ARROWSTREET

Memorandum

Date	15 April 2022
Project / No.	Lincoln-Eliot Elementary School / 18045
To	Alejandro Valcarce, Deputy Commissioner City of Newton
From	Tina Soo Hoo, Arrowstreet
Subject	150 Jackson Road Stormwater Memo Summary

Nitsch Engineering, Inc. has prepared a Stormwater Memorandum dated April 15, 2022 to support the Site Plan Approval application to the City of Newton for the proposed relocation of the existing Lincoln-Eliot Elementary School currently located at 191 Pearl Street, Newton, MA. The proposed relocation site is 150 Jackson Road (15 Walnut Park), Newton, MA. 150 Jackson Road which is the current location of the Newton Early Childhood Program (NECP) as well the Newton Public School (NPS) District Storage and Custodial Workshop.

The proposed project improvements include:

- Demolition of the previous convent and chapel
- Renovation of the existing classrooms, cafeteria, and auditorium
- A new building addition in the approximate location of the convent and chapel which will consist of a new main entrance, new lobby, new administrative office, gymnasium, media center and several other support spaces.
- Reconfiguration and improvements to the site includes new entrance plaza, new van and bus drop off/pick up zones, new Blue Zone, new playground, new multi-use lawn area, new entrance plaza, and new outdoor classrooms
- Installation of a new stormwater management system to provide mitigation, treatment, and groundwater recharge.

The proposed stormwater management system has been designed to comply with the requirements of the City of Newton Floodplain/Watershed Protection Provisions and the Massachusetts Department of Environmental Protection (DEP) Stormwater Management Standards.

For full description of the existing and proposed conditions, Stormwater Management Analysis, MassDEP Stormwater Management Standards, please see the full report issued by Nitsch Engineering, Inc on April 15, 2022.

In conclusion, the Project's stormwater management system will reduce or maintain peak runoff rates and volumes using infiltration BMPs and improve the water quality of stormwater being discharged from the Site. Environmentally sensitive site design and low impact development techniques will be implemented throughout the Site.

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April 15, 2022

DRAFT

STORMWATER MEMORANDUM

For

LINCOLN ELIOT SCHOOL
Newton, MA

Prepared for:

Arrowstreet
10 Post Office Square
Suite 700N
Boston, MA 02109

Prepared by:

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Nitsch Project #13033

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FIGURES

APPENDICES

1.0 INTRODUCTION

Nitsch Engineering has prepared this Stormwater Report to support the Site Plan Review application to the City of Newton for the new Lincoln Eliot School located in Newton, MA. The Project site is located at 150 Jackson Road (subsequently referred to as the "Site"). The Project includes the demolition of an existing portion of a building, renovation of the portion of the building to remain, and an addition to create the new Lincoln Eliot School.

The site improvements include the following:

1. Construction of parking facilitates and pedestrian walkways;
2. Demolition of a portion existing building;
3. Renovation to the remaining portion of the building;
4. Construction of a new building wing;
5. Construction of playground areas and field area;
6. Installation of new utilities to support the proposed building; and
7. Construction of a new stormwater management system.

The proposed stormwater management system has been designed to comply with the requirements of the City of Newton Stormwater Regulations and the Massachusetts Department of Environmental Protection (DEP) Stormwater Management Standards.

2.0 EXISTING CONDITIONS

The Site is located at 150 Jackson Road. The existing building is housed on the former Aquinas College site and will be renovated to function as the Lincoln Eliot Elementary School. The 7.6-acre site includes the 1-acre footprint building and large paved parking areas over the site with an approximate 25-foot elevation change from the lower eastern side (Jackson Road) to the higher western side (Walnut Park) of the site.

2.1 Existing Drainage Infrastructure

Stormwater generated by the existing Site is collected using catch basins and is piped via a closed drainage system across Jackson Road and discharges to a reinforced concrete culvert of unknown size. The existing stormwater management system was constructed prior to the 2008 MassDEP Stormwater Management Standards, and the Site provides minimal peak flow attenuation, water quality treatment, and groundwater recharge.

An existing depression within the undeveloped area north of the Site collects stormwater runoff from the northern portion of the Site. The status and infiltration rate of the underlying soils is unknown; it is assumed the depression infiltrates quickly enough to prevent flooding of the adjacent properties.

Some portions of the existing Site generate runoff that sheet flows directly onto adjacent streets and properties without any mitigation or treatment measures. The proposed conditions will either match these drainage patterns or decrease the amount of stormwater running offsite.

2.2 NRSC Soil Designations

The Soil Classification Summary (Table 1) outlines the Natural Resources Conservation Services (NRCS) designation of the soil series at the Site. The majority of soils are classified as Urban land, which does not have a hydrologic soil group (HSG) rating. The Woodbridge-Urban land complex located in the eastern portion of the site are HSG C/D (minimal infiltration). The Merrimac-Urban land complex located in the western portion of the site are HSG A (high infiltration).

Table 1. NRCS Soil Classification Summary

Soil Unit	Soil Series	Hydrologic Soil Group
602	Urban Land	-
623C	Woodbridge-Urban land complex	C/D
626B	Merrimac-Urban land complex	A

2.3 On-Site Soil Investigations

Approximately 10 test pits and 4 borings were performed on Site on February 24, 2022, by Ransom Consulting, LLC. The results of the test pits and borings were consistent throughout the Site and indicated sand and gravel, which are classified as HSG A. Ledge was encountered in multiple test pits at varying depths. Groundwater, however, was not found in any of the pits or borings. Based on the geotechnical report finding coarse sand and gravel consistently in the test pits, it is assumed the HSG of the native soil is type A. Refer to the NRCS Soil Maps and Descriptions in Appendix C.

2.4 Wetland Resource Areas

There are no regulated wetlands within 200 feet of the Site. The Site is not within a regulated Flood Plain.

2.5 Total Maximum Daily Load (TMDL)

The Site ultimately discharges into the Charles River. The Site is located within the Charles Watershed and will potentially be subject to a Draft Pathogen Total Maximum Daily Load (TMDL) if it is finalized by MassDEP. The Project has been designed to minimize stormwater discharge and associated pathogen pollutants through extensive infiltration practices to meet the intent of the TMDL.

3.0 PROPOSED CONDITIONS

3.1 Project Description

The proposed Project includes demolition of an existing portion of a building, renovation of the portion of the building to remain, and an addition to create the new Lincoln Eliot School. The proposed site improvements include the following:

The site improvements include the following:

1. Construction of parking facilitates and pedestrian walkways;
2. Demolition of a portion existing building;
3. Renovation to the remaining portion of the building;
4. Construction of a new building wing;
5. Construction of playground areas and field area;
6. Installation of new utilities to support the proposed building; and
7. Construction of a new stormwater management system.

The Project is a redevelopment of the existing site. The Project is anticipated to decrease the overall impervious area for the Project by approximately 0.81 acres. A portion – approximately 0.15 acres – of the proposed loading area in the southwest corner of the Site is intended to be porous asphalt. Refer to Table 2 for a comparison of the existing and proposed land use for the Site.

Table 2. Proposed land use for Lincoln-Eliot School (in acres)

Land Use	Existing Site (acres)	Proposed Site (acres)	Change
Buildings	0.81	0.97	+0.16
Site Pavement	2.37	1.40	-0.97
Porous Asphalt	0.0	0.15	+0.15
Landscaped Areas	1.55	2.30	+0.75
Wooded Areas	0.46	0.37	-0.09
Total	5.19	5.19	---

3.2 Stormwater Management System

The Site will include the installation of a stormwater management system that is being designed to meet the MassDEP Stormwater Management Standards and the City of Newton Stormwater Regulations. As a redevelopment, the Project is required to meet the Stormwater Management Standards to the maximum extent practicable as described in Section 5.

The Project has been designed using environmentally-sensitive site design and LID techniques. This design prevents the generation of stormwater and non-point source pollution by reducing impervious surfaces with porous asphalt, disconnecting flow paths, treating and infiltrating stormwater at its source, and protecting natural processes. Stormwater systems have been designed to model natural hydrologic features, including promoting infiltration throughout the site.

The proposed stormwater management system for the Project will include porous asphalt, deep sump and hooded catch basins, infiltrating bioretention basins with sediment forebays, subsurface infiltration systems, and proprietary water quality structures. Overflow from the proposed BMPs will be discharged to the existing culvert which runs alongside Jackson Road.

Deep Sump and Hooded Catch Basins

Deep sump and hooded catch basins are proposed to provide pretreatment in the impervious areas of the parking lot and driveways. Stormwater captured in the catch basins will be directed to another treatment or infiltration BMP prior to discharge.

Catch basins will also be installed around the perimeter of the porous asphalt loading dock areas as an overflow bypass. However, the porous asphalt systems have been sized so that there is no overflow from the 100-year storm. Therefore, it is unlikely the overflow catch basins will ever be utilized.

Porous Asphalt

1 porous asphalt system totaling approximately 0.16 acres is proposed as part of this project. The system is proposed in the loading area to the southwest of the building.

The porous asphalt will replace traditional impervious area and allow runoff to be treated and infiltrated within the pavement section. The filter course and reservoir course were sized according to the

University of New Hampshire Design Specifications for Porous Asphalt Pavement and Infiltration Beds.

Catch basins will be located at the lowest point of each porous asphalt system. These catch basins are not expected to collect stormwater under normal conditions. The reservoir course of the porous asphalt has been designed to completely handle and infiltration the 100-year storm. The catch basins and associated piping systems, are essentially a back-up system for the porous asphalt system.

Subsurface Infiltration System

Stormwater will be collected and infiltrated using 1 subsurface infiltration system. Subsurface Infiltration System #1 is proposed to collect and infiltrate runoff from the proposed building, impervious, and landscaped site areas associated with northwestern portion of the site. The system consists of 224 StormTech SC-740 chambers enveloped by crushed stone. Subsurface Infiltration System 1 is designed to completely infiltrate the 2- and 10-year, 24-hour design storms, and significantly reduces the peak rate and runoff volumes in the 25- and 100-year design storms.

Site impervious area that is tributary to these systems will be pretreated using deep sump and hooded catch basins and proprietary water quality units to meet the 44% TSS removal requirement set forth by the MassDEP Stormwater Standards for discharge to highly permeable soils.

Preliminary test pit information detected the presence of relatively shallow bedrock underneath the proposed parking area where the infiltration system is currently proposed. Further investigation and analysis is required to determine the extent of the bedrock. The size, type, and location of the subsurface infiltration system may change depending on the results of the further investigations and analyses.

Bioretention Basin with Sediment Forebay

Two bioretention basins are proposed throughout the Site.

Bioretention Basin #1 is proposed to treat stormwater runoff generated by the eastern portion of the site. The bioretention basin includes a minimum 24-inch media filter to provide TSS and nutrient pollutant removal and will provide infiltration.

Pretreatment for the bioretention basin will be provided by a sediment forebay. The sediment forebay will be designed in accordance with the MassDEP Stormwater Management Handbook to provide a water quality volume (WQV) equivalent to 0.1 inches per impervious acre.

Bioretention Basins #2A, 2B, 2C are proposed to treat stormwater runoff generated by the western portion of the site. The bioretention basins includes a minimum 24-inch media filter to provide TSS and nutrient pollutant removal and will provide infiltration.

Pretreatment for the bioretention basins will be provided by a sediment forebay. The sediment forebay was designed in accordance with the MassDEP Stormwater Management Handbook to provide a water quality volume (WQV) equivalent to 0.1 inches per impervious acre.

Preliminary test pit information detected the presence of relatively shallow bedrock underneath the areas where the bioretention basins are currently proposed. If two feet of separation between the bottom of the bioretention basin soil media sections and the top of bedrock cannot be provided, the systems will not be designed to be infiltrating. In that case, the basins will be used primarily for water quality treatment to filter the water through the soil media, the systems will be lined, and underdrains

at the bottom of the bioretention sections will be installed to discharge water to the on-site closed drainage system.

Design and sizing of the bioretention areas will progress as the overall project design progresses. The bioretention areas are not currently included in the HydroCAD model. The bioretention basins are not needed to meet pre-/post-development rate requirements and are functioning primarily for water quality treatment.

Water Quality Structures

Ten (10) proprietary water quality structures are proposed for water quality pretreatment in areas of the Site where space is limited or additional pretreatment is required prior to infiltration. These BMPs have been designed to remove greater than 80% TSS in conjunction with their associated deep sump and hooded catch basins.

Stormwater Outfall with Level Spreader

A level spreader will be included at the stormwater discharge location into the cascading bioretention basin. The level spreader will receive concentrated flow and convert it to sheet flow so it can disperse uniformly across a stable slope.

3.3 Stormwater Management During Construction

The Site Contractor will be responsible for stormwater management of the active construction site and is required to adhere to the conditions of the 2022 Construction General Permit under the Environmental Protection Agency through the preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP). A draft SWPPP will be prepared in accordance with the MassDEP Stormwater Management Standards and the 2022 Construction General Permit before construction begins.

4.0 STORMWATER MANAGEMENT ANALYSIS

4.1 Methodology

Nitsch Engineering completed a hydrologic analysis of the existing project site utilizing Soil Conservation Service (SCS) Runoff Curve Number (CN) methodology. The SCS method calculates the rate at which the runoff reaches the design point considering several factors: the slope and flow lengths of the subcatchment area, the soil type of the subcatchment area, and the type of surface cover in the subcatchment area. HydroCAD Version 10.00 computer modeling software was used in conjunction with the SCS method to determine the peak runoff rates and runoff volumes for the 2-, 10-, 25-, and 100-year, 24-hour storm events. The proposed project site is being analyzed with the same methodology.

The Site was divided into multiple drainage areas, or subcatchments, which drain to the design points along the property boundary and within the site. For each subcatchment area, SCS Runoff Curve Numbers (CNs) were selected by using the cover type and hydrologic soil group of each area. The peak runoff rates and runoff volumes for the 2-, 10-, 25- and 100-year 24-hour storm events were then determined by inputting the drainage areas, CNs, and time of concentration (T_c) paths into the HydroCAD model.

The National Oceanic and Atmospheric Administration Atlas 14 precipitation frequency estimates were used to calculate the 2-, 10-, 25-, and 100- year 24-hour storm events in HydroCAD. Refer to the HydroCAD calculations in Appendix A and B for rainfall information.

4.2 HydroCAD Version 10.00

The HydroCAD computer program uses SCS and TR-20 methods to model drainage systems. TR-20 (Technical Release 20) was developed by the Soil Conservation Service to estimate runoff and peak discharges in small watersheds. TR-20 is generally accepted by engineers and reviewing authorities as the standard method for estimating runoff and peak discharges.

HydroCAD Version 10.00 uses up to four types of components to analyze the hydrology of a given site: subcatchments, reaches, basins, and links. Subcatchments are areas of land that produce surface runoff. The area, weighted CN, and T_c characterize each individual subcatchment area. Reaches are generally uniform streams, channels, or pipes that convey water from one point to another. A basin is any impoundment that fills with water from one or more sources and empties via an outlet structure. Links are used to introduce hydrographs into a project from another source or to provide a junction for more than one hydrograph within a project. The time span for the model was set for 0-48 hours in order to prevent truncation of the hydrograph.

Modeling of Porous Asphalt Section

The porous asphalt systems were modeled according to methodology developed by the University of New Hampshire Stormwater Center (UNHSC). Under ideal conditions, porous asphalt with a suitable base will rapidly infiltrate several inches of water, resulting in no runoff in the traditional sense. However, the HydroCAD model needs to evaluate the “runoff” that is penetrating through the porous asphalt. This requires the use of a high CN (98) to capture most of the rainfall.

Once intercepted by the porous asphalt surface, the water will take some time to travel through the base layers of the roadway, before ponding in the voids of the stone base. The UNHSC has studied this behavior and developed an extended T_c value to simulate the travel time through the base. Their research determined that a T_c of 790 minutes has produced good predictions of the final discharge from porous asphalt with a 41-inch base (measured above the underdrains). It is believed that a proportional Tc can be used for a smaller base thickness, as long as the layers remain proportional and are in accordance with the UNH specifications.

4.3 Existing Hydrologic Conditions

As summarized in Section 2.1, Nitsch Engineering delineated the project site into numerous on-site subcatchment (watershed) areas discharging to four (4) design points utilizing an existing conditions survey and on-site observations (See Figure DR-1). The design points (DP) are defined as Jackson Road (DP-1), the off-site woods to the north (DP-2), Waban Street (DP-3) and the off-site property to the southeast (DP-4). The HydroCAD model for existing conditions is provided in Appendix A and results from the HydroCAD calculations are summarized below in Table 3.

4.4 Proposed Hydrologic Conditions

The proposed project has been designed to mitigate the change in stormwater runoff at each of the design points as required by the DEP Stormwater Management Standards and the City of Newton Stormwater Regulations. The existing watershed areas were modified to reflect the proposed topography, storm drainage structures and BMPs, and roof areas. (See Figure DR-2). The HydroCAD model for proposed conditions is provided in Appendix B and results from the calculations are summarized in Table 3.

4.5 Peak Flow Rates

The proposed stormwater management system is expected to reduce the proposed peak runoff rates to at or below the existing rates for Design Points DP-1, DP-2, DP-3, and DP-4. Table 3 below summarize the existing and proposed hydrologic analyses for the site at each design point.

Table 3 – Peak Rates of Runoff in Cubic Feet per Second (cfs)

	Storm Event	2-year	10-year	25-year	100-year
DP-1	Existing	8.60	16.83	22.10	30.11
	Proposed	1.87	5.85	8.78	13.63
DP-2	Existing	0.00	0.01	0.05	0.30
	Proposed	0.00	0.0	0.0	0.04
DP-3	Existing	0.01	0.36	0.90	1.93
	Proposed	0.00	0.04	0.18	0.47
DP-4	Existing	0.00	0.00	0.01	0.06
	Proposed	0.00	0.00	0.01	0.06

Stormwater Goals from the City of Newton

The City of Newton is in the process of creating a Stormwater Ordinance. Because that Ordinance has not been approved yet, the City stated several stormwater goals for the Project to try to achieve. These goals include:

1. Recharge 2-inches times the proposed impervious area of the Site;
2. Provide 80% Total Suspended Solids Removal;
3. Provide 50% Total Phosphorus Removal; and
4. Incorporate Green Infrastructure where possible.

The current stormwater design meets all of the above goals.

5.0 MassDEP Stormwater Management Standards

The Project is considered a ***redevelopment*** under the DEP Stormwater Management System. As such, the project is required to meet Standards 2, 3, and the pretreatment and structural best management practice requirements of Standards 4,5, and 6 only to the maximum extent practicable. Existing stormwater discharges need to comply with Standard 1 only to the maximum extent practicable. The project will comply with all other Standards. The site will be designed to meet or meet to the maximum extent practicable the MassDEP Stormwater Management Standards as summarized below:

Standard 1: No New Untreated Discharges

The Project will not discharge any untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. Stormwater from the Site will be collected and treated in accordance with the MassDEP Stormwater Management Standards and stormwater outfalls will be stabilized to prevent erosion.

Standard 2: Peak Rate Attenuation

The proposed stormwater management system is designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates. To prevent storm damage and downstream flooding, the proposed stormwater management practices will mitigate peak runoff rates for the 2-, 10-, 25- and 100-year, 24-hour storm events. Refer to Table 3 above for a pre- and post-development peak runoff rate comparison.

Standard 3: Groundwater Recharge

The Site was designed using environmentally-sensitive site design, low impact development techniques, and stormwater BMP treatment trains to minimize the loss of annual recharge to groundwater. Per the City of Newton Stormwater requirements, the post-development site will provide recharge volume greater than two (2) inches over the total impervious area of the Site (11,293 cubic feet).

The infiltration BMPs are sized to exceed the recharge volume required under the City of Newton Stormwater requirements (Table 4).

Table 4 – Proposed Recharge Volumes for Stormwater BMPs

Infiltration BMP	Recharge Volume (cf)
Subsurface Infiltration System 1	13,713
Total	13,713

The HydroCAD reports provided in Appendix B indicate that all proposed infiltration BMPs will drain within 72 hours for the 2-, 10-, 25-, and 100-year storm events, meeting the 72-hour MassDEP drawdown requirement.

A minimum 2 feet but less than 4 feet of separation has been maintained between the bottom of the infiltration system and seasonal high groundwater.

Standard 4: Water Quality Treatment

The proposed stormwater management system will be designed to remove greater than 80% of the average annual post-construction load of Total Suspended Solids (TSS) and 50% of Total Phosphorus. Structural stormwater BMPs including deep sump and hooded catch basins, bioretention basins, porous asphalt, and water quality units sized to capture the required water quality volume (1 inch) and remove a minimum of 80% of Total Suspended Solids and 50% Total Phosphorus.

Table 5. Proposed Treatment Train Summary

Watershed	Treatment Train
PR-1B, 1D, 1F	Deep Sump Catch Basin -> Water Quality Unit -> Infiltration System
Pr-1C	Deep Sump Catch Basin -> Water Quality Unit
PR-1E	Porous Pavement

The proposed water quality treatment BMPs are subject to the 44% TSS removal pretreatment requirement and the 1-inch rule for calculating water quality volumes because the site contains soils with a rapid infiltration rate (greater than 2.4 inches per hour).

Pretreatment for all infiltration BMPs will meet or exceed the 44% TSS removal requirement. Pretreatment for the proposed bioretention basin will be provided using deep sump and hooded catch basins and a sediment forebay. Pretreatment for the subsurface infiltration systems will be provided using deep sump and hooded catch basins and water quality units that have been sized using the flow rate associated with the water quality volume. The porous asphalt sections were designed in accordance with the University of New Hampshire Design Specifications for Porous Asphalt Pavement and Infiltration Beds and include a 12-inch filter course of bank run gravel to provide water quality treatment prior to flowing into the reservoir course.

Source control and pollution prevention measures, such as vacuum cleaning, street sweeping, proper snow management, and stabilization of eroded surfaces, will be included in the Long-Term Pollution Prevention Plan and Operation and Maintenance Plan.

Standard 5: Land Uses with Higher Potential Pollutant Loads

The project is not considered a LUHPPL and therefore, this standard is not applicable.

Standard 6: Critical Areas

The Project is not located within any critical areas. Therefore, this standard is not applicable.

Standard 7: Redevelopments

The Project is considered a redevelopment under the MassDEP Stormwater Management Standards. Therefore, the project is required to meet Standard 2, Standard 3, and the pretreatment and structural stormwater BMP requirements of Standards 4, 5, and 6 to the maximum extent practicable. The projects should comply with all other requirements of the Stormwater Management Standards and improve existing conditions. The Project meets this standard.

Standard 8: Construction Period Pollution Prevention and Sedimentation Control

A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) will be developed and implemented during the Notice of Intent permitting process.

Because the Project will disturb more than one (1) acre of land, a Notice of Intent will be submitted to the Environmental Protection Agency (EPA) for coverage under the National Pollution Discharge Elimination System (NPDES) Construction General Permit. As part of this application the Applicant is required to prepare a Stormwater Pollution Prevention Plan (SWPPP) and implement the measures in the SWPPP. The SWPPP, which is to be kept on site, includes erosion and sediment controls (stabilization practices and structural practices), temporary and permanent stormwater management measures, Contractor inspection schedules and reporting of all SWPPP features, materials management, waste disposal, off-site vehicle tracking, spill prevention and response, sanitation, and non-stormwater discharges.

Standard 9: Operation and Maintenance Plan

A post-construction operation and maintenance plan will be prepared and will be implemented to ensure that stormwater management systems function as designed. Source control and stormwater

BMP operation requirements for the site are summarized in the Long-Term Pollution Prevention Plan and Operation and Maintenance Plan.

Standard 10: Prohibition of Illicit Discharges

There will be no illicit discharges to the stormwater management system associated with the Project.

6.0 CONCLUSION

In conclusion, the Project's stormwater management system will reduce or maintain peak runoff rates and volumes through the use of infiltration BMPs and improve the water quality of stormwater being discharged from the Site. Environmentally sensitive site design and low impact development techniques will be implemented throughout the Site. The Project is being designed to meet and exceed the MassDEP Stormwater Management Standards and City of Newton Stormwater Regulations.

