

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TSS Removal Worksheets

TSS Removal Calculation Worksheet

VHB, Inc..
101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
P 617.924.1770

Project Name:	**Mirror Lake**	Sheet:	**1 of 1**
Project Number:	**16702**	Date:	**22-Jul-2025**
Location:	**Devens, MA**	Computed by:	**LEH**
Discharge Point:	**A**	Checked by:	**KCW**
Drainage Area(s):	**3A, 4A**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D-E)
Permeable Pavement	**90%**	**1.00**	**0.90**	**0.10**
	0%	**0.10**	**0.00**	**0.10**
	0%	**0.10**	**0.00**	**0.10**
	0%	**0.10**	**0.00**	**0.10**
	0%	**0.10**	**0.00**	**0.10**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.

** Equals remaining load from previous BMP (E)

Treatment Train TSS Removal = **90%**

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Appendix D: Standard 8 Supporting Information

- List of recommended Construction Period BMPs
- Recommended construction period maintenance checklist

Recommended Construction Period Pollution Prevention and Erosion and Sedimentation Controls

Section A: Erosion and Sedimentation Control Measures

As part of the Notice of Intent process, an erosion and sedimentation control plan will be developed, and will include measures such as those described below.

Erosion and Sedimentation Control Measures

The following erosion and sedimentation controls are for use during the earthwork and construction phases of the project. The following controls are provided as recommendations for the site contractor and do not constitute or replace the final Stormwater Pollution Prevention Plan that must be fully implemented by the Contractor and owner in Compliance with EPA NPDES regulations.

Hay Bale Barriers

Hay bale barriers will be placed to trap sediment transported by runoff before it reaches the drainage system or leaves the construction site. Bales will be set at least four inches into the existing ground to minimize undercutting by runoff.

Silt Fencing

In areas where high runoff velocities or high sediment loads are expected, hay bale barriers will be backed up with silt fencing. This semi-permeable barrier made of a synthetic porous fabric will provide additional protection. The silt fences and hay bale barrier will be replaced as determined by periodic field inspections.

Compost Berms

Catch Basin Protection

Newly constructed and existing catch basins will be protected with hay bale barriers (where appropriate) or silt sacks throughout construction.

Gravel and Construction Entrance/Exit

A temporary crushed-stone construction entrance/exit will be constructed. A cross slope will be placed in the entrance to direct runoff to a protected catch basin inlet or settling area. If deemed necessary after construction begins, a wash pad may be included to wash off vehicle wheels before leaving the project site.

Diversion Channels

Diversion channels will be used to collect runoff from construction areas and discharge to either sedimentation basins or protected catch basin inlets.

Temporary Sediment Basins

Temporary sediment basins will be designed either as excavations or bermed stormwater detention structures (depending on grading) that will retain runoff for a sufficient period of time to allow suspended soil particles to settle out prior to discharge. These temporary basins will be located based on construction needs as determined by the contractor and outlet devices will be designed to control velocity and sediment. Points of discharge from sediment basins will be stabilized to minimize erosion.

Vegetative Slope Stabilization

Stabilization of open soil surfaces will be implemented within 14 days after grading or construction activities have temporarily or permanently ceased, unless there is sufficient snow cover to prohibit implementation. Vegetative slope stabilization will be used to minimize erosion on slopes of 3:1 or flatter. Annual grasses, such as annual rye, will be used to ensure rapid germination and production of root mass. Permanent stabilization will be completed with the planting of perennial grasses or legumes. Establishment of temporary and permanent vegetative cover may be established by hydro-seeding or sodding. A suitable topsoil, good seedbed preparation, and adequate lime, fertilizer and water will be provided for effective establishment of these vegetative stabilization methods. Mulch will also be used after permanent seeding to protect soil from the impact of falling rain and to increase the capacity of the soil to absorb water.

Maintenance

- The contractor or subcontractor will be responsible for implementing each control shown on the Sedimentation and Erosion Control Plan. In accordance with EPA regulations, the contractor must sign a copy of a certification to verify that a plan has been prepared and that permit regulations are understood.

- The on-site contractor will inspect all sediment and erosion control structures periodically and after each rainfall event. Records of the inspections will be prepared and maintained on-site by the contractor.

- Silt shall be removed from behind barriers if greater than 6-inches deep or as needed.

- Damaged or deteriorated items will be repaired immediately after identification.

- The underside of hay bales should be kept in close contact with the earth and reset as necessary.

- Sediment that is collected in structures shall be disposed of properly and covered if stored on-site.

- Erosion control structures shall remain in place until all disturbed earth has been securely stabilized. After removal of structures, disturbed areas shall be regraded and stabilized as necessary.

The sedimentation and erosion control plan is included in project plan set; Erosion Control Maintenance checklist is included here for quick reference.

Refer to C-101 Site Preparation Plan.

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Construction Best Management Practices - Maintenance/Evaluation Checklist

Construction Practices Maintenance/ Evaluation Checklist

Mirror Lake Parking Lot Expansion – Devens, MA

Best Management Practice	Inspection Frequency	Date Inspected	Inspector Initials	Minimum Maintenance and Key Items to Check	Cleaning or Repair Needed ☐Yes/No (List Items)	Date of Cleaning or Repair	Performed by:
Hay Bales/ Silt Fencing	Weekly and after any rainfall			Sediment build up, broken bales or stakes			
Gravel Construction Entrance	Weekly and after any rainfall			Filled voids, runoff/sediments into street			
Catch Basin Protection	Weekly and after any rainfall			Clogged or sediment build-up at surface or in basin			
Diversion Channels	Weekly and after any rainfall			Maintained, moved as necessary to correct locations, Check for erosion or breakout			
Temporary Sedimentation Basins	Weekly and after any rainfall			Cracking, erosion, breakout, sediment buildup, contaminants			

Stormwater Control Manager: _____

Section B: Construction Spill Prevention & Response

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Construction Phase Spill Prevention

Spill prevention equipment and training will be provided by the property management company.

Initial Notification

In the event of a spill the facility and/or construction manager or supervisor will be notified immediately.

Facility Manager (name):	Hillary Clark
Facility Manager (phone):	(617) 894-2305
Construction Manager (name) :	TBD
Construction Manager (phone):	TBD

The supervisor will first contact the Fire Department and then notify the Police Department, the Public Health Commission and the Conservation Commission. The Fire Department is ultimately responsible for matters of public health and safety and should be notified immediately.

Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the main construction/facility office and readily accessible to all employees. A hazardous waste spill report shall be completed as necessary using the attached form.

Emergency Notification Phone Numbers

1. FACILITY MANAGER

Name: _____ Phone: _____

Beeper/Cell: _____

Home Phone: _____

Alternate Contact: _____ Phone: _____

Beeper/Cell: _____

Home Phone: _____

2. FIRE & POLICE DEPARTMENT Emergency: 911

3. CLEANUP CONTRACTOR

Address: _____ Phone: _____

4. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP) Emergency: (800) 304-1133

5. NATIONAL RESPONSE CENTER Phone: (800) 424-8802

Alternate: U.S. Environmental Protection Agency Emergency: (###) ###-####

Business: (###) ###-####

6. DEVENS DEPARTMENT OF PUBLIC WORKS Phone: (978) 772-1864

Devens Enterprise Commission: Phone: (978) 772-8831

Hazardous Waste & Oil Spill Report

Date: _____ **Time:** _____ **AM / PM**

Exact location (Transformer #): _____

Type of equipment: _____ **Make:** _____ **Size:** _____

S / N: _____ **Weather Conditions:** _____

On or near water? ☐ Yes ☐ No **If yes, name of body of water:** _____

Type of chemical / oil spilled: _____

Amount of chemical / oil spilled: _____

Cause of spill: _____

Measures taken to contain or clean up spill: _____

Amount of chemical / oil recovered: _____ **Method:** _____

Material collected as a result of cleanup:

_____ drums containing _____

_____ drums containing _____

_____ drums containing _____

Location and method of debris disposal: _____

Name and address of any person, firm, or corporation suffering charges: _____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring: _____

Spill reported by General Office by: _____ **Time:** _____ **AM / PM**

Spill reported to DEP / National Response Center by: _____

DEP Date: _____ **Time:** _____ **AM / PM** **Inspector:** _____

NRC Date: _____ **Time:** _____ **AM / PM** **Inspector:** _____

Additional comments: _____

Assessment – Initial Containment

The supervisor or manager will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. A list of recommended spill equipment to be kept on site is included on the following page.

Fire / Police Department:	911
Devens Department of Public Works	(978) 772-1864
Devens Enterprise Commission:	(617) 635-3850

Emergency Response Equipment

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

Supplies	Quantity	Recommended Suppliers
Sorbent Pillows/"Pigs"	2	http://www.newpig.com Item # KIT276 — mobile container with two pigs
Sorbent Boom/Sock	25 feet	http://www.forestry-suppliers.com
Sorbent Pads	50	
Lite-Dri® Absorbent	5 pounds	
Shovel	1	Item # 33934 — Shovel (or equivalent)
Pry Bar	1	Item # 43210 — Manhole cover pick (or equivalent)
Goggles	1 pair	Item # 23334 — Goggles (or equivalent)
Gloves – Heavy	1 pair	Item # 90926 — Gloves (or equivalent)