FIGURES

Existing Drainage Areas

Description Quantity Unit

CLIENT:

NEWTON PUBLIC SCHOOLS
Equity & Excellence

ARCHITECT:

ARROWSTREET
ARCHITECTURE & DESIGN

10 POST OFFICE SQUARE
SUITE 700N
BOSTON MA 02109
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PROJECT INFORMATION:

Lincoln-Eliot Elementary School

150 Jackson Road, Newton, MA 02458

ISSUANCE:

DRAFT SCHEMATIC DESIGN

STAMP:

REVISIONS:

No.	Date	Description

PROJECT NORTH / TRUE NORTH

KEY PLAN

DRAWING TITLE:

EXISTING DRAINAGE PLAN

Project No.	**13033**
Drawn By	**BSR**
Date	**03/24/2022**
Scale	**AS NOTED**

DRAWING NUMBER:

EX-DA

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Proposed Drainage Areas

CLIENT:

NEWTON PUBLIC SCHOOLS
Rigor & Excellence

ARCHITECT:

ARROWSTREET
ARCHITECTURE & DESIGN

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PROJECT INFORMATION:

Lincoln-Eliot Elementary School

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ISSUANCE:

DRAFT SCHEMATIC DESIGN

STAMP:

REVISIONS:

No.	Date	Description

PROJECT NORTH / TRUE NORTH

KEY PLAN

DRAWING TITLE:

PROPOSED DRAINAGE PLAN

Project No.	**13033**
Drawn By	**BSR**
Date	**04/08/2022**
Scale	**AS NOTED**

DRAWING NUMBER:

PR-DA

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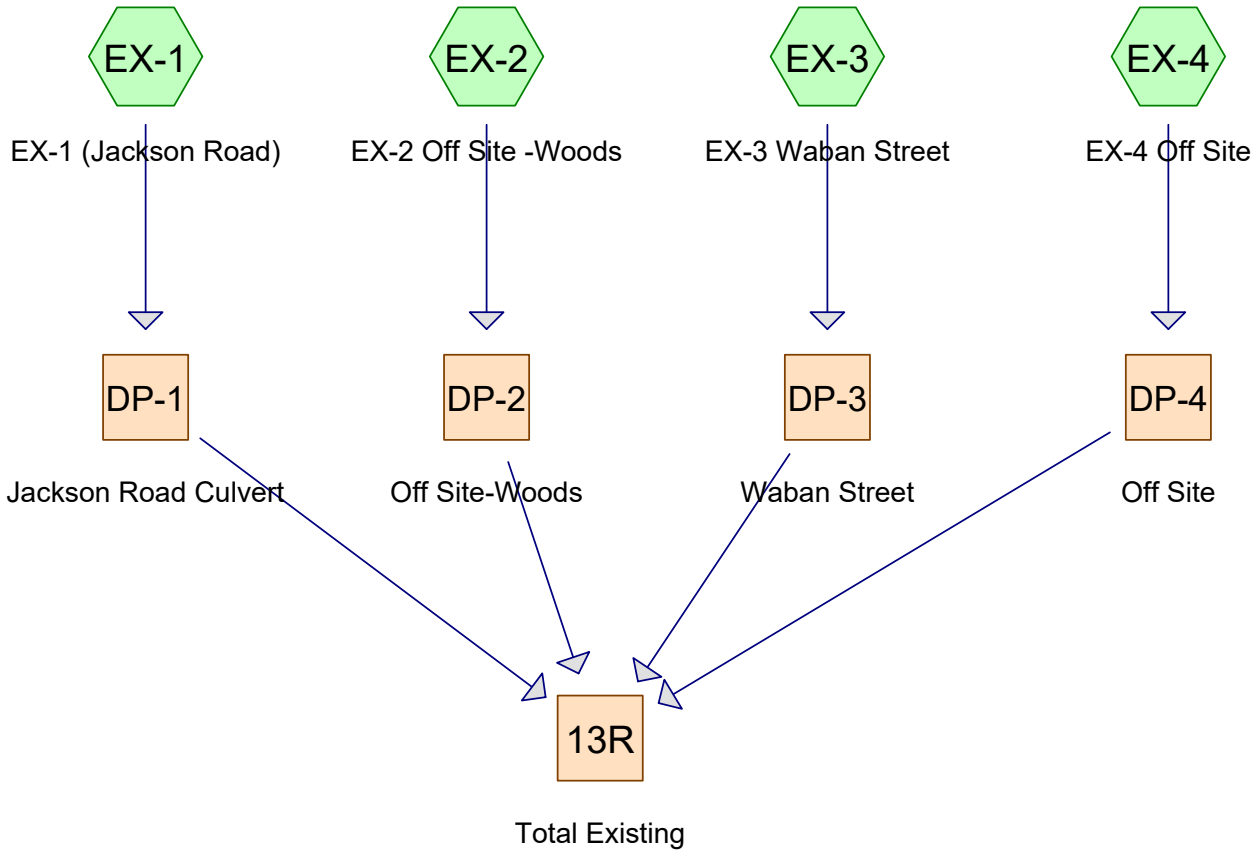
APPENDIX A

Pre-Development Conditions – HydroCAD Calculations

EXISTING



Subcat Reach Pond Link

Routing Diagram for 13033 - Lincoln Elliot HydroCAD
Prepared by Nitsch Engineering, Printed 4/14/2022

13033 - Lincoln Elliot HydroCAD

Prepared by Nitsch Engineering

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-inch	NOAA 24-hr	C	Default	24.00	1	2.00	2
2	2-year	NOAA 24-hr	C	Default	24.00	1	3.25	2
3	10-year	NOAA 24-hr	C	Default	24.00	1	5.13	2
4	25-year	NOAA 24-hr	C	Default	24.00	1	6.31	2
5	100-year	NOAA 24-hr	C	Default	24.00	1	8.12	2

13033 - Lincoln Elliot HydroCAD

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
67,601	39	>75% Grass cover, Good, HSG A (EX-1, EX-2, EX-3, EX-4)
93,392	98	Paved parking, HSG A (EX-1)
35,301	98	Roofs, HSG A (EX-1)
9,783	98	Unconnected pavement, HSG A (EX-3)
20,131	36	Woods, Fair, HSG A (EX-1, EX-2)
226,208	**75**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
226,208	HSG A	EX-1, EX-2, EX-3, EX-4
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
226,208		**TOTAL AREA**

13033 - Lincoln Elliot HydroCAD

Ground Covers (selected nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
67,601	0	0	0	0	67,601	>75% Grass cover, Good	
93,392	0	0	0	0	93,392	Paved parking	
35,301	0	0	0	0	35,301	Roofs	
9,783	0	0	0	0	9,783	Unconnected pavement	
20,131	0	0	0	0	20,131	Woods, Fair	
226,208	**0**	**0**	**0**	**0**	**226,208**	**TOTAL AREA**	

Summary for Subcatchment EX-1: EX-1 (Jackson Road)

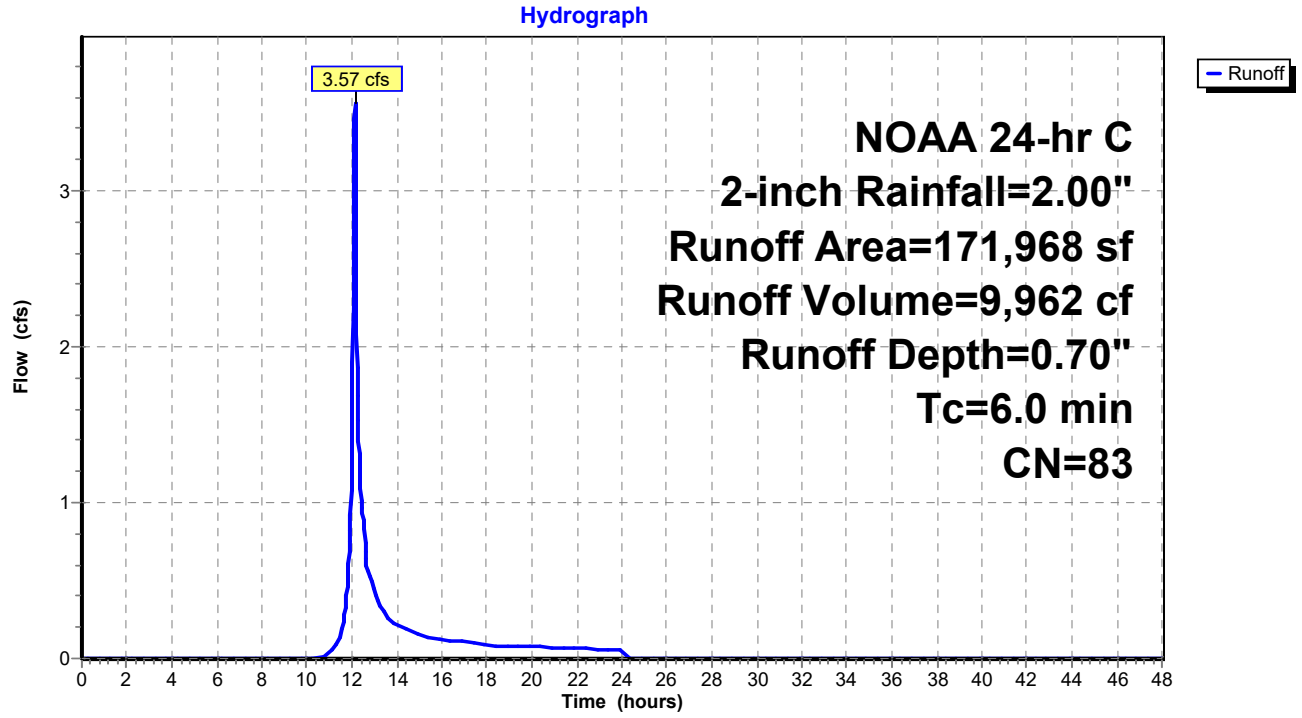
Runoff = 3.57 cfs @ 12.14 hrs, Volume= 9,962 cf, Depth= 0.70"
Routed to Reach DP-1 : Jackson Road Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-inch Rainfall=2.00"

Area (sf)	CN	Description
35,301	98	Roofs, HSG A
93,392	98	Paved parking, HSG A
4,345	36	Woods, Fair, HSG A
38,930	39	>75% Grass cover, Good, HSG A
171,968	83	Weighted Average
43,275		25.16% Pervious Area
128,693		74.84% Impervious Area

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

Subcatchment EX-1: EX-1 (Jackson Road)



Hydrograph for Subcatchment EX-1: EX-1 (Jackson Road)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.02	0.00	0.00
2.00	0.05	0.00	0.00
3.00	0.07	0.00	0.00
4.00	0.10	0.00	0.00
5.00	0.13	0.00	0.00
6.00	0.16	0.00	0.00
7.00	0.20	0.00	0.00
8.00	0.24	0.00	0.00
9.00	0.29	0.00	0.00
10.00	0.36	0.00	0.00
11.00	0.48	0.00	0.03
12.00	0.95	0.11	**1.49**
13.00	1.52	0.39	**0.43**
14.00	1.64	0.46	0.22
15.00	1.71	0.50	0.15
16.00	1.76	0.54	0.12
17.00	1.80	0.57	0.11
18.00	1.84	0.59	0.09
19.00	1.87	0.61	0.08
20.00	1.90	0.63	0.08
21.00	1.93	0.65	0.07
22.00	1.95	0.66	0.07
23.00	1.98	0.68	0.06
24.00	**2.00**	**0.70**	0.06
25.00	2.00	0.70	0.00
26.00	2.00	0.70	0.00
27.00	2.00	0.70	0.00
28.00	2.00	0.70	0.00
29.00	2.00	0.70	0.00
30.00	2.00	0.70	0.00
31.00	2.00	0.70	0.00
32.00	2.00	0.70	0.00
33.00	2.00	0.70	0.00
34.00	2.00	0.70	0.00
35.00	2.00	0.70	0.00
36.00	2.00	0.70	0.00
37.00	2.00	0.70	0.00
38.00	2.00	0.70	0.00
39.00	2.00	0.70	0.00
40.00	2.00	0.70	0.00
41.00	2.00	0.70	0.00
42.00	2.00	0.70	0.00
43.00	2.00	0.70	0.00
44.00	2.00	0.70	0.00
45.00	2.00	0.70	0.00
46.00	2.00	0.70	0.00
47.00	2.00	0.70	0.00
48.00	2.00	0.70	0.00

Summary for Subcatchment EX-2: EX-2 Off Site -Woods

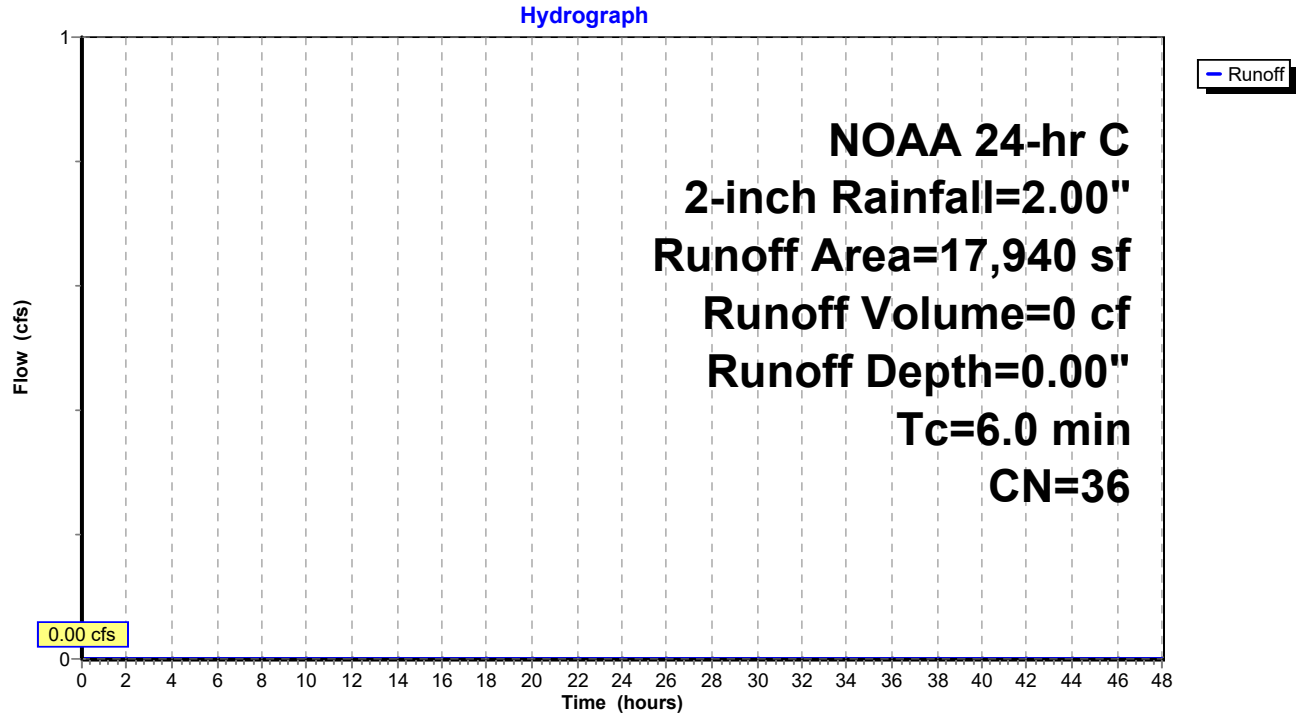
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach DP-2 : Off Site-Woods

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-inch Rainfall=2.00"

Area (sf)	CN	Description
2,154	39	>75% Grass cover, Good, HSG A
15,786	36	Woods, Fair, HSG A
17,940	36	Weighted Average
17,940		100.00% Pervious Area

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

Subcatchment EX-2: EX-2 Off Site -Woods



Hydrograph for Subcatchment EX-2: EX-2 Off Site -Woods

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	**0.00**	**0.00**
1.00	0.02	0.00	0.00
2.00	0.05	0.00	0.00
3.00	0.07	0.00	0.00
4.00	0.10	0.00	0.00
5.00	0.13	0.00	0.00
6.00	0.16	0.00	0.00
7.00	0.20	0.00	0.00
8.00	0.24	0.00	0.00
9.00	0.29	0.00	0.00
10.00	0.36	0.00	0.00
11.00	0.48	0.00	0.00
12.00	0.95	0.00	0.00
13.00	1.52	0.00	0.00
14.00	1.64	0.00	0.00
15.00	1.71	0.00	0.00
16.00	1.76	0.00	0.00
17.00	1.80	0.00	0.00
18.00	1.84	0.00	0.00
19.00	1.87	0.00	0.00
20.00	1.90	0.00	0.00
21.00	1.93	0.00	0.00
22.00	1.95	0.00	0.00
23.00	1.98	0.00	0.00
24.00	**2.00**	0.00	0.00
25.00	2.00	0.00	0.00
26.00	2.00	0.00	0.00
27.00	2.00	0.00	0.00
28.00	2.00	0.00	0.00
29.00	2.00	0.00	0.00
30.00	2.00	0.00	0.00
31.00	2.00	0.00	0.00
32.00	2.00	0.00	0.00
33.00	2.00	0.00	0.00
34.00	2.00	0.00	0.00
35.00	2.00	0.00	0.00
36.00	2.00	0.00	0.00
37.00	2.00	0.00	0.00
38.00	2.00	0.00	0.00
39.00	2.00	0.00	0.00
40.00	2.00	0.00	0.00
41.00	2.00	0.00	0.00
42.00	2.00	0.00	0.00
43.00	2.00	0.00	0.00
44.00	2.00	0.00	0.00
45.00	2.00	0.00	0.00
46.00	2.00	0.00	0.00
47.00	2.00	0.00	0.00
48.00	2.00	0.00	0.00

Summary for Subcatchment EX-3: EX-3 Waban Street

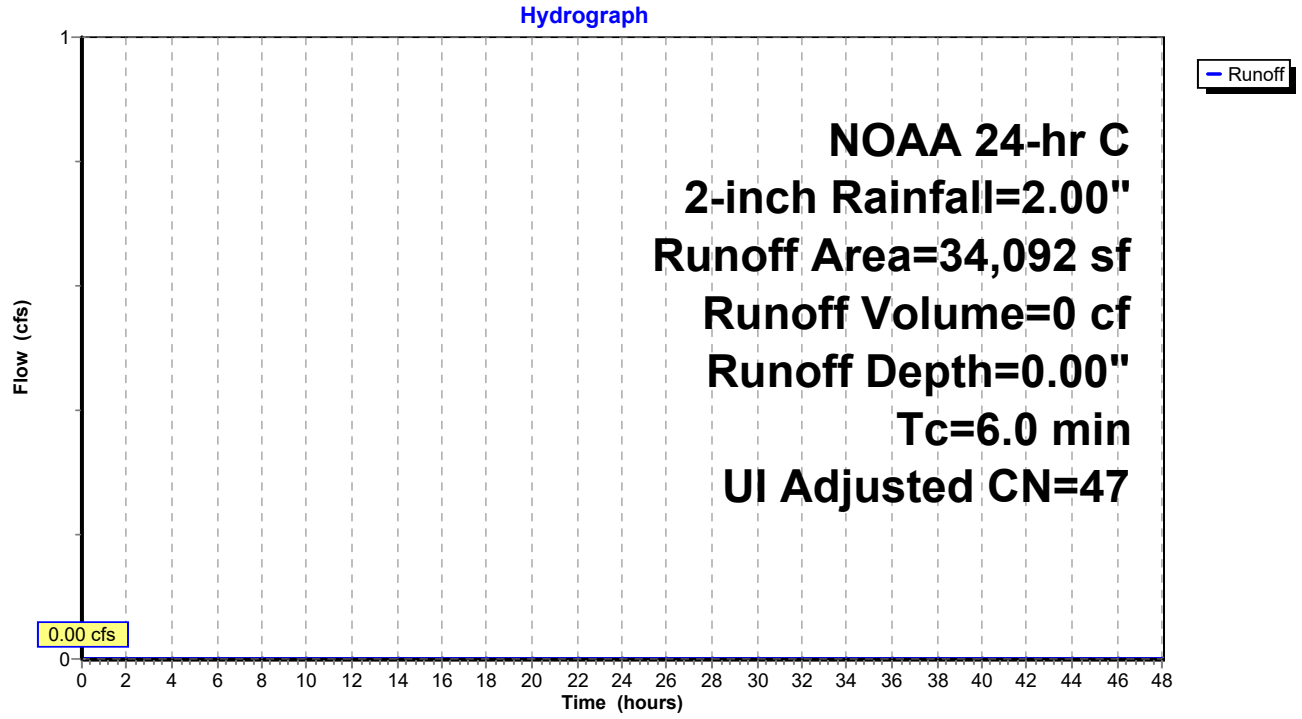
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach DP-3 : Waban Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-inch Rainfall=2.00"

Area (sf)	CN	Adj	Description
9,783	98		Unconnected pavement, HSG A
24,309	39		>75% Grass cover, Good, HSG A
34,092	56	47	Weighted Average, UI Adjusted
24,309			71.30% Pervious Area
9,783			28.70% Impervious Area
9,783			100.00% Unconnected

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

Subcatchment EX-3: EX-3 Waban Street



Hydrograph for Subcatchment EX-3: EX-3 Waban Street

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	**0.00**	**0.00**
1.00	0.02	0.00	0.00
2.00	0.05	0.00	0.00
3.00	0.07	0.00	0.00
4.00	0.10	0.00	0.00
5.00	0.13	0.00	0.00
6.00	0.16	0.00	0.00
7.00	0.20	0.00	0.00
8.00	0.24	0.00	0.00
9.00	0.29	0.00	0.00
10.00	0.36	0.00	0.00
11.00	0.48	0.00	0.00
12.00	0.95	0.00	0.00
13.00	1.52	0.00	0.00
14.00	1.64	0.00	0.00
15.00	1.71	0.00	0.00
16.00	1.76	0.00	0.00
17.00	1.80	0.00	0.00
18.00	1.84	0.00	0.00
19.00	1.87	0.00	0.00
20.00	1.90	0.00	0.00
21.00	1.93	0.00	0.00
22.00	1.95	0.00	0.00
23.00	1.98	0.00	0.00
24.00	**2.00**	0.00	0.00
25.00	2.00	0.00	0.00
26.00	2.00	0.00	0.00
27.00	2.00	0.00	0.00
28.00	2.00	0.00	0.00
29.00	2.00	0.00	0.00
30.00	2.00	0.00	0.00
31.00	2.00	0.00	0.00
32.00	2.00	0.00	0.00
33.00	2.00	0.00	0.00
34.00	2.00	0.00	0.00
35.00	2.00	0.00	0.00
36.00	2.00	0.00	0.00
37.00	2.00	0.00	0.00
38.00	2.00	0.00	0.00
39.00	2.00	0.00	0.00
40.00	2.00	0.00	0.00
41.00	2.00	0.00	0.00
42.00	2.00	0.00	0.00
43.00	2.00	0.00	0.00
44.00	2.00	0.00	0.00
45.00	2.00	0.00	0.00
46.00	2.00	0.00	0.00
47.00	2.00	0.00	0.00
48.00	2.00	0.00	0.00

Summary for Subcatchment EX-4: EX-4 Off Site

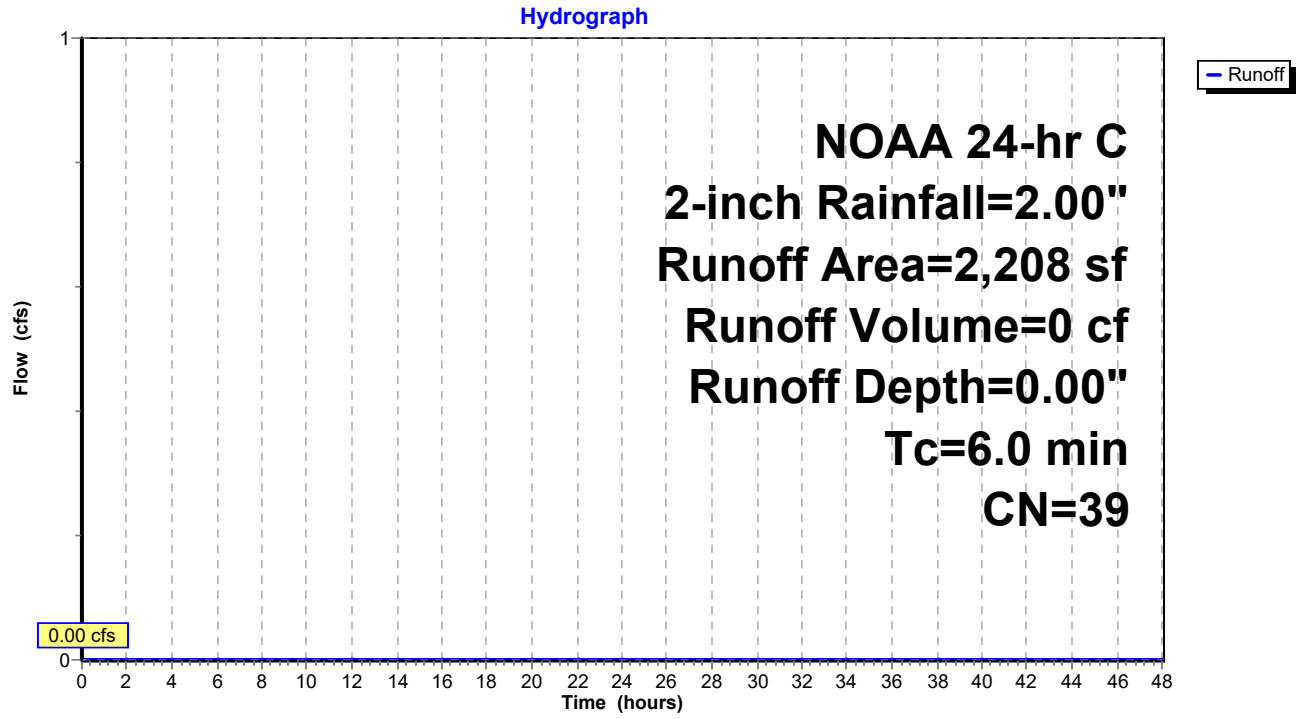
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach DP-4 : Off Site

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-inch Rainfall=2.00"

Area (sf)	CN	Description
2,208	39	>75% Grass cover, Good, HSG A
2,208		100.00% Pervious Area

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

Subcatchment EX-4: EX-4 Off Site



Hydrograph for Subcatchment EX-4: EX-4 Off Site

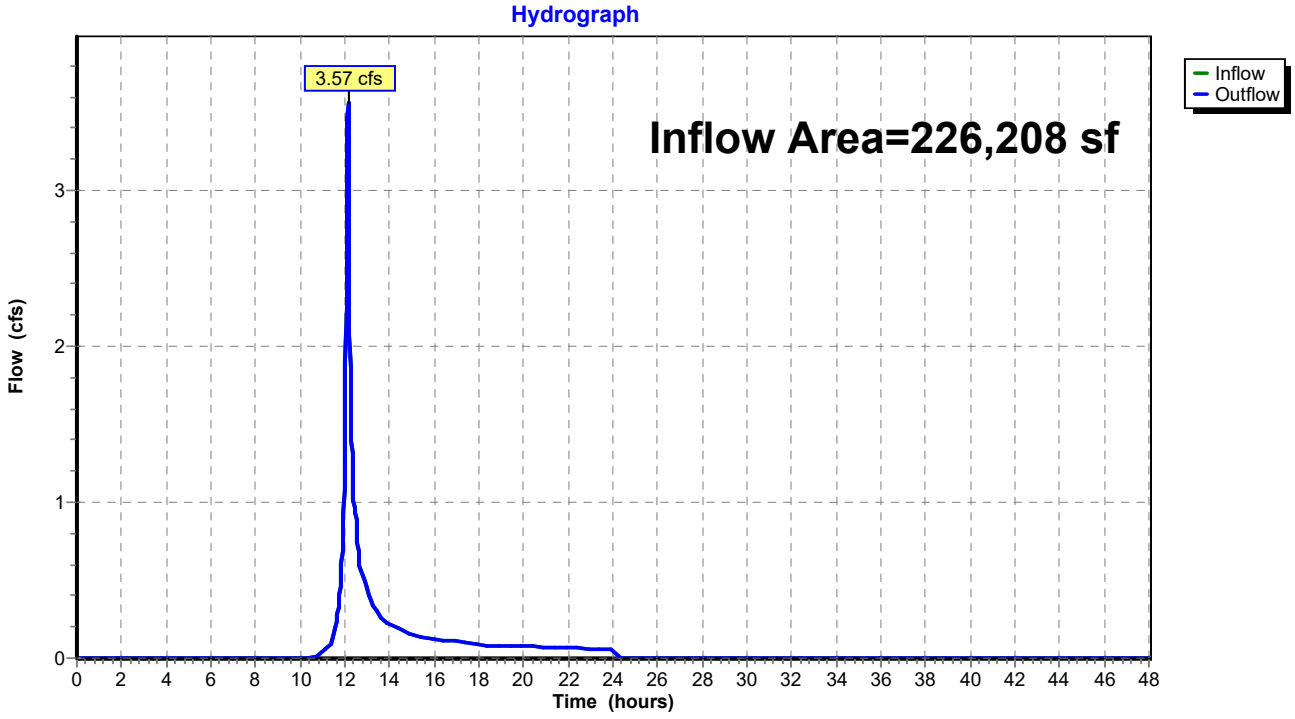
Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	**0.00**	**0.00**
1.00	0.02	0.00	0.00
2.00	0.05	0.00	0.00
3.00	0.07	0.00	0.00
4.00	0.10	0.00	0.00
5.00	0.13	0.00	0.00
6.00	0.16	0.00	0.00
7.00	0.20	0.00	0.00
8.00	0.24	0.00	0.00
9.00	0.29	0.00	0.00
10.00	0.36	0.00	0.00
11.00	0.48	0.00	0.00
12.00	0.95	0.00	0.00
13.00	1.52	0.00	0.00
14.00	1.64	0.00	0.00
15.00	1.71	0.00	0.00
16.00	1.76	0.00	0.00
17.00	1.80	0.00	0.00
18.00	1.84	0.00	0.00
19.00	1.87	0.00	0.00
20.00	1.90	0.00	0.00
21.00	1.93	0.00	0.00
22.00	1.95	0.00	0.00
23.00	1.98	0.00	0.00
24.00	**2.00**	0.00	0.00
25.00	2.00	0.00	0.00
26.00	2.00	0.00	0.00
27.00	2.00	0.00	0.00
28.00	2.00	0.00	0.00
29.00	2.00	0.00	0.00
30.00	2.00	0.00	0.00
31.00	2.00	0.00	0.00
32.00	2.00	0.00	0.00
33.00	2.00	0.00	0.00
34.00	2.00	0.00	0.00
35.00	2.00	0.00	0.00
36.00	2.00	0.00	0.00
37.00	2.00	0.00	0.00
38.00	2.00	0.00	0.00
39.00	2.00	0.00	0.00
40.00	2.00	0.00	0.00
41.00	2.00	0.00	0.00
42.00	2.00	0.00	0.00
43.00	2.00	0.00	0.00
44.00	2.00	0.00	0.00
45.00	2.00	0.00	0.00
46.00	2.00	0.00	0.00
47.00	2.00	0.00	0.00
48.00	2.00	0.00	0.00

Summary for Reach 13R: Total Existing

Inflow Area = 226,208 sf, 61.22% Impervious, Inflow Depth = 0.53" for 2-inch event
Inflow = 3.57 cfs @ 12.14 hrs, Volume= 9,962 cf
Outflow = 3.57 cfs @ 12.14 hrs, Volume= 9,962 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 13R: Total Existing



Hydrograph for Reach 13R: Total Existing

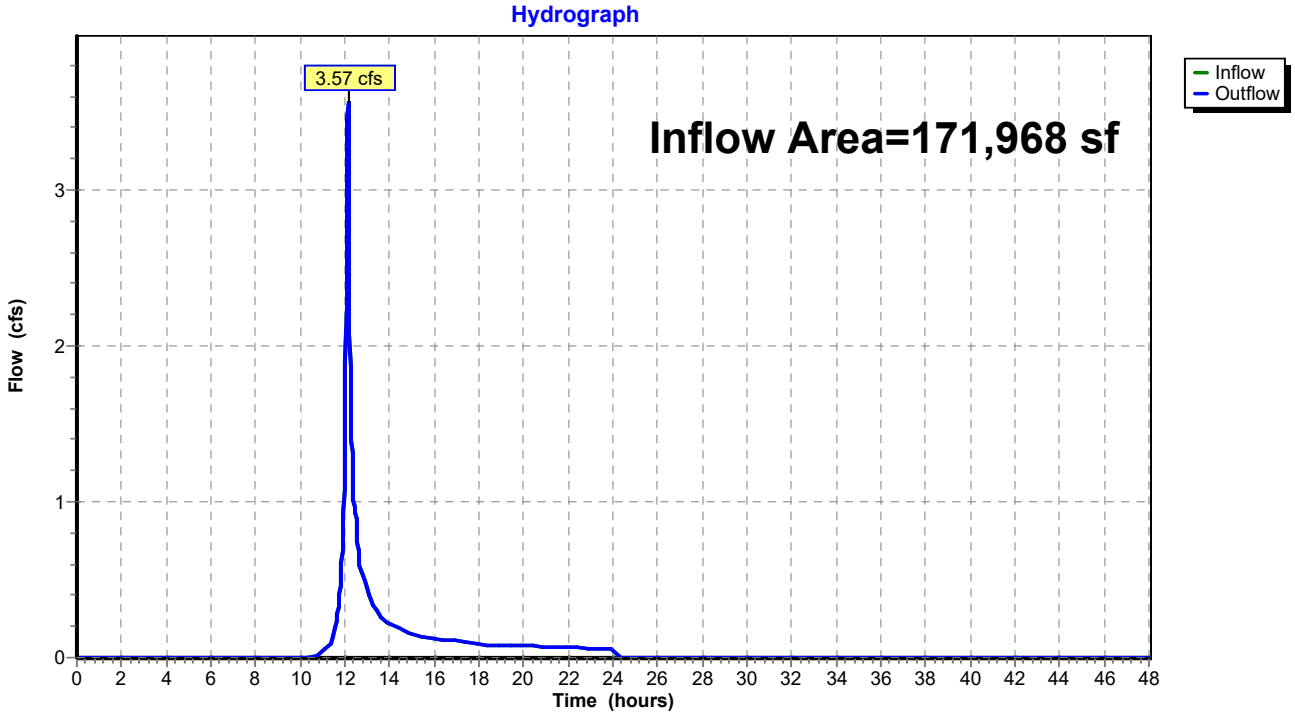
Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	0.00		0.00
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.00		0.00
10.00	0.00		0.00
11.00	0.03		0.03
12.00	**1.49**		**1.49**
13.00	**0.43**		**0.43**
14.00	0.22		0.22
15.00	0.15		0.15
16.00	0.12		0.12
17.00	0.11		0.11
18.00	0.09		0.09
19.00	0.08		0.08
20.00	0.08		0.08
21.00	0.07		0.07
22.00	0.07		0.07
23.00	0.06		0.06
24.00	0.06		0.06
25.00	0.00		0.00
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Reach DP-1: Jackson Road Culvert

Inflow Area = 171,968 sf, 74.84% Impervious, Inflow Depth = 0.70" for 2-inch event
Inflow = 3.57 cfs @ 12.14 hrs, Volume= 9,962 cf
Outflow = 3.57 cfs @ 12.14 hrs, Volume= 9,962 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach 13R : Total Existing

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach DP-1: Jackson Road Culvert



Hydrograph for Reach DP-1: Jackson Road Culvert

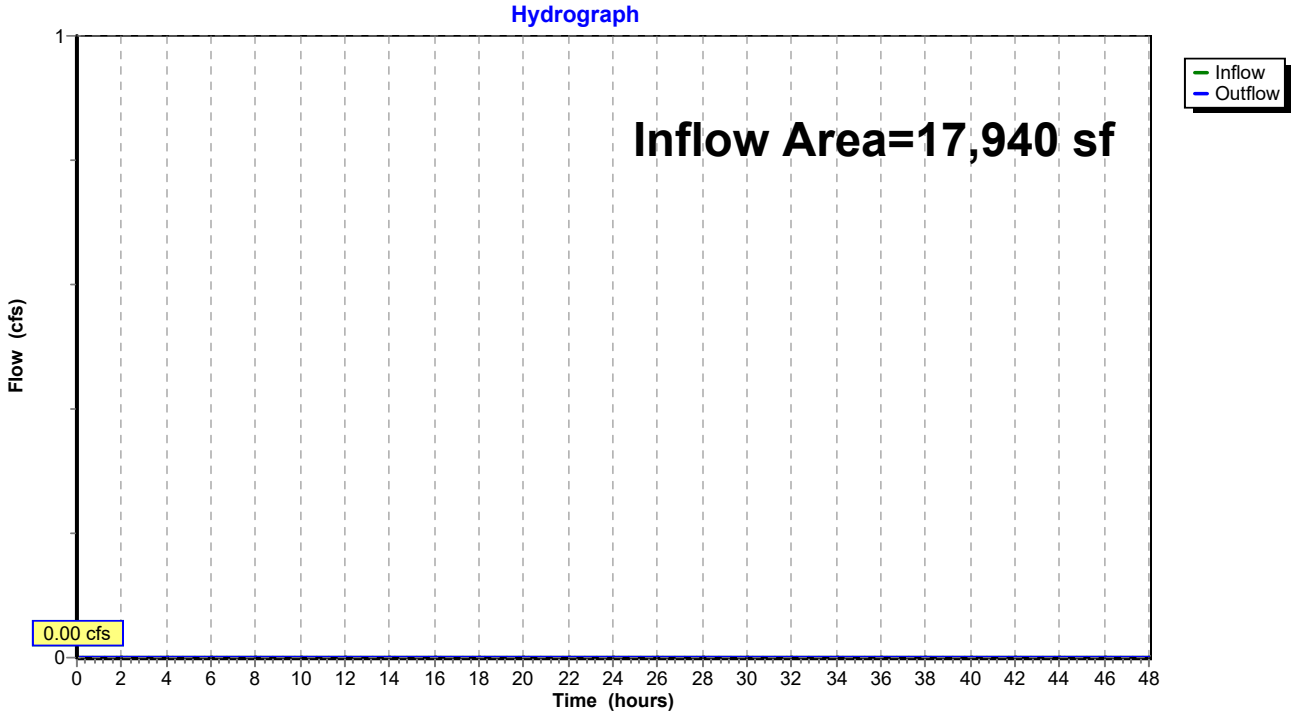
Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	0.00		0.00
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.00		0.00
10.00	0.00		0.00
11.00	0.03		0.03
12.00	**1.49**		**1.49**
13.00	**0.43**		**0.43**
14.00	0.22		0.22
15.00	0.15		0.15
16.00	0.12		0.12
17.00	0.11		0.11
18.00	0.09		0.09
19.00	0.08		0.08
20.00	0.08		0.08
21.00	0.07		0.07
22.00	0.07		0.07
23.00	0.06		0.06
24.00	0.06		0.06
25.00	0.00		0.00
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Reach DP-2: Off Site-Woods

Inflow Area = 17,940 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-inch event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach 13R : Total Existing

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach DP-2: Off Site-Woods



Hydrograph for Reach DP-2: Off Site-Woods

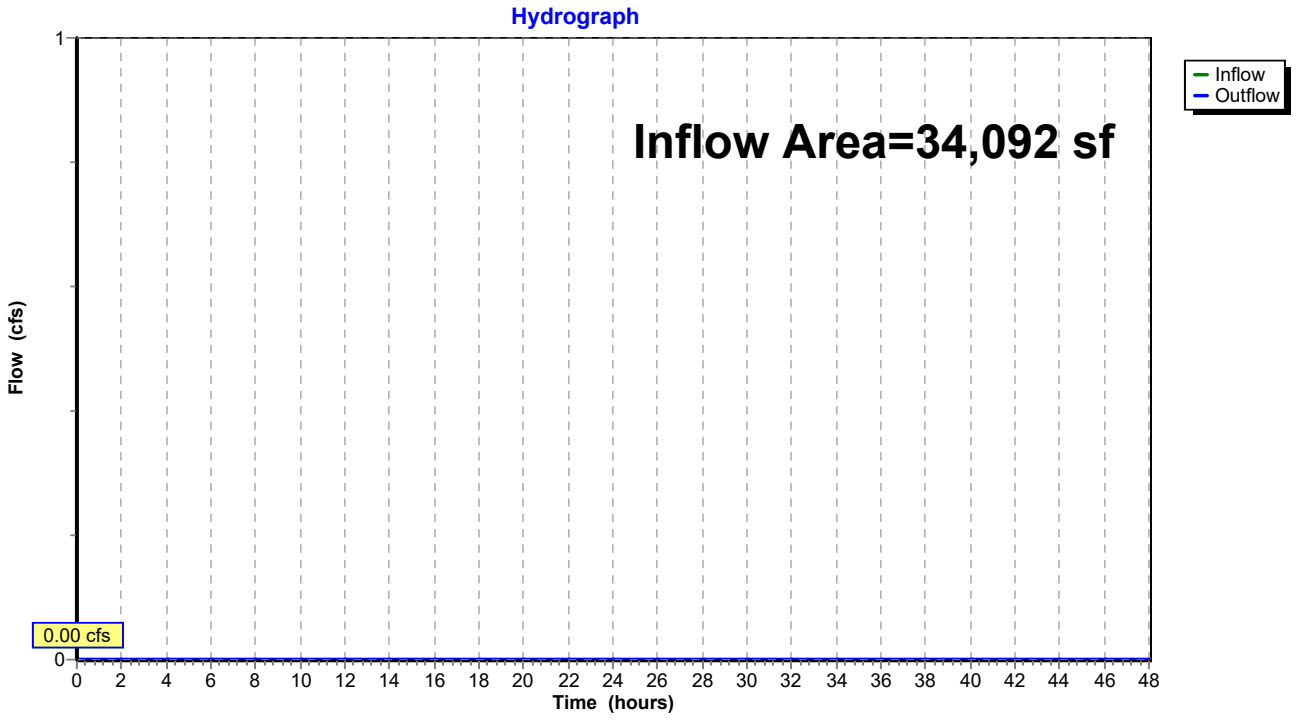
Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	**0.00**		**0.00**
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.00		0.00
10.00	0.00		0.00
11.00	0.00		0.00
12.00	0.00		0.00
13.00	0.00		0.00
14.00	0.00		0.00
15.00	0.00		0.00
16.00	0.00		0.00
17.00	0.00		0.00
18.00	0.00		0.00
19.00	0.00		0.00
20.00	0.00		0.00
21.00	0.00		0.00
22.00	0.00		0.00
23.00	0.00		0.00
24.00	0.00		0.00
25.00	0.00		0.00
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Reach DP-3: Waban Street

Inflow Area = 34,092 sf, 28.70% Impervious, Inflow Depth = 0.00" for 2-inch event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach 13R : Total Existing

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach DP-3: Waban Street



Hydrograph for Reach DP-3: Waban Street

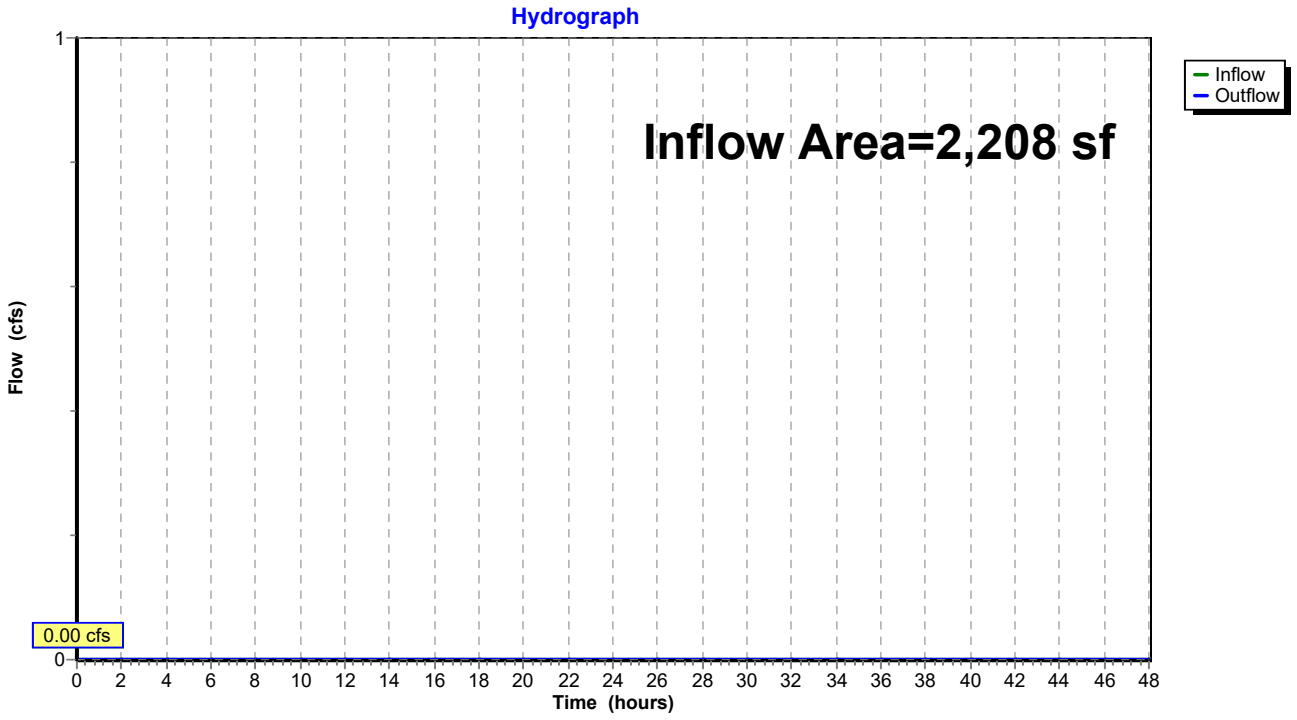
Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	**0.00**		**0.00**
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.00		0.00
10.00	0.00		0.00
11.00	0.00		0.00
12.00	0.00		0.00
13.00	0.00		0.00
14.00	0.00		0.00
15.00	0.00		0.00
16.00	0.00		0.00
17.00	0.00		0.00
18.00	0.00		0.00
19.00	0.00		0.00
20.00	0.00		0.00
21.00	0.00		0.00
22.00	0.00		0.00
23.00	0.00		0.00
24.00	0.00		0.00
25.00	0.00		0.00
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Reach DP-4: Off Site

Inflow Area = 2,208 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-inch event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach 13R : Total Existing

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach DP-4: Off Site



Hydrograph for Reach DP-4: Off Site

Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	**0.00**		**0.00**
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.00		0.00
10.00	0.00		0.00
11.00	0.00		0.00
12.00	0.00		0.00
13.00	0.00		0.00
14.00	0.00		0.00
15.00	0.00		0.00
16.00	0.00		0.00
17.00	0.00		0.00
18.00	0.00		0.00
19.00	0.00		0.00
20.00	0.00		0.00
21.00	0.00		0.00
22.00	0.00		0.00
23.00	0.00		0.00
24.00	0.00		0.00
25.00	0.00		0.00
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Subcatchment EX-1: EX-1 (Jackson Road)

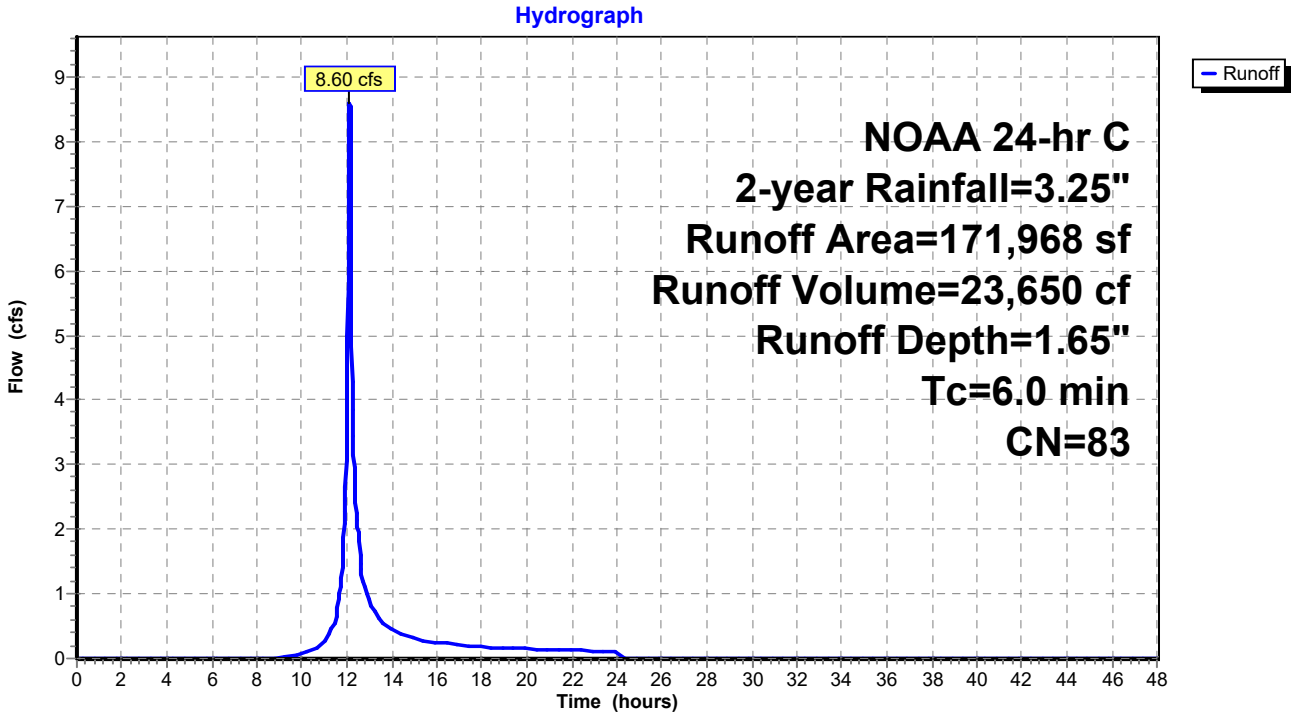
Runoff = 8.60 cfs @ 12.13 hrs, Volume= 23,650 cf, Depth= 1.65"
Routed to Reach DP-1 : Jackson Road Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-year Rainfall=3.25"

Area (sf)	CN	Description
35,301	98	Roofs, HSG A
93,392	98	Paved parking, HSG A
4,345	36	Woods, Fair, HSG A
38,930	39	>75% Grass cover, Good, HSG A
171,968	83	Weighted Average
43,275		25.16% Pervious Area
128,693		74.84% Impervious Area

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

Subcatchment EX-1: EX-1 (Jackson Road)



Hydrograph for Subcatchment EX-1: EX-1 (Jackson Road)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.04	0.00	0.00
2.00	0.07	0.00	0.00
3.00	0.11	0.00	0.00
4.00	0.16	0.00	0.00
5.00	0.21	0.00	0.00
6.00	0.26	0.00	0.00
7.00	0.32	0.00	0.00
8.00	0.39	0.00	0.00
9.00	0.47	0.00	0.02
10.00	0.59	0.01	0.08
11.00	0.78	0.06	0.27
12.00	1.55	0.41	**4.09**
13.00	2.47	1.03	**0.91**
14.00	2.66	1.18	0.45
15.00	2.78	1.27	0.31
16.00	2.86	1.34	0.25
17.00	2.93	1.39	0.21
18.00	2.99	1.44	0.17
19.00	3.04	1.48	0.16
20.00	3.09	1.52	0.15
21.00	3.14	1.56	0.14
22.00	3.18	1.59	0.13
23.00	3.21	1.62	0.12
24.00	**3.25**	**1.65**	0.13
25.00	3.25	1.65	0.00
26.00	3.25	1.65	0.00
27.00	3.25	1.65	0.00
28.00	3.25	1.65	0.00
29.00	3.25	1.65	0.00
30.00	3.25	1.65	0.00
31.00	3.25	1.65	0.00
32.00	3.25	1.65	0.00
33.00	3.25	1.65	0.00
34.00	3.25	1.65	0.00
35.00	3.25	1.65	0.00
36.00	3.25	1.65	0.00
37.00	3.25	1.65	0.00
38.00	3.25	1.65	0.00
39.00	3.25	1.65	0.00
40.00	3.25	1.65	0.00
41.00	3.25	1.65	0.00
42.00	3.25	1.65	0.00
43.00	3.25	1.65	0.00
44.00	3.25	1.65	0.00
45.00	3.25	1.65	0.00
46.00	3.25	1.65	0.00
47.00	3.25	1.65	0.00
48.00	3.25	1.65	0.00

Summary for Subcatchment EX-2: EX-2 Off Site -Woods

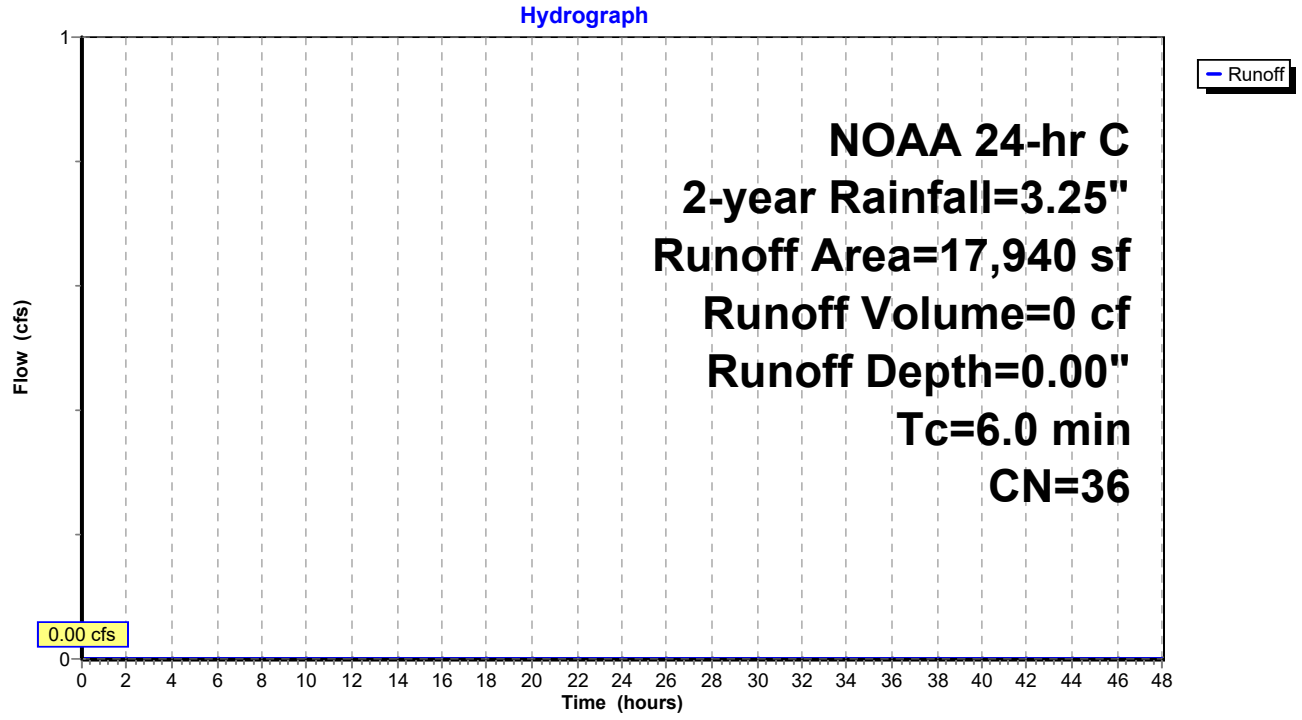
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach DP-2 : Off Site-Woods

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-year Rainfall=3.25"

Area (sf)	CN	Description
2,154	39	>75% Grass cover, Good, HSG A
15,786	36	Woods, Fair, HSG A
17,940	36	Weighted Average
17,940		100.00% Pervious Area

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

Subcatchment EX-2: EX-2 Off Site -Woods



Hydrograph for Subcatchment EX-2: EX-2 Off Site -Woods

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	**0.00**	**0.00**
1.00	0.04	0.00	0.00
2.00	0.07	0.00	0.00
3.00	0.11	0.00	0.00
4.00	0.16	0.00	0.00
5.00	0.21	0.00	0.00
6.00	0.26	0.00	0.00
7.00	0.32	0.00	0.00
8.00	0.39	0.00	0.00
9.00	0.47	0.00	0.00
10.00	0.59	0.00	0.00
11.00	0.78	0.00	0.00
12.00	1.55	0.00	0.00
13.00	2.47	0.00	0.00
14.00	2.66	0.00	0.00
15.00	2.78	0.00	0.00
16.00	2.86	0.00	0.00
17.00	2.93	0.00	0.00
18.00	2.99	0.00	0.00
19.00	3.04	0.00	0.00
20.00	3.09	0.00	0.00
21.00	3.14	0.00	0.00
22.00	3.18	0.00	0.00
23.00	3.21	0.00	0.00
24.00	**3.25**	0.00	0.00
25.00	3.25	0.00	0.00
26.00	3.25	0.00	0.00
27.00	3.25	0.00	0.00
28.00	3.25	0.00	0.00
29.00	3.25	0.00	0.00
30.00	3.25	0.00	0.00
31.00	3.25	0.00	0.00
32.00	3.25	0.00	0.00
33.00	3.25	0.00	0.00
34.00	3.25	0.00	0.00
35.00	3.25	0.00	0.00
36.00	3.25	0.00	0.00
37.00	3.25	0.00	0.00
38.00	3.25	0.00	0.00
39.00	3.25	0.00	0.00
40.00	3.25	0.00	0.00
41.00	3.25	0.00	0.00
42.00	3.25	0.00	0.00
43.00	3.25	0.00	0.00
44.00	3.25	0.00	0.00
45.00	3.25	0.00	0.00
46.00	3.25	0.00	0.00
47.00	3.25	0.00	0.00
48.00	3.25	0.00	0.00

Summary for Subcatchment EX-3: EX-3 Waban Street

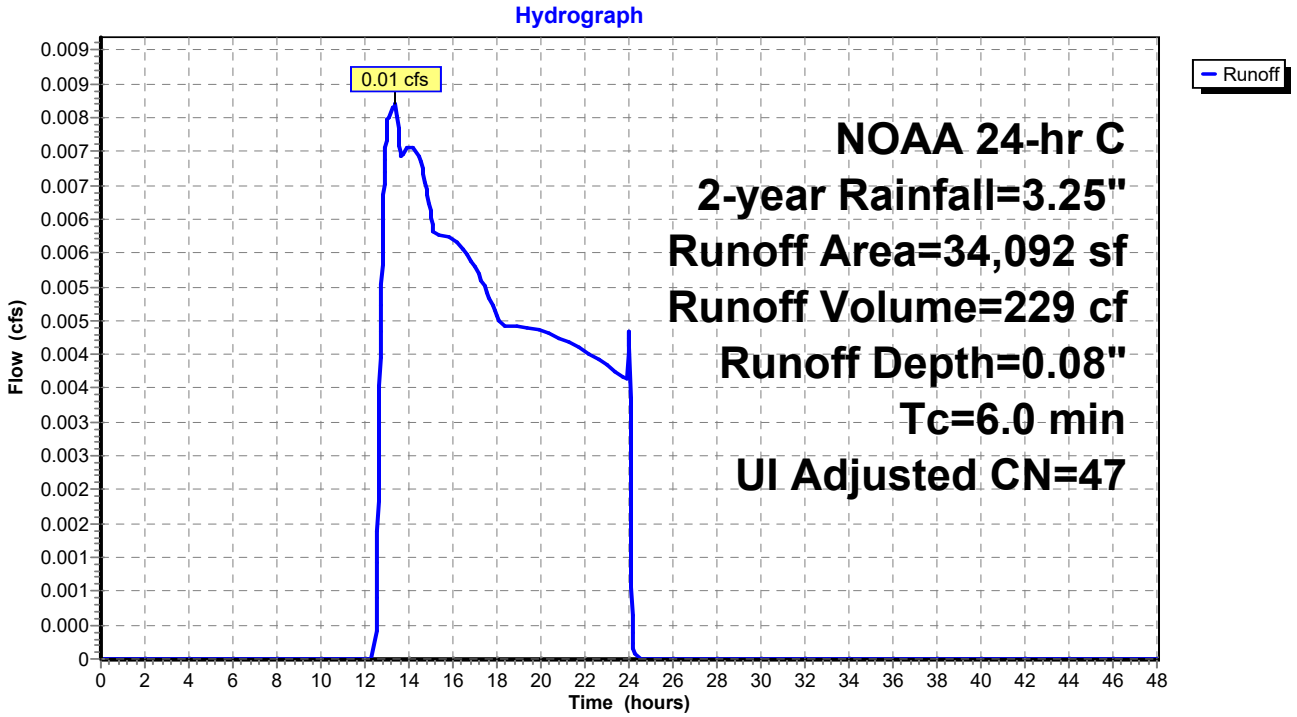
Runoff = 0.01 cfs @ 13.34 hrs, Volume= 229 cf, Depth= 0.08"
Routed to Reach DP-3 : Waban Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-year Rainfall=3.25"

Area (sf)	CN	Adj	Description
9,783	98		Unconnected pavement, HSG A
24,309	39		>75% Grass cover, Good, HSG A
34,092	56	47	Weighted Average, UI Adjusted
24,309			71.30% Pervious Area
9,783			28.70% Impervious Area
9,783			100.00% Unconnected

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

Subcatchment EX-3: EX-3 Waban Street



Hydrograph for Subcatchment EX-3: EX-3 Waban Street

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.04	0.00	0.00
2.00	0.07	0.00	0.00
3.00	0.11	0.00	0.00
4.00	0.16	0.00	0.00
5.00	0.21	0.00	0.00
6.00	0.26	0.00	0.00
7.00	0.32	0.00	0.00
8.00	0.39	0.00	0.00
9.00	0.47	0.00	0.00
10.00	0.59	0.00	0.00
11.00	0.78	0.00	0.00
12.00	1.55	0.00	0.00
13.00	2.47	0.00	**0.01**
14.00	2.66	0.01	**0.01**
15.00	2.78	0.02	0.01
16.00	2.86	0.03	0.01
17.00	2.93	0.04	0.01
18.00	2.99	0.05	0.01
19.00	3.04	0.05	0.00
20.00	3.09	0.06	0.00
21.00	3.14	0.06	0.00
22.00	3.18	0.07	0.00
23.00	3.21	0.08	0.00
24.00	**3.25**	**0.08**	0.00
25.00	3.25	0.08	0.00
26.00	3.25	0.08	0.00
27.00	3.25	0.08	0.00
28.00	3.25	0.08	0.00
29.00	3.25	0.08	0.00
30.00	3.25	0.08	0.00
31.00	3.25	0.08	0.00
32.00	3.25	0.08	0.00
33.00	3.25	0.08	0.00
34.00	3.25	0.08	0.00
35.00	3.25	0.08	0.00
36.00	3.25	0.08	0.00
37.00	3.25	0.08	0.00
38.00	3.25	0.08	0.00
39.00	3.25	0.08	0.00
40.00	3.25	0.08	0.00
41.00	3.25	0.08	0.00
42.00	3.25	0.08	0.00
43.00	3.25	0.08	0.00
44.00	3.25	0.08	0.00
45.00	3.25	0.08	0.00
46.00	3.25	0.08	0.00
47.00	3.25	0.08	0.00
48.00	3.25	0.08	0.00

Summary for Subcatchment EX-4: EX-4 Off Site

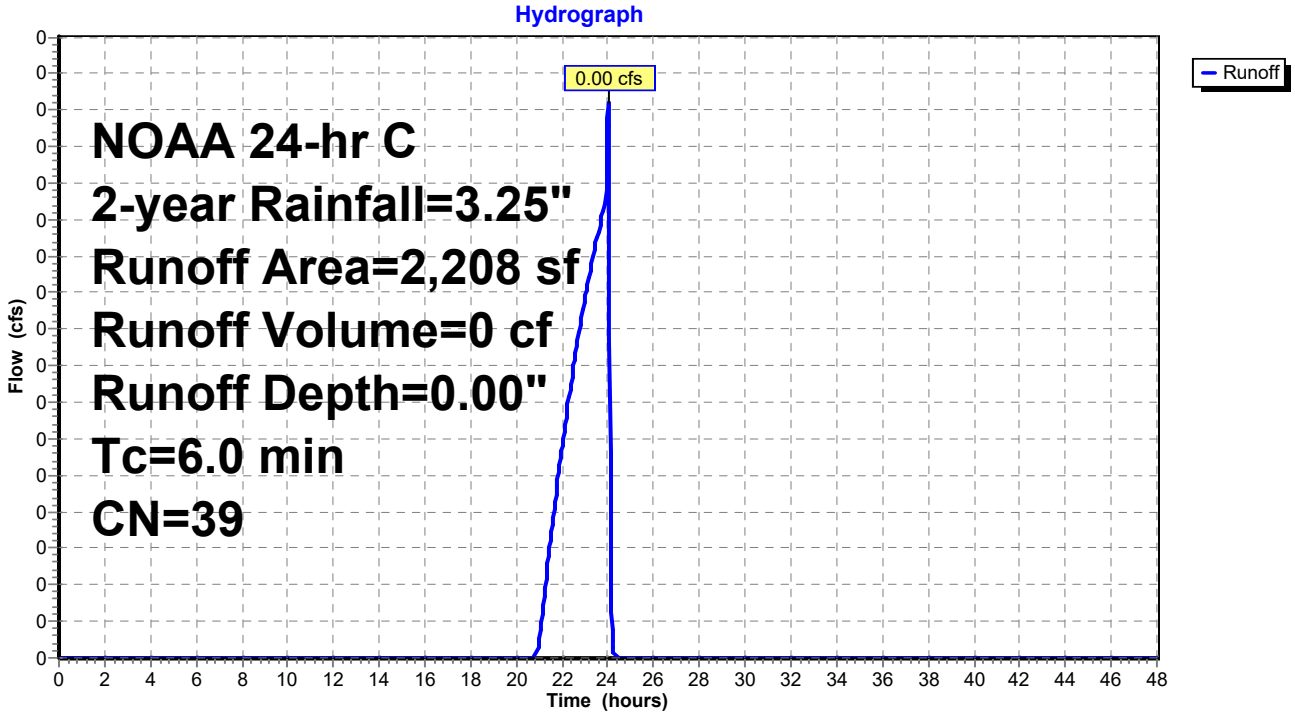
Runoff = 0.00 cfs @ 24.02 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach DP-4 : Off Site

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-year Rainfall=3.25"

Area (sf)	CN	Description
2,208	39	>75% Grass cover, Good, HSG A
2,208		100.00% Pervious Area

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

Subcatchment EX-4: EX-4 Off Site



Hydrograph for Subcatchment EX-4: EX-4 Off Site

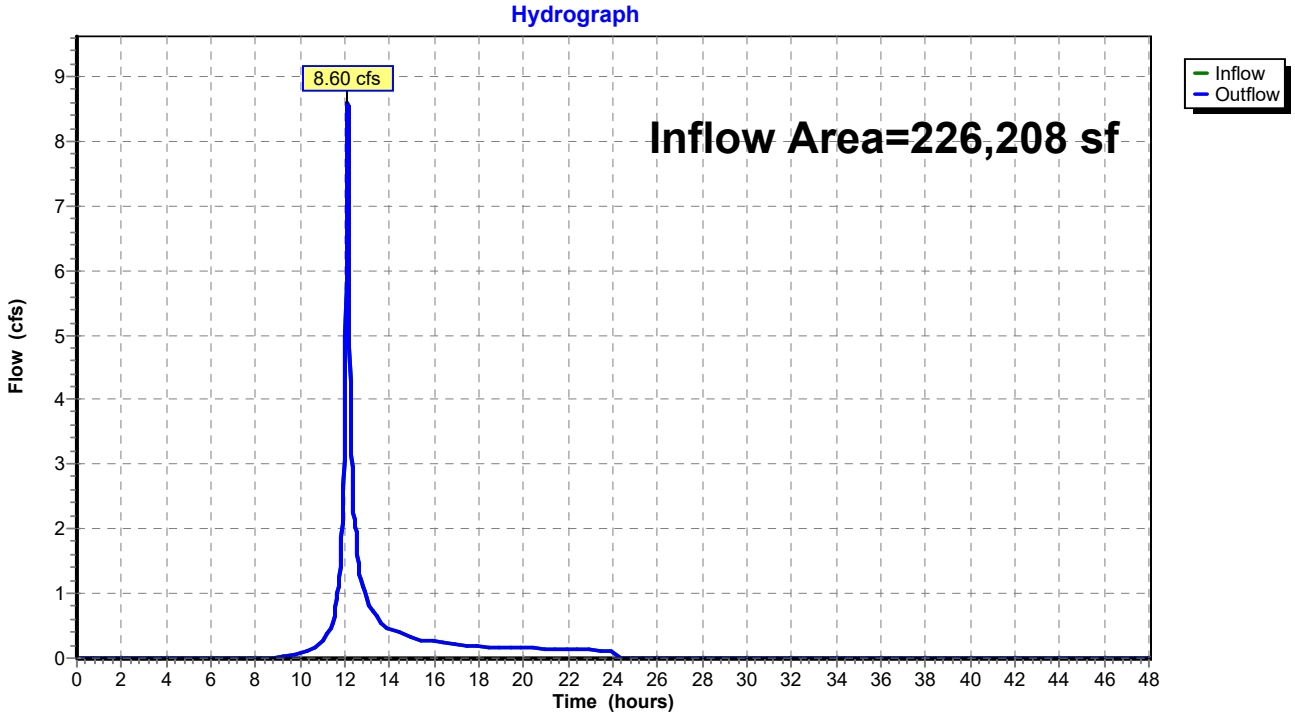
Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.04	0.00	0.00
2.00	0.07	0.00	0.00
3.00	0.11	0.00	0.00
4.00	0.16	0.00	0.00
5.00	0.21	0.00	0.00
6.00	0.26	0.00	0.00
7.00	0.32	0.00	0.00
8.00	0.39	0.00	0.00
9.00	0.47	0.00	0.00
10.00	0.59	0.00	0.00
11.00	0.78	0.00	0.00
12.00	1.55	0.00	0.00
13.00	2.47	0.00	0.00
14.00	2.66	0.00	0.00
15.00	2.78	0.00	0.00
16.00	2.86	0.00	0.00
17.00	2.93	0.00	0.00
18.00	2.99	0.00	0.00
19.00	3.04	0.00	0.00
20.00	3.09	0.00	0.00
21.00	3.14	0.00	0.00
22.00	3.18	0.00	0.00
23.00	3.21	0.00	0.00
24.00	**3.25**	**0.00**	**0.00**
25.00	3.25	0.00	**0.00**
26.00	3.25	0.00	0.00
27.00	3.25	0.00	0.00
28.00	3.25	0.00	0.00
29.00	3.25	0.00	0.00
30.00	3.25	0.00	0.00
31.00	3.25	0.00	0.00
32.00	3.25	0.00	0.00
33.00	3.25	0.00	0.00
34.00	3.25	0.00	0.00
35.00	3.25	0.00	0.00
36.00	3.25	0.00	0.00
37.00	3.25	0.00	0.00
38.00	3.25	0.00	0.00
39.00	3.25	0.00	0.00
40.00	3.25	0.00	0.00
41.00	3.25	0.00	0.00
42.00	3.25	0.00	0.00
43.00	3.25	0.00	0.00
44.00	3.25	0.00	0.00
45.00	3.25	0.00	0.00
46.00	3.25	0.00	0.00
47.00	3.25	0.00	0.00
48.00	3.25	0.00	0.00

Summary for Reach 13R: Total Existing

Inflow Area = 226,208 sf, 61.22% Impervious, Inflow Depth = 1.27" for 2-year event
Inflow = 8.60 cfs @ 12.13 hrs, Volume= 23,879 cf
Outflow = 8.60 cfs @ 12.13 hrs, Volume= 23,879 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 13R: Total Existing



Hydrograph for Reach 13R: Total Existing

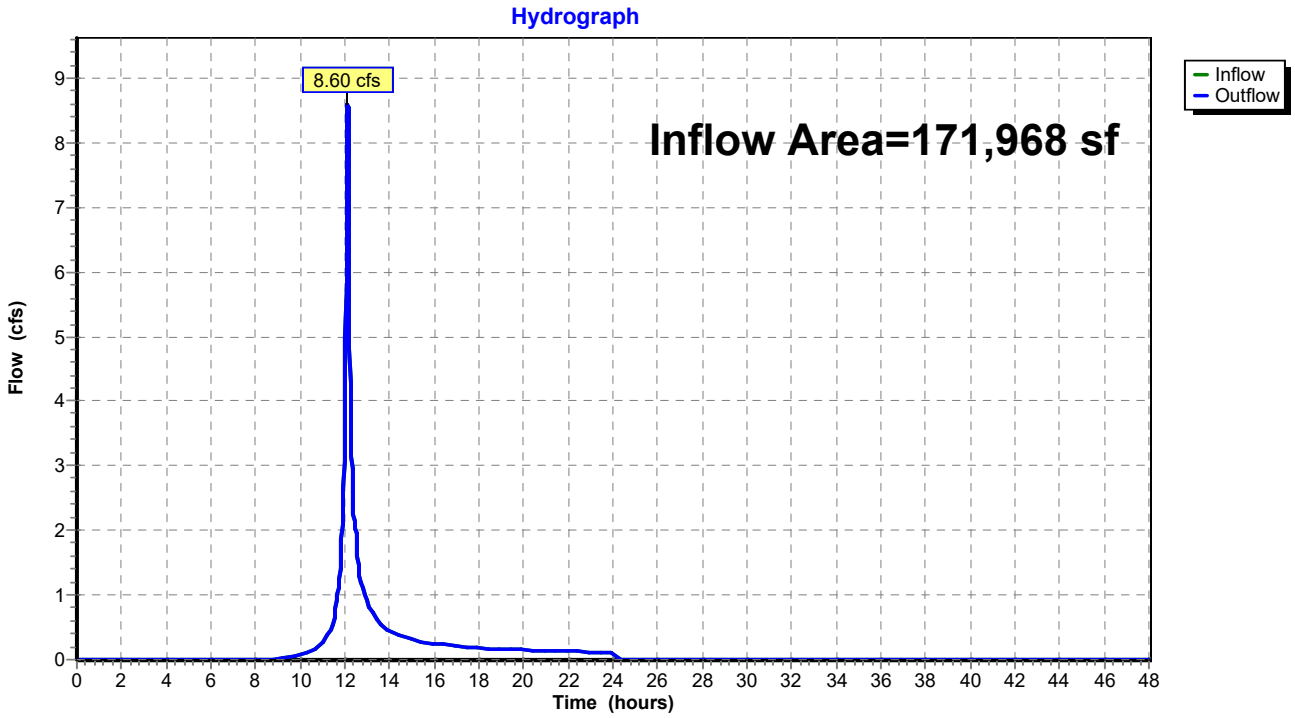
Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	0.00		0.00
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.02		0.02
10.00	0.08		0.08
11.00	0.27		0.27
12.00	**4.09**		**4.09**
13.00	**0.92**		**0.92**
14.00	0.46		0.46
15.00	0.31		0.31
16.00	0.26		0.26
17.00	0.22		0.22
18.00	0.18		0.18
19.00	0.16		0.16
20.00	0.15		0.15
21.00	0.14		0.14
22.00	0.13		0.13
23.00	0.12		0.12
24.00	0.13		0.13
25.00	0.00		0.00
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Reach DP-1: Jackson Road Culvert

Inflow Area = 171,968 sf, 74.84% Impervious, Inflow Depth = 1.65" for 2-year event
Inflow = 8.60 cfs @ 12.13 hrs, Volume= 23,650 cf
Outflow = 8.60 cfs @ 12.13 hrs, Volume= 23,650 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach 13R : Total Existing

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach DP-1: Jackson Road Culvert



Hydrograph for Reach DP-1: Jackson Road Culvert

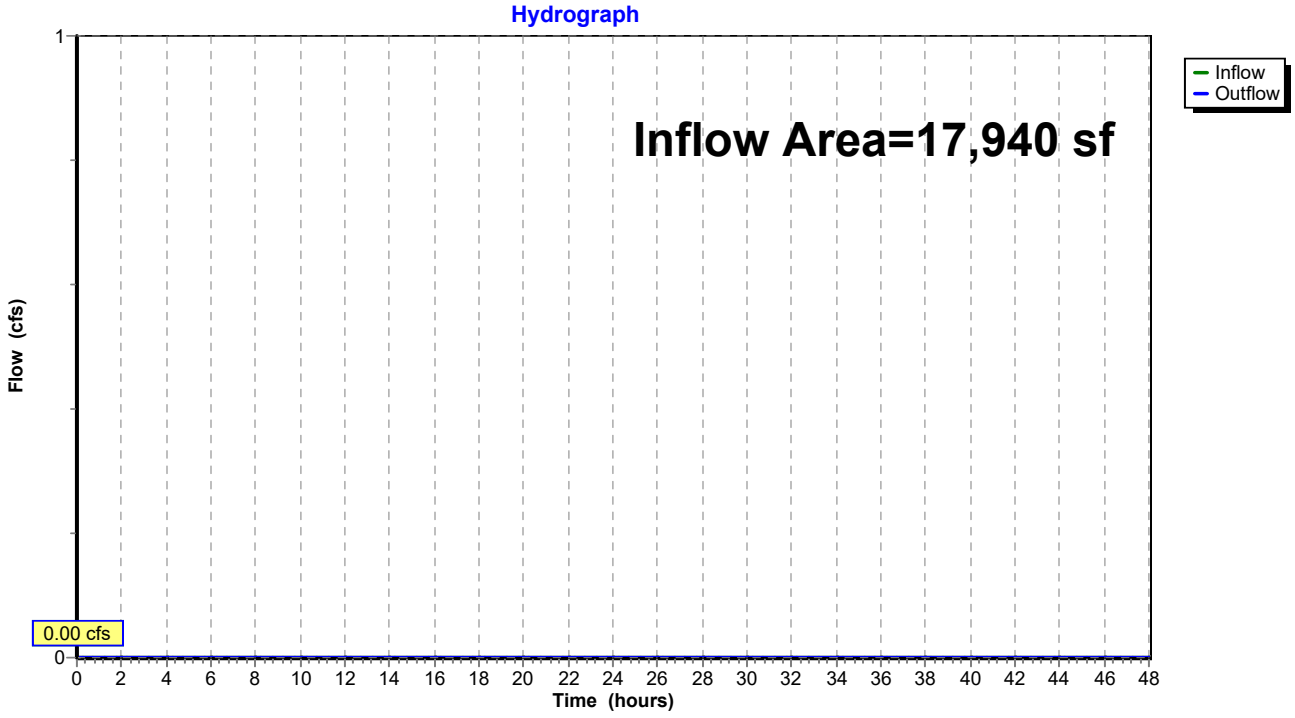
Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	0.00		0.00
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.02		0.02
10.00	0.08		0.08
11.00	0.27		0.27
12.00	**4.09**		**4.09**
13.00	**0.91**		**0.91**
14.00	0.45		0.45
15.00	0.31		0.31
16.00	0.25		0.25
17.00	0.21		0.21
18.00	0.17		0.17
19.00	0.16		0.16
20.00	0.15		0.15
21.00	0.14		0.14
22.00	0.13		0.13
23.00	0.12		0.12
24.00	0.13		0.13
25.00	0.00		0.00
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Reach DP-2: Off Site-Woods

Inflow Area = 17,940 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach 13R : Total Existing

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach DP-2: Off Site-Woods



Hydrograph for Reach DP-2: Off Site-Woods

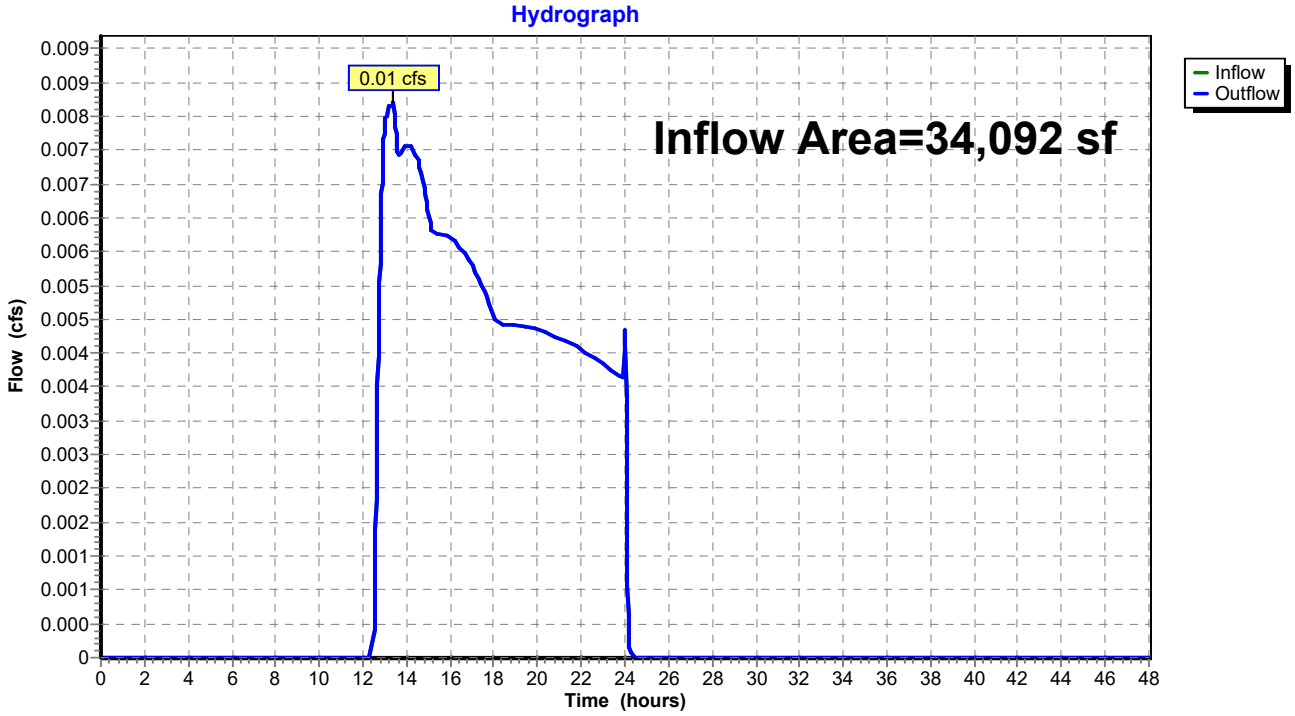
Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	**0.00**		**0.00**
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.00		0.00
10.00	0.00		0.00
11.00	0.00		0.00
12.00	0.00		0.00
13.00	0.00		0.00
14.00	0.00		0.00
15.00	0.00		0.00
16.00	0.00		0.00
17.00	0.00		0.00
18.00	0.00		0.00
19.00	0.00		0.00
20.00	0.00		0.00
21.00	0.00		0.00
22.00	0.00		0.00
23.00	0.00		0.00
24.00	0.00		0.00
25.00	0.00		0.00
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Reach DP-3: Waban Street

Inflow Area = 34,092 sf, 28.70% Impervious, Inflow Depth = 0.08" for 2-year event
Inflow = 0.01 cfs @ 13.34 hrs, Volume= 229 cf
Outflow = 0.01 cfs @ 13.34 hrs, Volume= 229 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach 13R : Total Existing

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach DP-3: Waban Street



Hydrograph for Reach DP-3: Waban Street

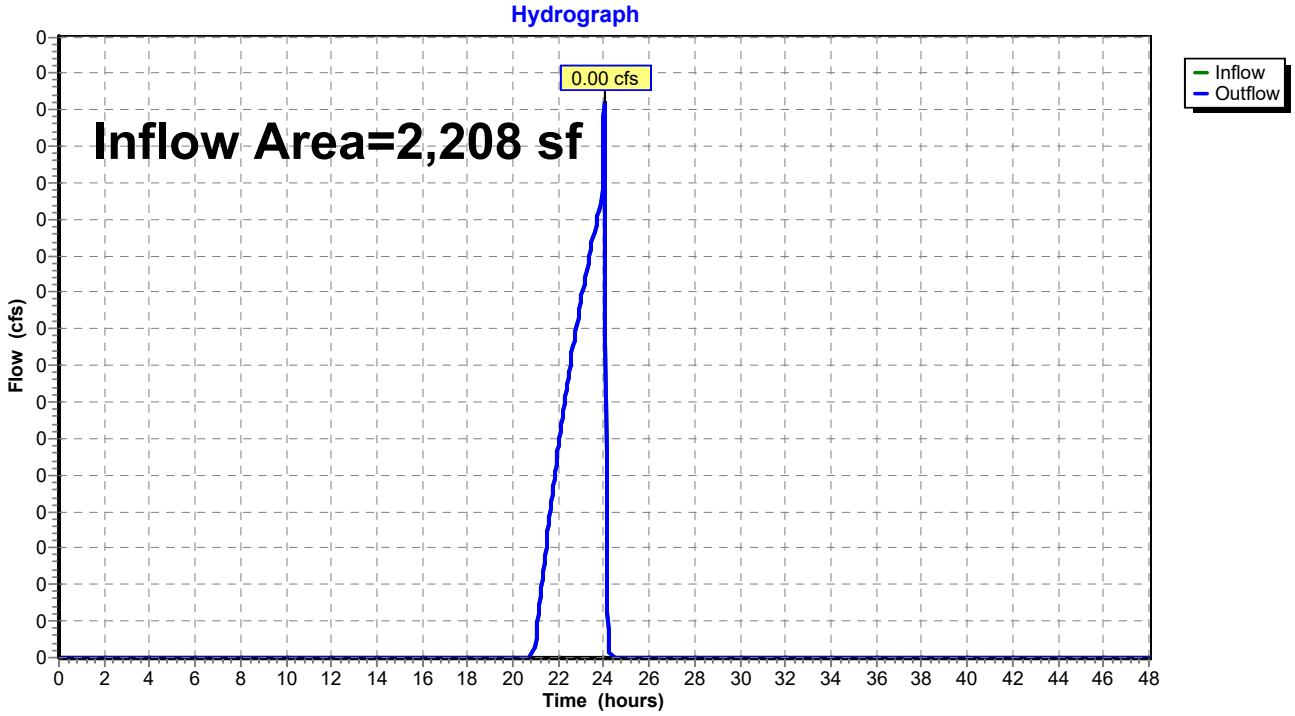
Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	0.00		0.00
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.00		0.00
10.00	0.00		0.00
11.00	0.00		0.00
12.00	0.00		0.00
13.00	**0.01**		**0.01**
14.00	**0.01**		**0.01**
15.00	0.01		0.01
16.00	0.01		0.01
17.00	0.01		0.01
18.00	0.01		0.01
19.00	0.00		0.00
20.00	0.00		0.00
21.00	0.00		0.00
22.00	0.00		0.00
23.00	0.00		0.00
24.00	0.00		0.00
25.00	0.00		0.00
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Reach DP-4: Off Site

Inflow Area = 2,208 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 24.02 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 24.02 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach 13R : Total Existing

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach DP-4: Off Site



Hydrograph for Reach DP-4: Off Site

Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	0.00		0.00
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.00		0.00
10.00	0.00		0.00
11.00	0.00		0.00
12.00	0.00		0.00
13.00	0.00		0.00
14.00	0.00		0.00
15.00	0.00		0.00
16.00	0.00		0.00
17.00	0.00		0.00
18.00	0.00		0.00
19.00	0.00		0.00
20.00	0.00		0.00
21.00	0.00		0.00
22.00	0.00		0.00
23.00	0.00		0.00
24.00	**0.00**		**0.00**
25.00	**0.00**		**0.00**
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Events for Subcatchment EX-1: EX-1 (Jackson Road)

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-inch	2.00	3.57	9,962	0.70
2-year	3.25	8.60	23,650	1.65
10-year	5.13	16.83	47,176	3.29
25-year	6.31	22.10	62,768	4.38
100-year	**8.12**	**30.11**	**87,303**	**6.09**

Events for Subcatchment EX-2: EX-2 Off Site -Woods

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-inch	2.00	0.00	0	0.00
2-year	3.25	0.00	0	0.00
10-year	5.13	0.01	191	0.13
25-year	6.31	0.05	552	0.37
100-year	**8.12**	**0.30**	**1,394**	**0.93**

Events for Subcatchment EX-3: EX-3 Waban Street

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-inch	2.00	0.00	0	0.00
2-year	3.25	0.01	229	0.08
10-year	5.13	0.36	1,659	0.58
25-year	6.31	0.90	3,047	1.07
100-year	**8.12**	**1.93**	**5,701**	**2.01**

Events for Subcatchment EX-4: EX-4 Off Site

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-inch	2.00	0.00	0	0.00
2-year	3.25	0.00	0	0.00
10-year	5.13	0.00	42	0.23
25-year	6.31	0.01	99	0.54
100-year	**8.12**	**0.06**	**222**	**1.21**

Events for Reach 13R: Total Existing

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-inch	3.57	3.57	**0.00**	**0**
2-year	8.60	8.60	0.00	0
10-year	17.16	17.16	0.00	0
25-year	22.99	22.99	0.00	0
100-year	**32.42**	**32.42**	0.00	0

Events for Reach DP-1: Jackson Road Culvert

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-inch	3.57	3.57	**0.00**	**0**
2-year	8.60	8.60	0.00	0
10-year	16.83	16.83	0.00	0
25-year	22.10	22.10	0.00	0
100-year	**30.11**	**30.11**	0.00	0

Events for Reach DP-2: Off Site-Woods

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-inch	0.00	0.00	**0.00**	**0**
2-year	0.00	0.00	0.00	0
10-year	0.01	0.01	0.00	0
25-year	0.05	0.05	0.00	0
100-year	**0.30**	**0.30**	0.00	0

Events for Reach DP-3: Waban Street

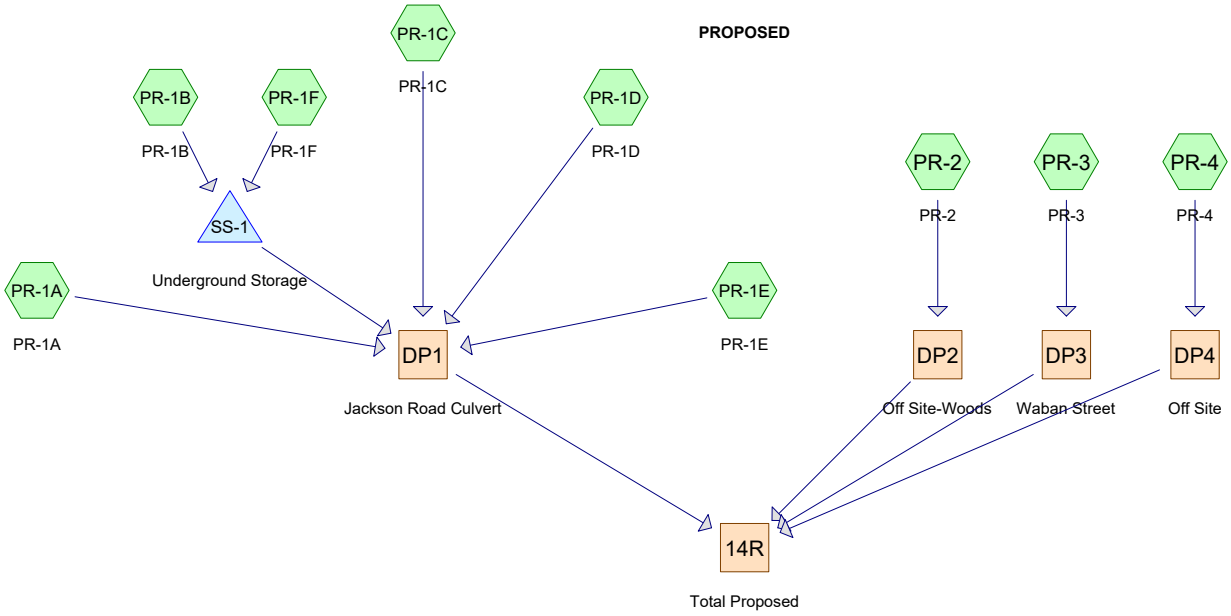
Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-inch	0.00	0.00	**0.00**	**0**
2-year	0.01	0.01	0.00	0
10-year	0.36	0.36	0.00	0
25-year	0.90	0.90	0.00	0
100-year	**1.93**	**1.93**	0.00	0

Events for Reach DP-4: Off Site

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-inch	0.00	0.00	**0.00**	**0**
2-year	0.00	0.00	0.00	0
10-year	0.00	0.00	0.00	0
25-year	0.01	0.01	0.00	0
100-year	**0.06**	**0.06**	0.00	0

APPENDIX B

Post-Development Conditions – HydroCAD Calculations



Subcat Reach Pond Link

Routing Diagram for 13033 - Lincoln Elliot HydroCAD
Prepared by Nitsch Engineering, Printed 4/14/2022

13033 - Lincoln Elliot HydroCAD

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-inch	NOAA 24-hr	C	Default	24.00	1	2.00	2
2	2-year	NOAA 24-hr	C	Default	24.00	1	3.25	2
3	10-year	NOAA 24-hr	C	Default	24.00	1	5.13	2
4	25-year	NOAA 24-hr	C	Default	24.00	1	6.31	2
5	100-year	NOAA 24-hr	C	Default	24.00	1	8.12	2

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
100,246	39	>75% Grass cover, Good, HSG A (PR-1A, PR-1B, PR-1D, PR-1E, PR-1F, PR-2, PR-3, PR-4)
67,759	98	Paved parking, HSG A (PR-1A, PR-1B, PR-1C, PR-1D, PR-1E, PR-1F, PR-3)
42,118	98	Roofs, HSG A (PR-1A, PR-1B)
5,134	36	Woods, Fair, HSG A (PR-1A, PR-1B)
10,951	30	Woods, Good, HSG A (PR-1C, PR-2)
226,208	**67**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
226,208	HSG A	PR-1A, PR-1B, PR-1C, PR-1D, PR-1E, PR-1F, PR-2, PR-3, PR-4
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
226,208		**TOTAL AREA**

13033 - Lincoln Elliot HydroCAD

Ground Covers (selected nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
100,246	0	0	0	0	100,246	>75% Grass cover, Good	
67,759	0	0	0	0	67,759	Paved parking	
42,118	0	0	0	0	42,118	Roofs	
5,134	0	0	0	0	5,134	Woods, Fair	
10,951	0	0	0	0	10,951	Woods, Good	
226,208	**0**	**0**	**0**	**0**	**226,208**	**TOTAL AREA**	

Summary for Subcatchment PR-1A: PR-1A

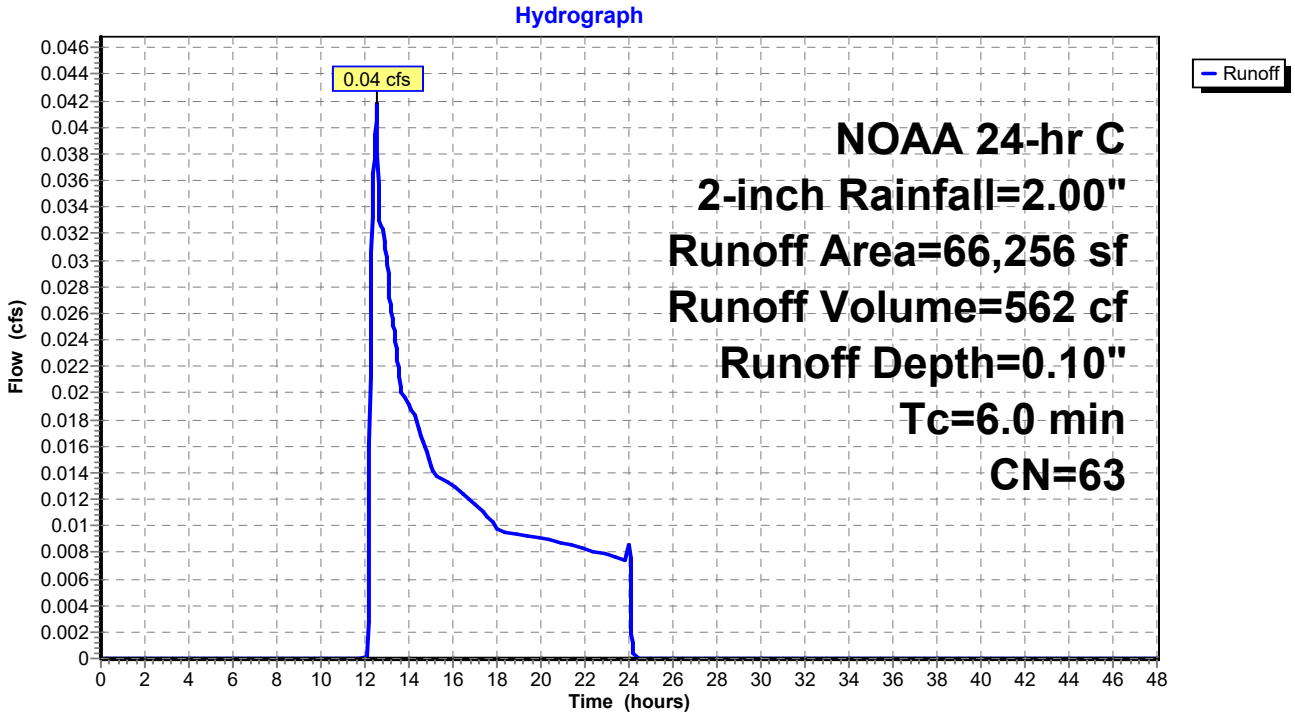
Runoff = 0.04 cfs @ 12.53 hrs, Volume= 562 cf, Depth= 0.10"
Routed to Reach DP1 : Jackson Road Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-inch Rainfall=2.00"

Area (sf)	CN	Description
26,580	98	Roofs, HSG A
942	98	Paved parking, HSG A
1,495	36	Woods, Fair, HSG A
37,239	39	>75% Grass cover, Good, HSG A
66,256	63	Weighted Average
38,734		58.46% Pervious Area
27,522		41.54% Impervious Area

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

Subcatchment PR-1A: PR-1A



Hydrograph for Subcatchment PR-1A: PR-1A

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.02	0.00	0.00
2.00	0.05	0.00	0.00
3.00	0.07	0.00	0.00
4.00	0.10	0.00	0.00
5.00	0.13	0.00	0.00
6.00	0.16	0.00	0.00
7.00	0.20	0.00	0.00
8.00	0.24	0.00	0.00
9.00	0.29	0.00	0.00
10.00	0.36	0.00	0.00
11.00	0.48	0.00	0.00
12.00	0.95	0.00	**0.00**
13.00	1.52	0.02	**0.03**
14.00	1.64	0.03	0.02
15.00	1.71	0.04	0.01
16.00	1.76	0.05	0.01
17.00	1.80	0.06	0.01
18.00	1.84	0.07	0.01
19.00	1.87	0.07	0.01
20.00	1.90	0.08	0.01
21.00	1.93	0.09	0.01
22.00	1.95	0.09	0.01
23.00	1.98	0.10	0.01
24.00	**2.00**	**0.10**	0.01
25.00	2.00	0.10	0.00
26.00	2.00	0.10	0.00
27.00	2.00	0.10	0.00
28.00	2.00	0.10	0.00
29.00	2.00	0.10	0.00
30.00	2.00	0.10	0.00
31.00	2.00	0.10	0.00
32.00	2.00	0.10	0.00
33.00	2.00	0.10	0.00
34.00	2.00	0.10	0.00
35.00	2.00	0.10	0.00
36.00	2.00	0.10	0.00
37.00	2.00	0.10	0.00
38.00	2.00	0.10	0.00
39.00	2.00	0.10	0.00
40.00	2.00	0.10	0.00
41.00	2.00	0.10	0.00
42.00	2.00	0.10	0.00
43.00	2.00	0.10	0.00
44.00	2.00	0.10	0.00
45.00	2.00	0.10	0.00
46.00	2.00	0.10	0.00
47.00	2.00	0.10	0.00
48.00	2.00	0.10	0.00

Summary for Subcatchment PR-1B: PR-1B

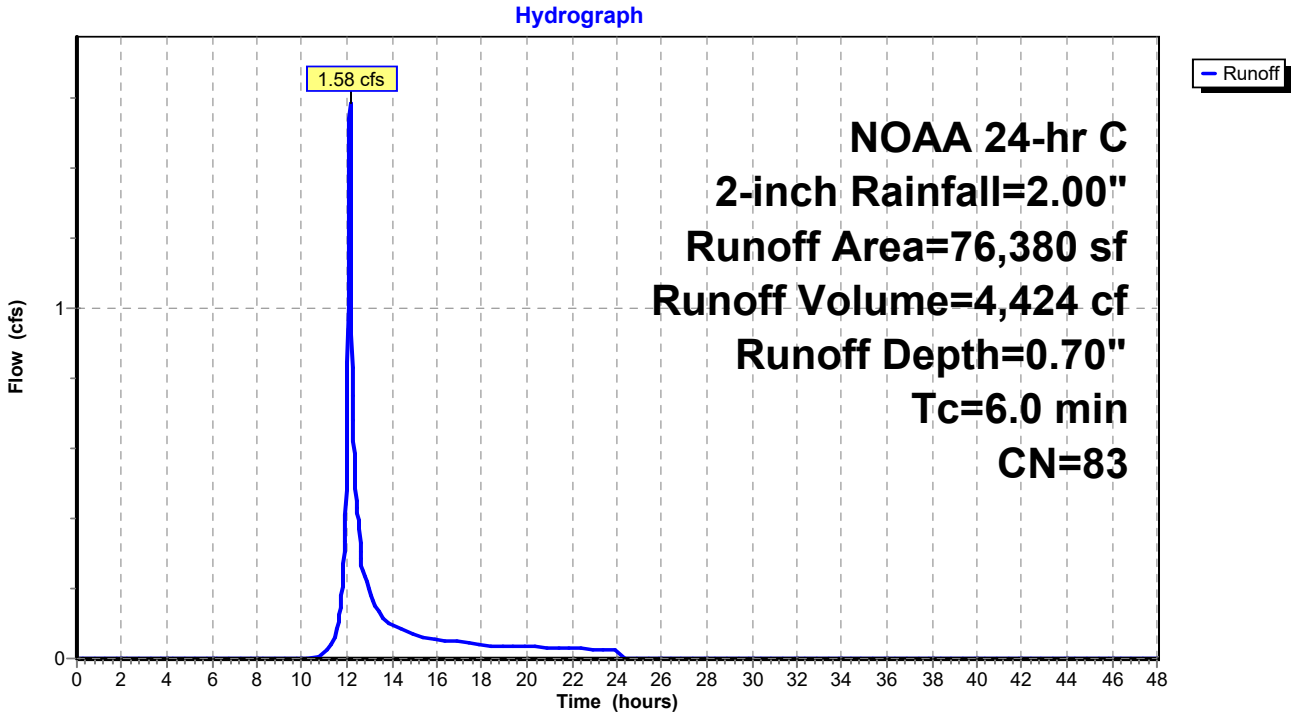
Runoff = 1.58 cfs @ 12.14 hrs, Volume= 4,424 cf, Depth= 0.70"
Routed to Pond SS-1 : Underground Storage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-inch Rainfall=2.00"

Area (sf)	CN	Description
15,538	98	Roofs, HSG A
41,675	98	Paved parking, HSG A
3,639	36	Woods, Fair, HSG A
15,528	39	>75% Grass cover, Good, HSG A
76,380	83	Weighted Average
19,167		25.09% Pervious Area
57,213		74.91% Impervious Area

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

Subcatchment PR-1B: PR-1B



Hydrograph for Subcatchment PR-1B: PR-1B

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.02	0.00	0.00
2.00	0.05	0.00	0.00
3.00	0.07	0.00	0.00
4.00	0.10	0.00	0.00
5.00	0.13	0.00	0.00
6.00	0.16	0.00	0.00
7.00	0.20	0.00	0.00
8.00	0.24	0.00	0.00
9.00	0.29	0.00	0.00
10.00	0.36	0.00	0.00
11.00	0.48	0.00	0.01
12.00	0.95	0.11	**0.66**
13.00	1.52	0.39	**0.19**
14.00	1.64	0.46	0.10
15.00	1.71	0.50	0.07
16.00	1.76	0.54	0.06
17.00	1.80	0.57	0.05
18.00	1.84	0.59	0.04
19.00	1.87	0.61	0.04
20.00	1.90	0.63	0.03
21.00	1.93	0.65	0.03
22.00	1.95	0.66	0.03
23.00	1.98	0.68	0.03
24.00	**2.00**	**0.70**	0.03
25.00	2.00	0.70	0.00
26.00	2.00	0.70	0.00
27.00	2.00	0.70	0.00
28.00	2.00	0.70	0.00
29.00	2.00	0.70	0.00
30.00	2.00	0.70	0.00
31.00	2.00	0.70	0.00
32.00	2.00	0.70	0.00
33.00	2.00	0.70	0.00
34.00	2.00	0.70	0.00
35.00	2.00	0.70	0.00
36.00	2.00	0.70	0.00
37.00	2.00	0.70	0.00
38.00	2.00	0.70	0.00
39.00	2.00	0.70	0.00
40.00	2.00	0.70	0.00
41.00	2.00	0.70	0.00
42.00	2.00	0.70	0.00
43.00	2.00	0.70	0.00
44.00	2.00	0.70	0.00
45.00	2.00	0.70	0.00
46.00	2.00	0.70	0.00
47.00	2.00	0.70	0.00
48.00	2.00	0.70	0.00

Summary for Subcatchment PR-1C: PR-1C

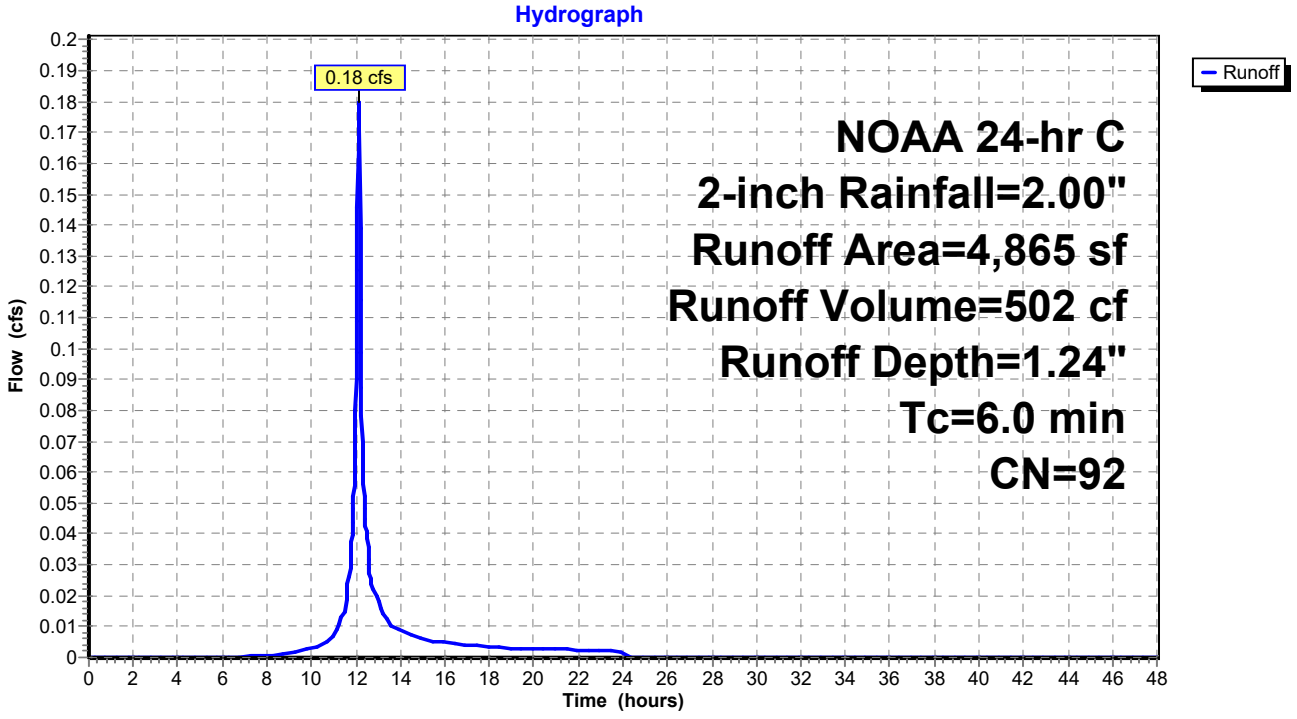
Runoff = 0.18 cfs @ 12.13 hrs, Volume= 502 cf, Depth= 1.24"
Routed to Reach DP1 : Jackson Road Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-inch Rainfall=2.00"

Area (sf)	CN	Description
4,427	98	Paved parking, HSG A
438	30	Woods, Good, HSG A
4,865	92	Weighted Average
438		9.00% Pervious Area
4,427		91.00% Impervious Area

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

Subcatchment PR-1C: PR-1C



Hydrograph for Subcatchment PR-1C: PR-1C

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.02	0.00	0.00
2.00	0.05	0.00	0.00
3.00	0.07	0.00	0.00
4.00	0.10	0.00	0.00
5.00	0.13	0.00	0.00
6.00	0.16	0.00	0.00
7.00	0.20	0.00	0.00
8.00	0.24	0.00	0.00
9.00	0.29	0.01	0.00
10.00	0.36	0.03	0.00
11.00	0.48	0.08	0.01
12.00	0.95	0.37	**0.09**
13.00	1.52	0.82	**0.02**
14.00	1.64	0.92	0.01
15.00	1.71	0.98	0.01
16.00	1.76	1.02	0.00
17.00	1.80	1.06	0.00
18.00	1.84	1.10	0.00
19.00	1.87	1.12	0.00
20.00	1.90	1.15	0.00
21.00	1.93	1.17	0.00
22.00	1.95	1.20	0.00
23.00	1.98	1.22	0.00
24.00	**2.00**	**1.24**	0.00
25.00	2.00	1.24	0.00
26.00	2.00	1.24	0.00
27.00	2.00	1.24	0.00
28.00	2.00	1.24	0.00
29.00	2.00	1.24	0.00
30.00	2.00	1.24	0.00
31.00	2.00	1.24	0.00
32.00	2.00	1.24	0.00
33.00	2.00	1.24	0.00
34.00	2.00	1.24	0.00
35.00	2.00	1.24	0.00
36.00	2.00	1.24	0.00
37.00	2.00	1.24	0.00
38.00	2.00	1.24	0.00
39.00	2.00	1.24	0.00
40.00	2.00	1.24	0.00
41.00	2.00	1.24	0.00
42.00	2.00	1.24	0.00
43.00	2.00	1.24	0.00
44.00	2.00	1.24	0.00
45.00	2.00	1.24	0.00
46.00	2.00	1.24	0.00
47.00	2.00	1.24	0.00
48.00	2.00	1.24	0.00

Summary for Subcatchment PR-1D: PR-1D

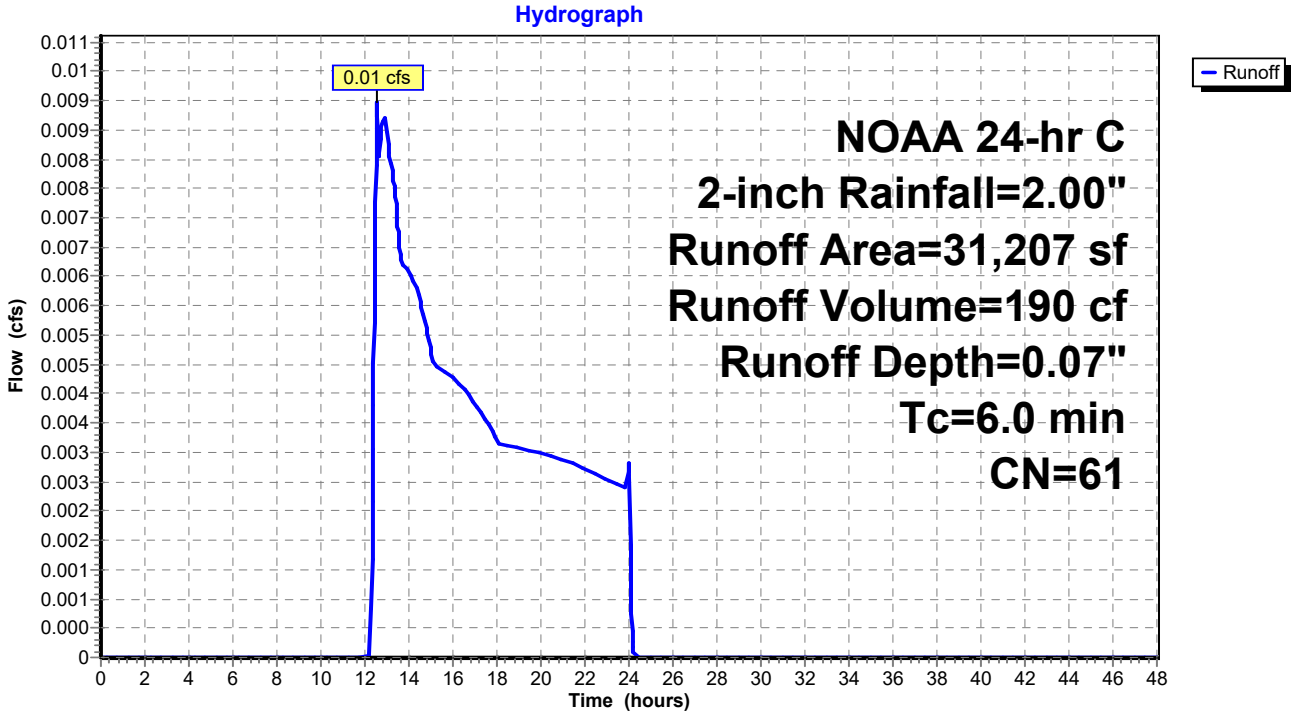
Runoff = 0.01 cfs @ 12.55 hrs, Volume= 190 cf, Depth= 0.07"
Routed to Reach DP1 : Jackson Road Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-inch Rainfall=2.00"

Area (sf)	CN	Description
11,566	98	Paved parking, HSG A
19,641	39	>75% Grass cover, Good, HSG A
31,207	61	Weighted Average
19,641		62.94% Pervious Area
11,566		37.06% Impervious Area

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

Subcatchment PR-1D: PR-1D



Hydrograph for Subcatchment PR-1D: PR-1D

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.02	0.00	0.00
2.00	0.05	0.00	0.00
3.00	0.07	0.00	0.00
4.00	0.10	0.00	0.00
5.00	0.13	0.00	0.00
6.00	0.16	0.00	0.00
7.00	0.20	0.00	0.00
8.00	0.24	0.00	0.00
9.00	0.29	0.00	0.00
10.00	0.36	0.00	0.00
11.00	0.48	0.00	0.00
12.00	0.95	0.00	**0.00**
13.00	1.52	0.01	**0.01**
14.00	1.64	0.02	0.01
15.00	1.71	0.03	0.01
16.00	1.76	0.03	0.00
17.00	1.80	0.04	0.00
18.00	1.84	0.05	0.00
19.00	1.87	0.05	0.00
20.00	1.90	0.06	0.00
21.00	1.93	0.06	0.00
22.00	1.95	0.06	0.00
23.00	1.98	0.07	0.00
24.00	**2.00**	**0.07**	0.00
25.00	2.00	0.07	0.00
26.00	2.00	0.07	0.00
27.00	2.00	0.07	0.00
28.00	2.00	0.07	0.00
29.00	2.00	0.07	0.00
30.00	2.00	0.07	0.00
31.00	2.00	0.07	0.00
32.00	2.00	0.07	0.00
33.00	2.00	0.07	0.00
34.00	2.00	0.07	0.00
35.00	2.00	0.07	0.00
36.00	2.00	0.07	0.00
37.00	2.00	0.07	0.00
38.00	2.00	0.07	0.00
39.00	2.00	0.07	0.00
40.00	2.00	0.07	0.00
41.00	2.00	0.07	0.00
42.00	2.00	0.07	0.00
43.00	2.00	0.07	0.00
44.00	2.00	0.07	0.00
45.00	2.00	0.07	0.00
46.00	2.00	0.07	0.00
47.00	2.00	0.07	0.00
48.00	2.00	0.07	0.00

Summary for Subcatchment PR-1E: PR-1E

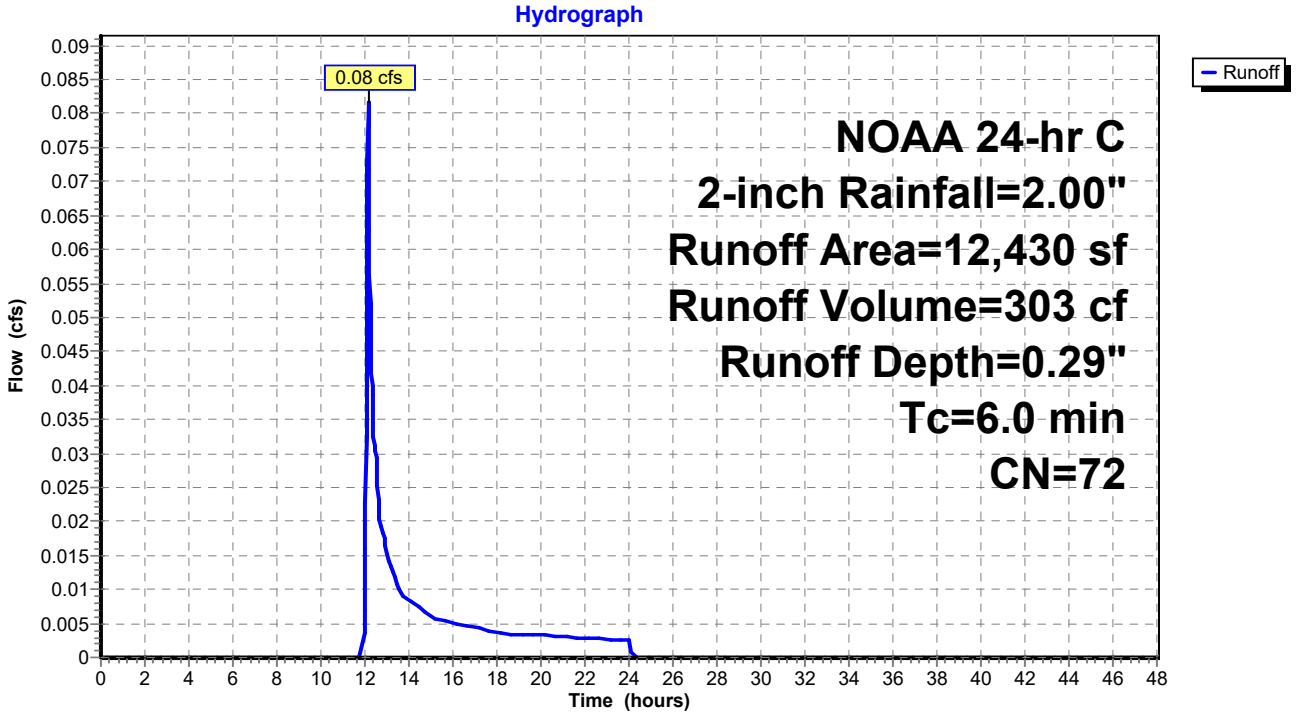
Runoff = 0.08 cfs @ 12.15 hrs, Volume= 303 cf, Depth= 0.29"
Routed to Reach DP1 : Jackson Road Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-inch Rainfall=2.00"

Area (sf)	CN	Description
6,880	98	Paved parking, HSG A
5,550	39	>75% Grass cover, Good, HSG A
12,430	72	Weighted Average
5,550		44.65% Pervious Area
6,880		55.35% Impervious Area

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

Subcatchment PR-1E: PR-1E



Hydrograph for Subcatchment PR-1E: PR-1E

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.02	0.00	0.00
2.00	0.05	0.00	0.00
3.00	0.07	0.00	0.00
4.00	0.10	0.00	0.00
5.00	0.13	0.00	0.00
6.00	0.16	0.00	0.00
7.00	0.20	0.00	0.00
8.00	0.24	0.00	0.00
9.00	0.29	0.00	0.00
10.00	0.36	0.00	0.00
11.00	0.48	0.00	0.00
12.00	0.95	0.01	**0.01**
13.00	1.52	0.12	**0.02**
14.00	1.64	0.15	0.01
15.00	1.71	0.18	0.01
16.00	1.76	0.20	0.01
17.00	1.80	0.21	0.00
18.00	1.84	0.23	0.00
19.00	1.87	0.24	0.00
20.00	1.90	0.25	0.00
21.00	1.93	0.26	0.00
22.00	1.95	0.27	0.00
23.00	1.98	0.28	0.00
24.00	**2.00**	**0.29**	0.00
25.00	2.00	0.29	0.00
26.00	2.00	0.29	0.00
27.00	2.00	0.29	0.00
28.00	2.00	0.29	0.00
29.00	2.00	0.29	0.00
30.00	2.00	0.29	0.00
31.00	2.00	0.29	0.00
32.00	2.00	0.29	0.00
33.00	2.00	0.29	0.00
34.00	2.00	0.29	0.00
35.00	2.00	0.29	0.00
36.00	2.00	0.29	0.00
37.00	2.00	0.29	0.00
38.00	2.00	0.29	0.00
39.00	2.00	0.29	0.00
40.00	2.00	0.29	0.00
41.00	2.00	0.29	0.00
42.00	2.00	0.29	0.00
43.00	2.00	0.29	0.00
44.00	2.00	0.29	0.00
45.00	2.00	0.29	0.00
46.00	2.00	0.29	0.00
47.00	2.00	0.29	0.00
48.00	2.00	0.29	0.00

Summary for Subcatchment PR-1F: PR-1F

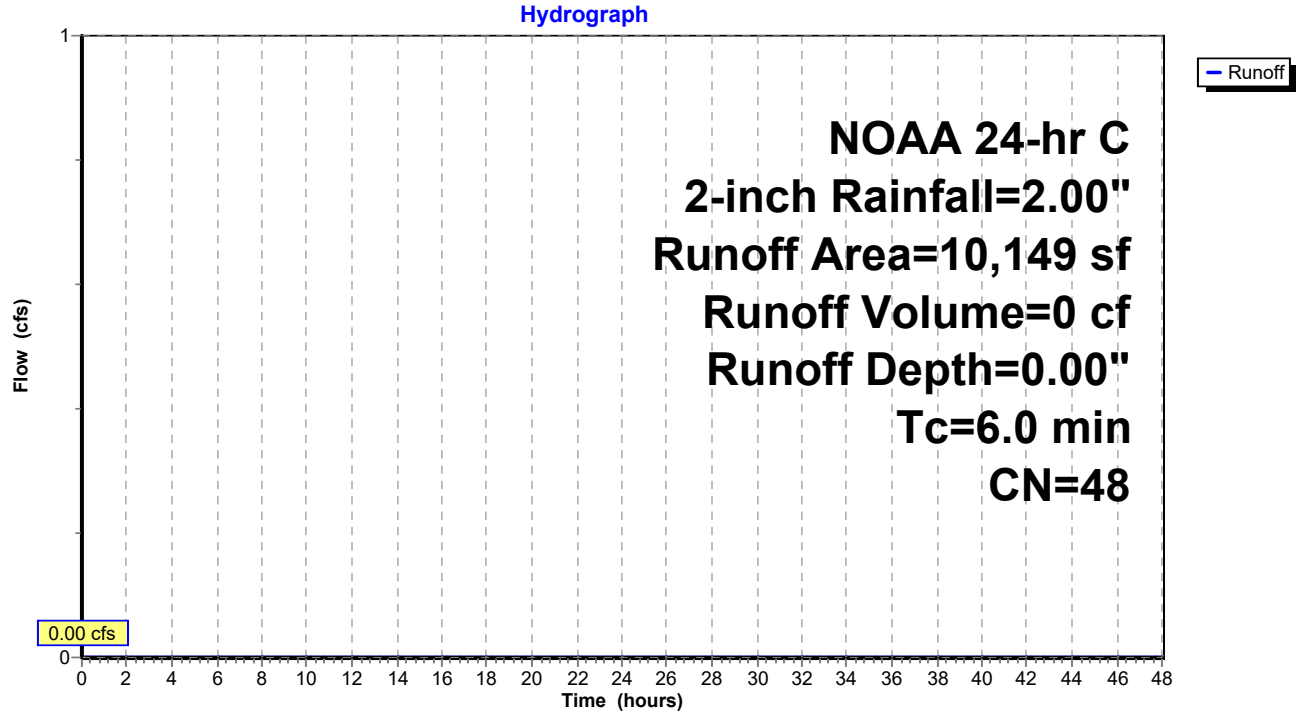
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Pond SS-1 : Underground Storage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-inch Rainfall=2.00"

Area (sf)	CN	Description
1,569	98	Paved parking, HSG A
8,580	39	>75% Grass cover, Good, HSG A
10,149	48	Weighted Average
8,580		84.54% Pervious Area
1,569		15.46% Impervious Area

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

Subcatchment PR-1F: PR-1F



Hydrograph for Subcatchment PR-1F: PR-1F

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	**0.00**	**0.00**
1.00	0.02	0.00	0.00
2.00	0.05	0.00	0.00
3.00	0.07	0.00	0.00
4.00	0.10	0.00	0.00
5.00	0.13	0.00	0.00
6.00	0.16	0.00	0.00
7.00	0.20	0.00	0.00
8.00	0.24	0.00	0.00
9.00	0.29	0.00	0.00
10.00	0.36	0.00	0.00
11.00	0.48	0.00	0.00
12.00	0.95	0.00	0.00
13.00	1.52	0.00	0.00
14.00	1.64	0.00	0.00
15.00	1.71	0.00	0.00
16.00	1.76	0.00	0.00
17.00	1.80	0.00	0.00
18.00	1.84	0.00	0.00
19.00	1.87	0.00	0.00
20.00	1.90	0.00	0.00
21.00	1.93	0.00	0.00
22.00	1.95	0.00	0.00
23.00	1.98	0.00	0.00
24.00	**2.00**	0.00	0.00
25.00	2.00	0.00	0.00
26.00	2.00	0.00	0.00
27.00	2.00	0.00	0.00
28.00	2.00	0.00	0.00
29.00	2.00	0.00	0.00
30.00	2.00	0.00	0.00
31.00	2.00	0.00	0.00
32.00	2.00	0.00	0.00
33.00	2.00	0.00	0.00
34.00	2.00	0.00	0.00
35.00	2.00	0.00	0.00
36.00	2.00	0.00	0.00
37.00	2.00	0.00	0.00
38.00	2.00	0.00	0.00
39.00	2.00	0.00	0.00
40.00	2.00	0.00	0.00
41.00	2.00	0.00	0.00
42.00	2.00	0.00	0.00
43.00	2.00	0.00	0.00
44.00	2.00	0.00	0.00
45.00	2.00	0.00	0.00
46.00	2.00	0.00	0.00
47.00	2.00	0.00	0.00
48.00	2.00	0.00	0.00

Summary for Subcatchment PR-2: PR-2

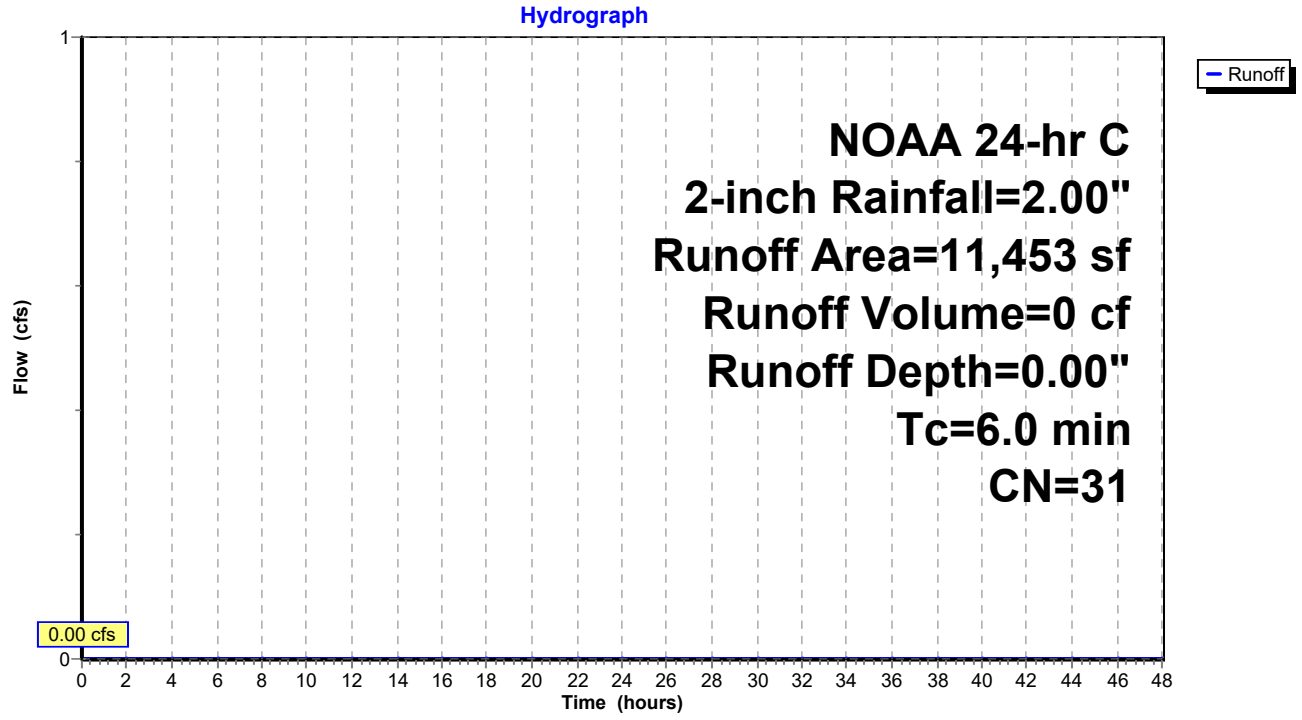
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach DP2 : Off Site-Woods

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-inch Rainfall=2.00"

Area (sf)	CN	Description
10,513	30	Woods, Good, HSG A
940	39	>75% Grass cover, Good, HSG A
11,453	31	Weighted Average
11,453		100.00% Pervious Area

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

Subcatchment PR-2: PR-2



Hydrograph for Subcatchment PR-2: PR-2

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	**0.00**	**0.00**
1.00	0.02	0.00	0.00
2.00	0.05	0.00	0.00
3.00	0.07	0.00	0.00
4.00	0.10	0.00	0.00
5.00	0.13	0.00	0.00
6.00	0.16	0.00	0.00
7.00	0.20	0.00	0.00
8.00	0.24	0.00	0.00
9.00	0.29	0.00	0.00
10.00	0.36	0.00	0.00
11.00	0.48	0.00	0.00
12.00	0.95	0.00	0.00
13.00	1.52	0.00	0.00
14.00	1.64	0.00	0.00
15.00	1.71	0.00	0.00
16.00	1.76	0.00	0.00
17.00	1.80	0.00	0.00
18.00	1.84	0.00	0.00
19.00	1.87	0.00	0.00
20.00	1.90	0.00	0.00
21.00	1.93	0.00	0.00
22.00	1.95	0.00	0.00
23.00	1.98	0.00	0.00
24.00	**2.00**	0.00	0.00
25.00	2.00	0.00	0.00
26.00	2.00	0.00	0.00
27.00	2.00	0.00	0.00
28.00	2.00	0.00	0.00
29.00	2.00	0.00	0.00
30.00	2.00	0.00	0.00
31.00	2.00	0.00	0.00
32.00	2.00	0.00	0.00
33.00	2.00	0.00	0.00
34.00	2.00	0.00	0.00
35.00	2.00	0.00	0.00
36.00	2.00	0.00	0.00
37.00	2.00	0.00	0.00
38.00	2.00	0.00	0.00
39.00	2.00	0.00	0.00
40.00	2.00	0.00	0.00
41.00	2.00	0.00	0.00
42.00	2.00	0.00	0.00
43.00	2.00	0.00	0.00
44.00	2.00	0.00	0.00
45.00	2.00	0.00	0.00
46.00	2.00	0.00	0.00
47.00	2.00	0.00	0.00
48.00	2.00	0.00	0.00

Summary for Subcatchment PR-3: PR-3

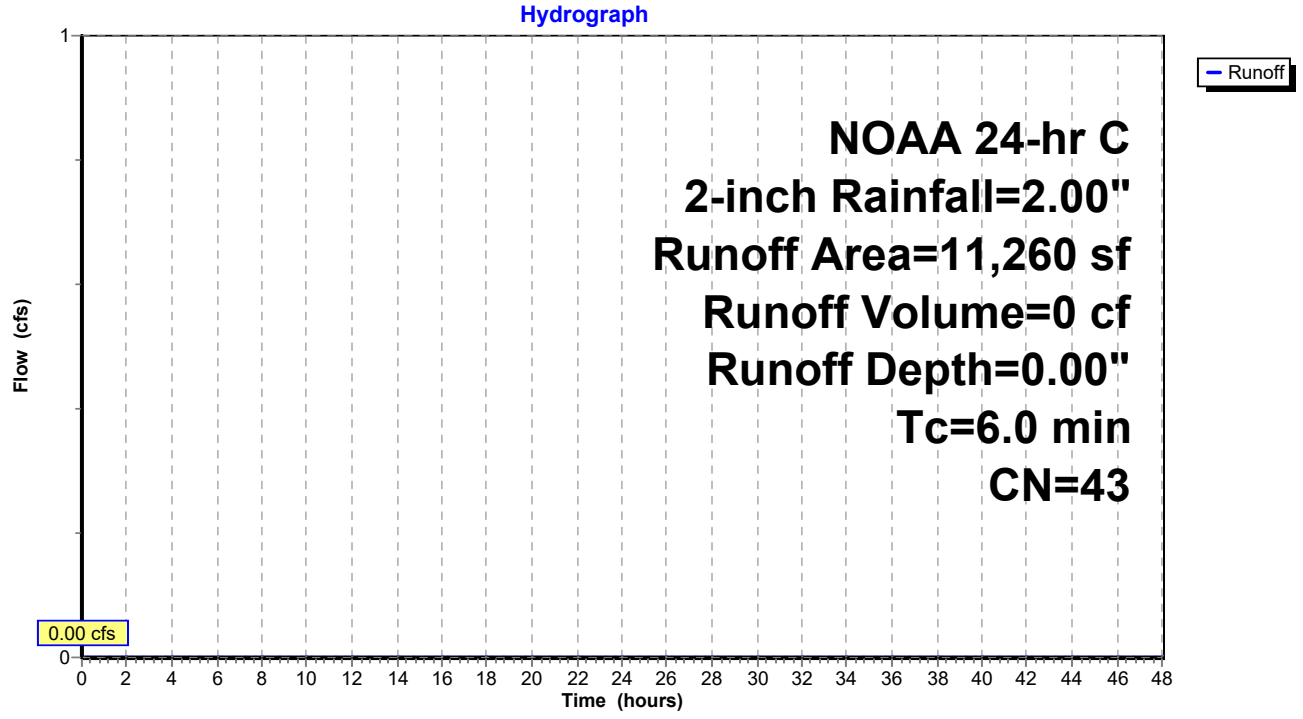
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach DP3 : Waban Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-inch Rainfall=2.00"

Area (sf)	CN	Description
700	98	Paved parking, HSG A
10,560	39	>75% Grass cover, Good, HSG A
11,260	43	Weighted Average
10,560		93.78% Pervious Area
700		6.22% Impervious Area

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

Subcatchment PR-3: PR-3



Hydrograph for Subcatchment PR-3: PR-3

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	**0.00**	**0.00**
1.00	0.02	0.00	0.00
2.00	0.05	0.00	0.00
3.00	0.07	0.00	0.00
4.00	0.10	0.00	0.00
5.00	0.13	0.00	0.00
6.00	0.16	0.00	0.00
7.00	0.20	0.00	0.00
8.00	0.24	0.00	0.00
9.00	0.29	0.00	0.00
10.00	0.36	0.00	0.00
11.00	0.48	0.00	0.00
12.00	0.95	0.00	0.00
13.00	1.52	0.00	0.00
14.00	1.64	0.00	0.00
15.00	1.71	0.00	0.00
16.00	1.76	0.00	0.00
17.00	1.80	0.00	0.00
18.00	1.84	0.00	0.00
19.00	1.87	0.00	0.00
20.00	1.90	0.00	0.00
21.00	1.93	0.00	0.00
22.00	1.95	0.00	0.00
23.00	1.98	0.00	0.00
24.00	**2.00**	0.00	0.00
25.00	2.00	0.00	0.00
26.00	2.00	0.00	0.00
27.00	2.00	0.00	0.00
28.00	2.00	0.00	0.00
29.00	2.00	0.00	0.00
30.00	2.00	0.00	0.00
31.00	2.00	0.00	0.00
32.00	2.00	0.00	0.00
33.00	2.00	0.00	0.00
34.00	2.00	0.00	0.00
35.00	2.00	0.00	0.00
36.00	2.00	0.00	0.00
37.00	2.00	0.00	0.00
38.00	2.00	0.00	0.00
39.00	2.00	0.00	0.00
40.00	2.00	0.00	0.00
41.00	2.00	0.00	0.00
42.00	2.00	0.00	0.00
43.00	2.00	0.00	0.00
44.00	2.00	0.00	0.00
45.00	2.00	0.00	0.00
46.00	2.00	0.00	0.00
47.00	2.00	0.00	0.00
48.00	2.00	0.00	0.00

Summary for Subcatchment PR-4: PR-4

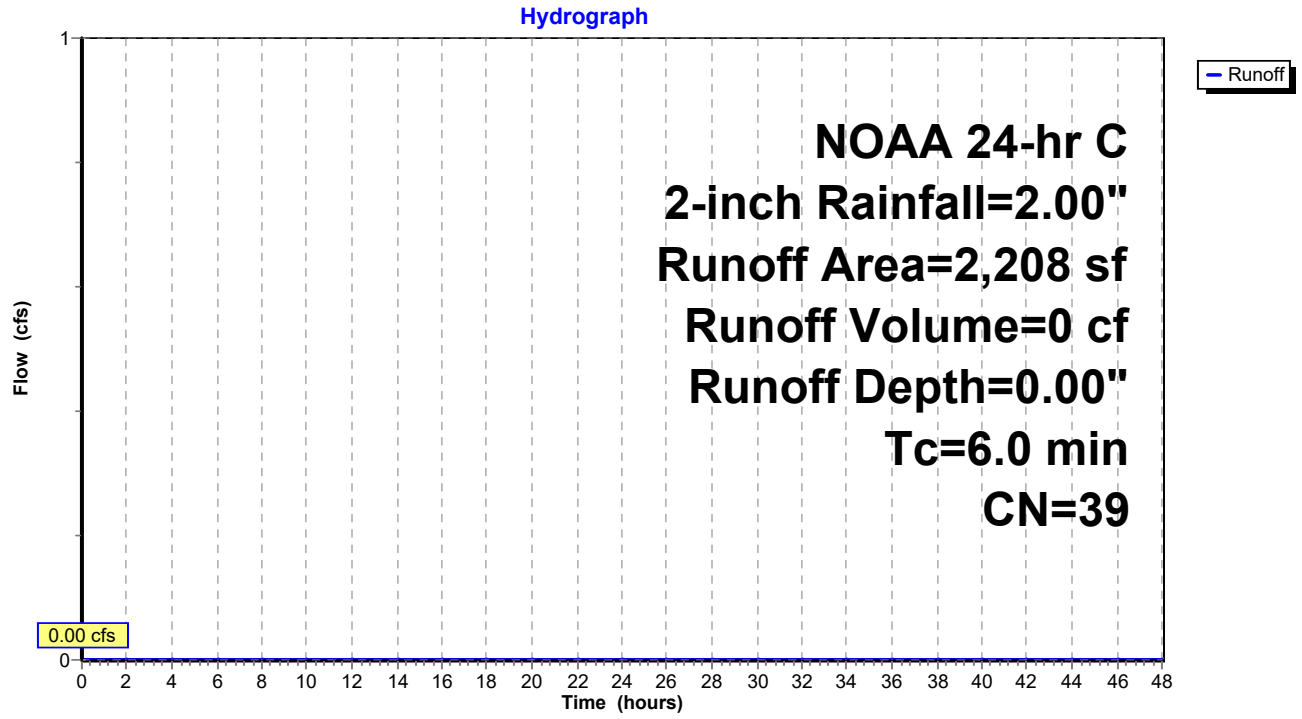
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach DP4 : Off Site

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-inch Rainfall=2.00"

Area (sf)	CN	Description
2,208	39	>75% Grass cover, Good, HSG A
2,208		100.00% Pervious Area

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

Subcatchment PR-4: PR-4



Hydrograph for Subcatchment PR-4: PR-4

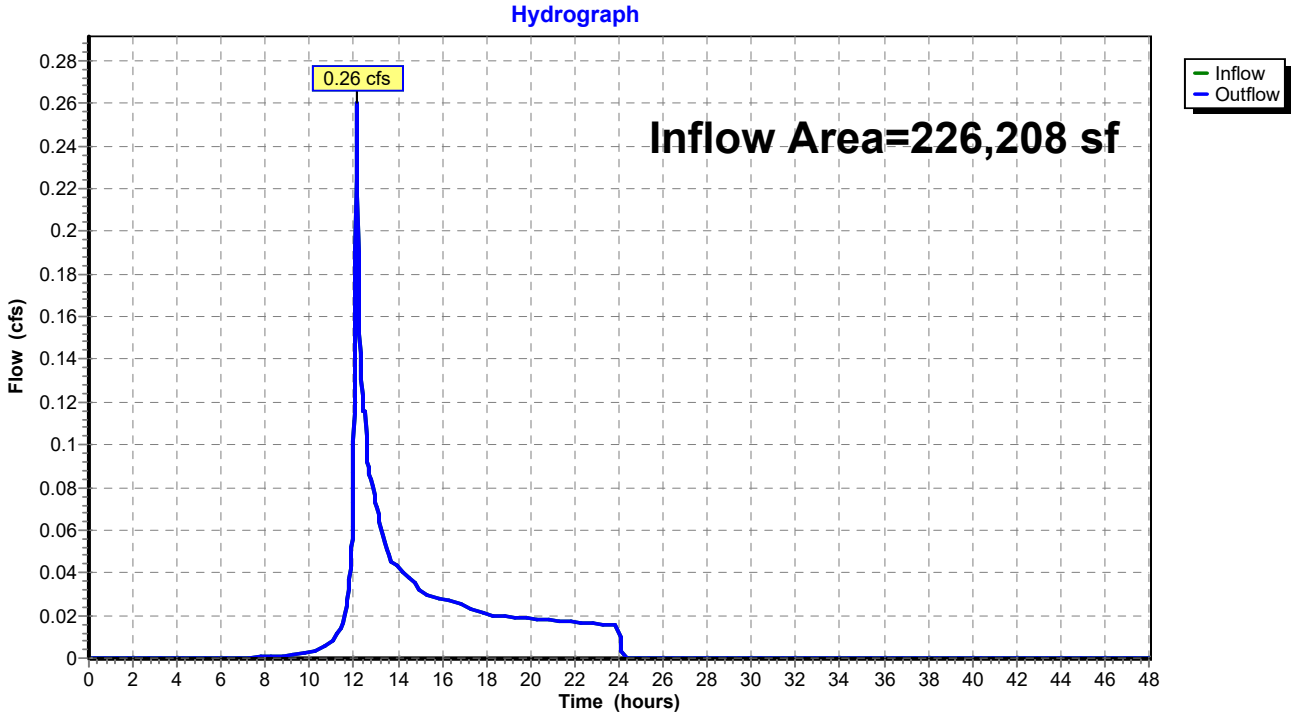
Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	**0.00**	**0.00**
1.00	0.02	0.00	0.00
2.00	0.05	0.00	0.00
3.00	0.07	0.00	0.00
4.00	0.10	0.00	0.00
5.00	0.13	0.00	0.00
6.00	0.16	0.00	0.00
7.00	0.20	0.00	0.00
8.00	0.24	0.00	0.00
9.00	0.29	0.00	0.00
10.00	0.36	0.00	0.00
11.00	0.48	0.00	0.00
12.00	0.95	0.00	0.00
13.00	1.52	0.00	0.00
14.00	1.64	0.00	0.00
15.00	1.71	0.00	0.00
16.00	1.76	0.00	0.00
17.00	1.80	0.00	0.00
18.00	1.84	0.00	0.00
19.00	1.87	0.00	0.00
20.00	1.90	0.00	0.00
21.00	1.93	0.00	0.00
22.00	1.95	0.00	0.00
23.00	1.98	0.00	0.00
24.00	**2.00**	0.00	0.00
25.00	2.00	0.00	0.00
26.00	2.00	0.00	0.00
27.00	2.00	0.00	0.00
28.00	2.00	0.00	0.00
29.00	2.00	0.00	0.00
30.00	2.00	0.00	0.00
31.00	2.00	0.00	0.00
32.00	2.00	0.00	0.00
33.00	2.00	0.00	0.00
34.00	2.00	0.00	0.00
35.00	2.00	0.00	0.00
36.00	2.00	0.00	0.00
37.00	2.00	0.00	0.00
38.00	2.00	0.00	0.00
39.00	2.00	0.00	0.00
40.00	2.00	0.00	0.00
41.00	2.00	0.00	0.00
42.00	2.00	0.00	0.00
43.00	2.00	0.00	0.00
44.00	2.00	0.00	0.00
45.00	2.00	0.00	0.00
46.00	2.00	0.00	0.00
47.00	2.00	0.00	0.00
48.00	2.00	0.00	0.00

Summary for Reach 14R: Total Proposed

Inflow Area = 226,208 sf, 48.57% Impervious, Inflow Depth = 0.08" for 2-inch event
Inflow = 0.26 cfs @ 12.14 hrs, Volume= 1,556 cf
Outflow = 0.26 cfs @ 12.14 hrs, Volume= 1,556 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 14R: Total Proposed



Hydrograph for Reach 14R: Total Proposed

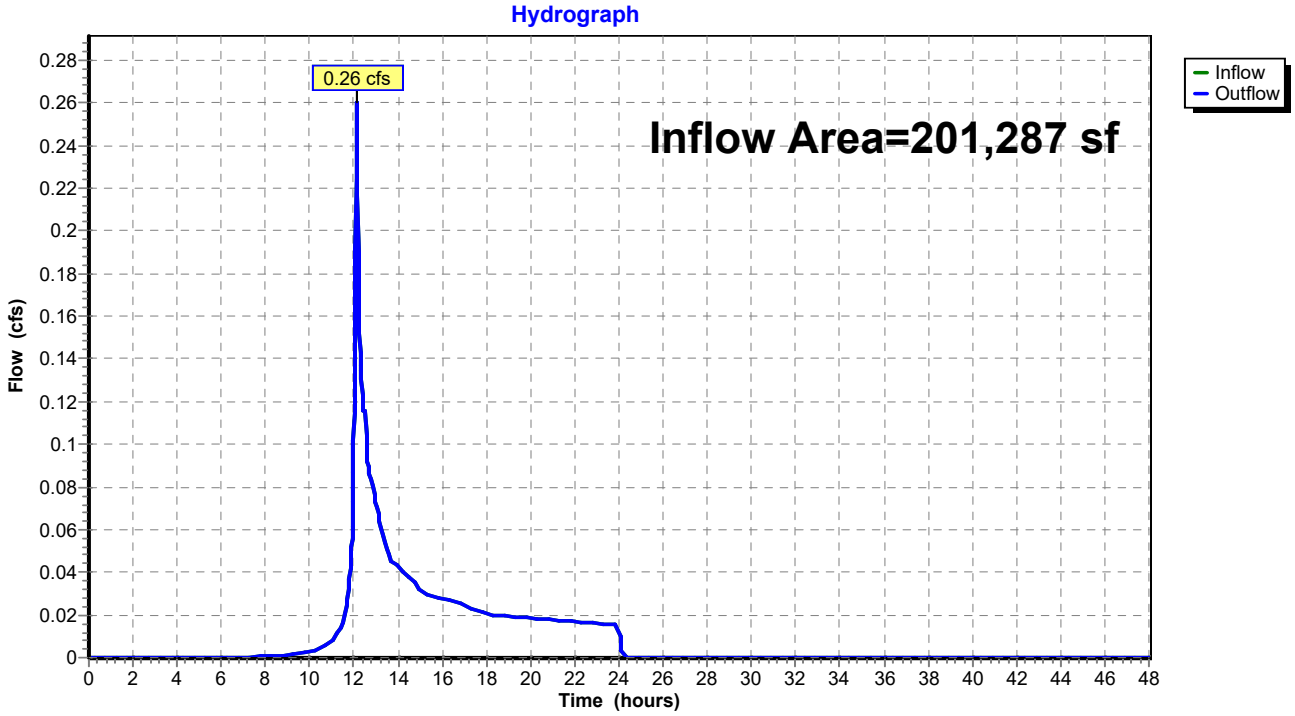
Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	0.00		0.00
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.00		0.00
10.00	0.00		0.00
11.00	0.01		0.01
12.00	**0.10**		**0.10**
13.00	**0.07**		**0.07**
14.00	0.04		0.04
15.00	0.03		0.03
16.00	0.03		0.03
17.00	0.02		0.02
18.00	0.02		0.02
19.00	0.02		0.02
20.00	0.02		0.02
21.00	0.02		0.02
22.00	0.02		0.02
23.00	0.02		0.02
24.00	0.02		0.02
25.00	0.00		0.00
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Reach DP1: Jackson Road Culvert

Inflow Area = 201,287 sf, 54.24% Impervious, Inflow Depth = 0.09" for 2-inch event
Inflow = 0.26 cfs @ 12.14 hrs, Volume= 1,556 cf
Outflow = 0.26 cfs @ 12.14 hrs, Volume= 1,556 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach 14R : Total Proposed

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach DP1: Jackson Road Culvert



Hydrograph for Reach DP1: Jackson Road Culvert

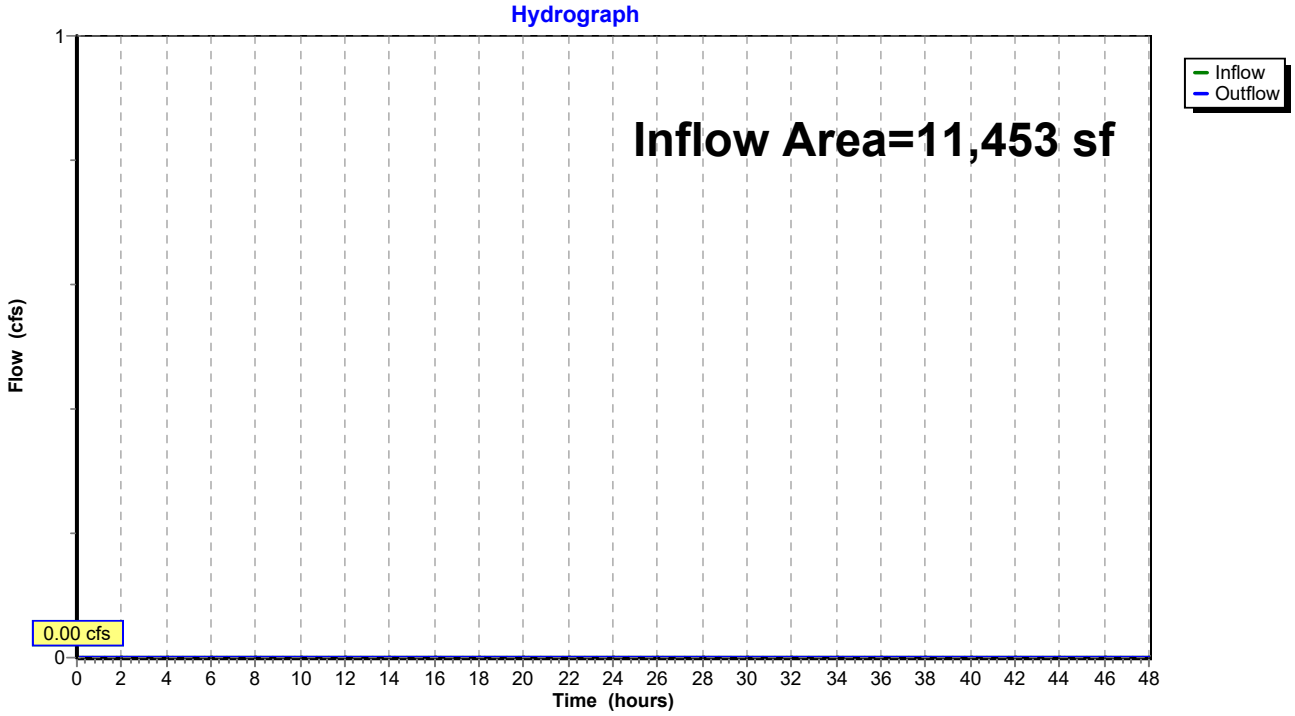
Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	0.00		0.00
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.00		0.00
10.00	0.00		0.00
11.00	0.01		0.01
12.00	**0.10**		**0.10**
13.00	**0.07**		**0.07**
14.00	0.04		0.04
15.00	0.03		0.03
16.00	0.03		0.03
17.00	0.02		0.02
18.00	0.02		0.02
19.00	0.02		0.02
20.00	0.02		0.02
21.00	0.02		0.02
22.00	0.02		0.02
23.00	0.02		0.02
24.00	0.02		0.02
25.00	0.00		0.00
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Reach DP2: Off Site-Woods

Inflow Area = 11,453 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-inch event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach 14R : Total Proposed

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach DP2: Off Site-Woods



Hydrograph for Reach DP2: Off Site-Woods

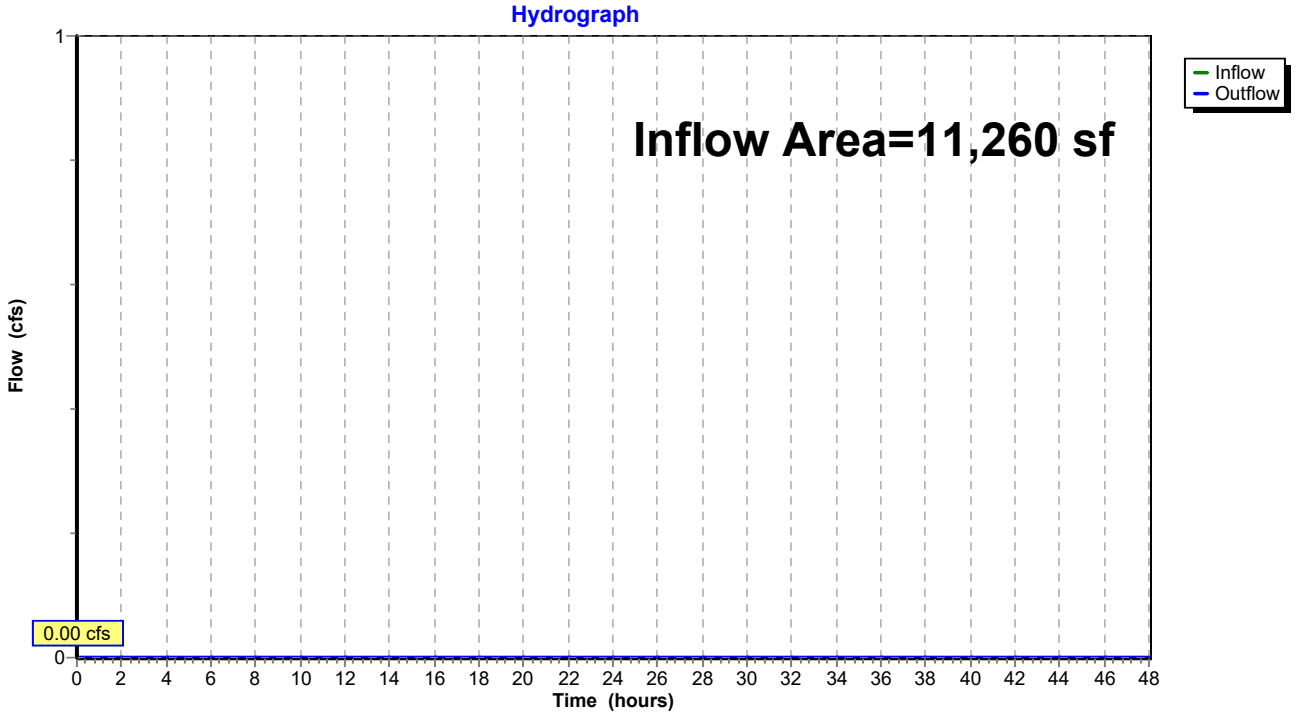
Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	**0.00**		**0.00**
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.00		0.00
10.00	0.00		0.00
11.00	0.00		0.00
12.00	0.00		0.00
13.00	0.00		0.00
14.00	0.00		0.00
15.00	0.00		0.00
16.00	0.00		0.00
17.00	0.00		0.00
18.00	0.00		0.00
19.00	0.00		0.00
20.00	0.00		0.00
21.00	0.00		0.00
22.00	0.00		0.00
23.00	0.00		0.00
24.00	0.00		0.00
25.00	0.00		0.00
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Reach DP3: Waban Street

Inflow Area = 11,260 sf, 6.22% Impervious, Inflow Depth = 0.00" for 2-inch event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach 14R : Total Proposed

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach DP3: Waban Street



Hydrograph for Reach DP3: Waban Street

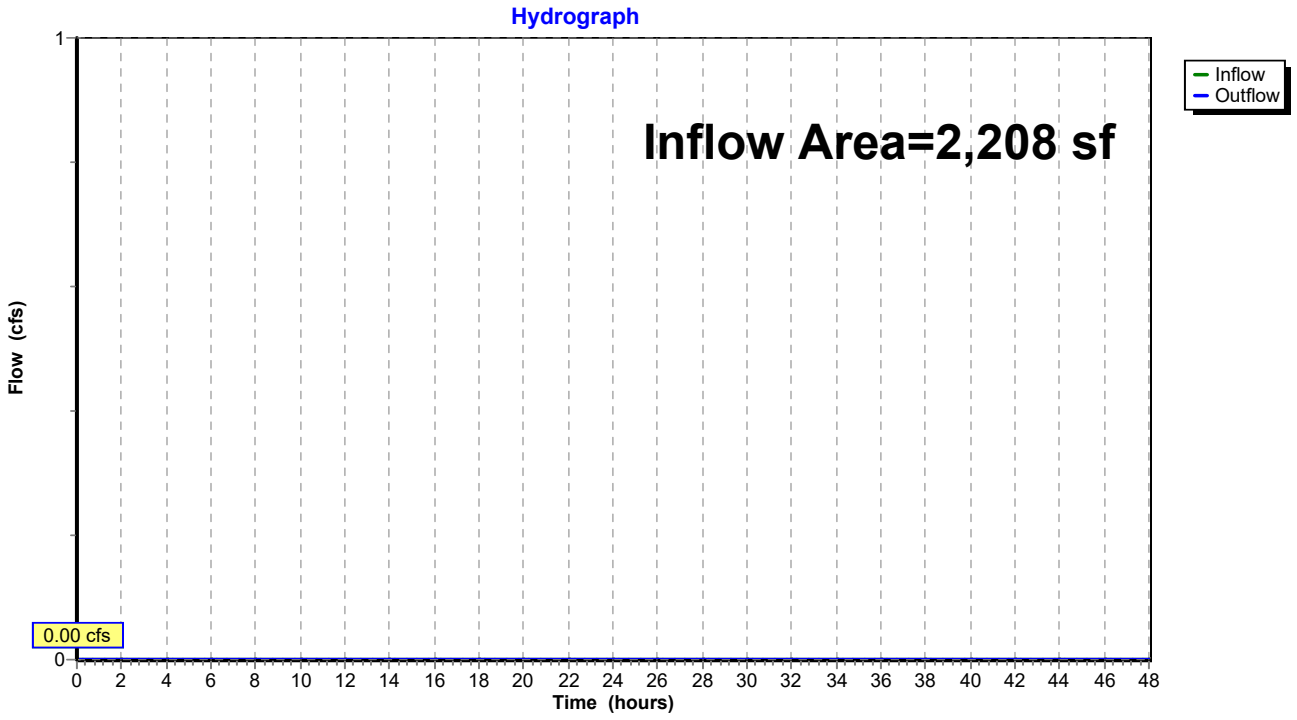
Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	**0.00**		**0.00**
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.00		0.00
10.00	0.00		0.00
11.00	0.00		0.00
12.00	0.00		0.00
13.00	0.00		0.00
14.00	0.00		0.00
15.00	0.00		0.00
16.00	0.00		0.00
17.00	0.00		0.00
18.00	0.00		0.00
19.00	0.00		0.00
20.00	0.00		0.00
21.00	0.00		0.00
22.00	0.00		0.00
23.00	0.00		0.00
24.00	0.00		0.00
25.00	0.00		0.00
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Reach DP4: Off Site

Inflow Area = 2,208 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-inch event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach 14R : Total Proposed

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach DP4: Off Site



Hydrograph for Reach DP4: Off Site

Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	**0.00**		**0.00**
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.00		0.00
10.00	0.00		0.00
11.00	0.00		0.00
12.00	0.00		0.00
13.00	0.00		0.00
14.00	0.00		0.00
15.00	0.00		0.00
16.00	0.00		0.00
17.00	0.00		0.00
18.00	0.00		0.00
19.00	0.00		0.00
20.00	0.00		0.00
21.00	0.00		0.00
22.00	0.00		0.00
23.00	0.00		0.00
24.00	0.00		0.00
25.00	0.00		0.00
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Pond SS-1: Underground Storage

Inflow Area = 86,529 sf, 67.93% Impervious, Inflow Depth = 0.61" for 2-inch event
Inflow = 1.58 cfs @ 12.14 hrs, Volume= 4,424 cf
Outflow = 0.45 cfs @ 12.00 hrs, Volume= 4,424 cf, Atten= 72%, Lag= 0.0 min
Discarded = 0.45 cfs @ 12.00 hrs, Volume= 4,424 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP1 : Jackson Road Culvert

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Peak Elev= 28.83' @ 12.41 hrs Surf.Area= 8,005 sf Storage= 790 cf

Plug-Flow detention time= 11.1 min calculated for 4,423 cf (100% of inflow)
Center-of-Mass det. time= 11.1 min (872.5 - 861.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	28.50'	5,319 cf	**77.50'W x 103.30'L x 3.50'H Field A** 28,019 cf Overall - 10,291 cf Embedded = 17,729 cf x 30.0% Voids
#2A	29.00'	10,291 cf	**ADS_StormTech SC-740 +Cap** x 224 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 224 Chambers in 16 Rows
		15,609 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	30.20'	**12.0" Round CMP_Round 12"** L= 5.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 30.20' / 30.10' S= 0.0200 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#3	Device 2	31.25'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.45 cfs @ 12.00 hrs HW=28.54' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.45 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=28.50' (Free Discharge)
↑—**2=CMP_Round 12"** (Controls 0.00 cfs)
↑—**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond SS-1: Underground Storage - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

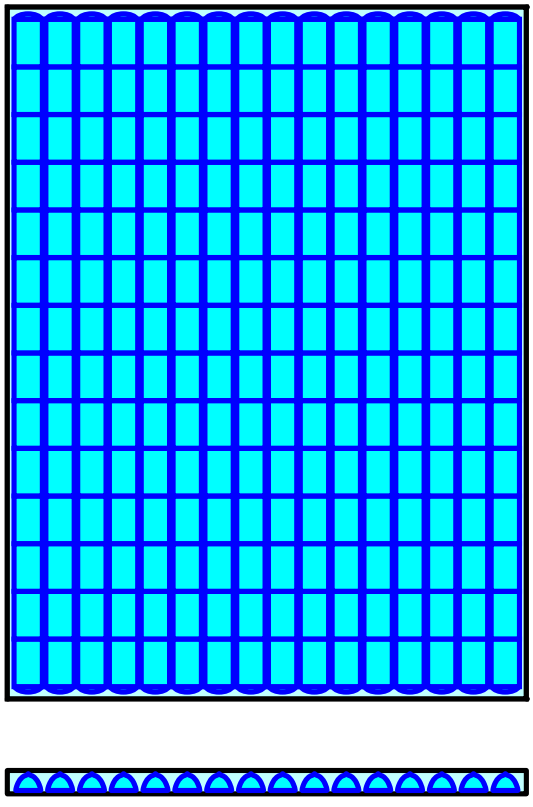
14 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 101.30' Row Length +12.0" End Stone x 2 = 103.30' Base Length
16 Rows x 51.0" Wide + 6.0" Spacing x 15 + 12.0" Side Stone x 2 = 77.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

224 Chambers x 45.9 cf = 10,290.6 cf Chamber Storage

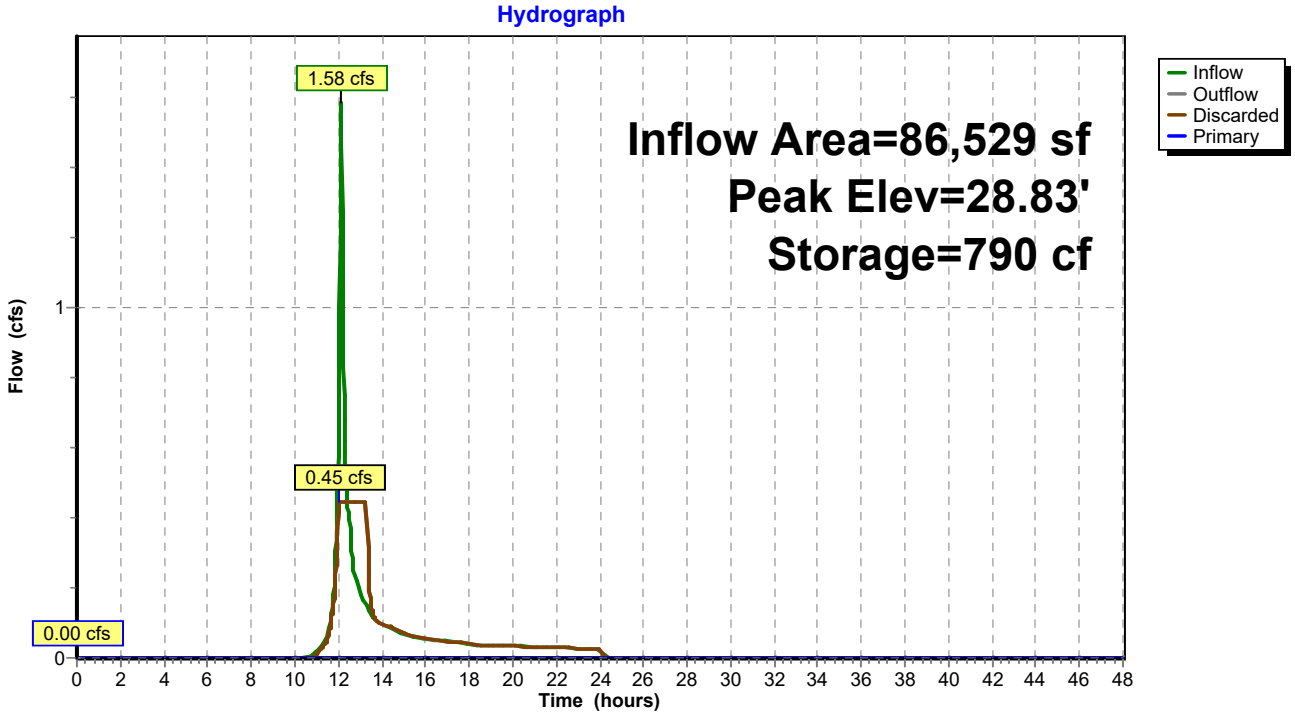
28,019.2 cf Field - 10,290.6 cf Chambers = 17,728.7 cf Stone x 30.0% Voids = 5,318.6 cf Stone Storage

Chamber Storage + Stone Storage = 15,609.2 cf = 0.358 af
Overall Storage Efficiency = 55.7%
Overall System Size = 103.30' x 77.50' x 3.50'

224 Chambers
1,037.7 cy Field
656.6 cy Stone



Pond SS-1: Underground Storage



Hydrograph for Pond SS-1: Underground Storage

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.00	0	28.50	0.00	0.00	**0.00**
1.00	0.00	0	28.50	0.00	0.00	0.00
2.00	0.00	0	28.50	0.00	0.00	0.00
3.00	0.00	0	28.50	0.00	0.00	0.00
4.00	0.00	0	28.50	0.00	0.00	0.00
5.00	0.00	0	28.50	0.00	0.00	0.00
6.00	0.00	0	28.50	0.00	0.00	0.00
7.00	0.00	0	28.50	0.00	0.00	0.00
8.00	0.00	0	28.50	0.00	0.00	0.00
9.00	0.00	0	28.50	0.00	0.00	0.00
10.00	0.00	0	28.50	0.00	0.00	0.00
11.00	0.01	2	28.50	0.01	0.01	0.00
12.00	**0.66**	**92**	**28.54**	**0.45**	**0.45**	0.00
13.00	**0.19**	**442**	**28.68**	0.45	0.45	0.00
14.00	0.10	19	28.51	0.10	0.10	0.00
15.00	0.07	13	28.51	0.07	0.07	0.00
16.00	0.06	11	28.50	0.06	0.06	0.00
17.00	0.05	9	28.50	0.05	0.05	0.00
18.00	0.04	7	28.50	0.04	0.04	0.00
19.00	0.04	7	28.50	0.04	0.04	0.00
20.00	0.03	6	28.50	0.03	0.03	0.00
21.00	0.03	6	28.50	0.03	0.03	0.00
22.00	0.03	6	28.50	0.03	0.03	0.00
23.00	0.03	5	28.50	0.03	0.03	0.00
24.00	0.03	5	28.50	0.03	0.03	0.00
25.00	0.00	0	28.50	0.00	0.00	0.00
26.00	0.00	0	28.50	0.00	0.00	0.00
27.00	0.00	0	28.50	0.00	0.00	0.00
28.00	0.00	0	28.50	0.00	0.00	0.00
29.00	0.00	0	28.50	0.00	0.00	0.00
30.00	0.00	0	28.50	0.00	0.00	0.00
31.00	0.00	0	28.50	0.00	0.00	0.00
32.00	0.00	0	28.50	0.00	0.00	0.00
33.00	0.00	0	28.50	0.00	0.00	0.00
34.00	0.00	0	28.50	0.00	0.00	0.00
35.00	0.00	0	28.50	0.00	0.00	0.00
36.00	0.00	0	28.50	0.00	0.00	0.00
37.00	0.00	0	28.50	0.00	0.00	0.00
38.00	0.00	0	28.50	0.00	0.00	0.00
39.00	0.00	0	28.50	0.00	0.00	0.00
40.00	0.00	0	28.50	0.00	0.00	0.00
41.00	0.00	0	28.50	0.00	0.00	0.00
42.00	0.00	0	28.50	0.00	0.00	0.00
43.00	0.00	0	28.50	0.00	0.00	0.00
44.00	0.00	0	28.50	0.00	0.00	0.00
45.00	0.00	0	28.50	0.00	0.00	0.00
46.00	0.00	0	28.50	0.00	0.00	0.00
47.00	0.00	0	28.50	0.00	0.00	0.00
48.00	0.00	0	28.50	0.00	0.00	0.00

Summary for Subcatchment PR-1A: PR-1A

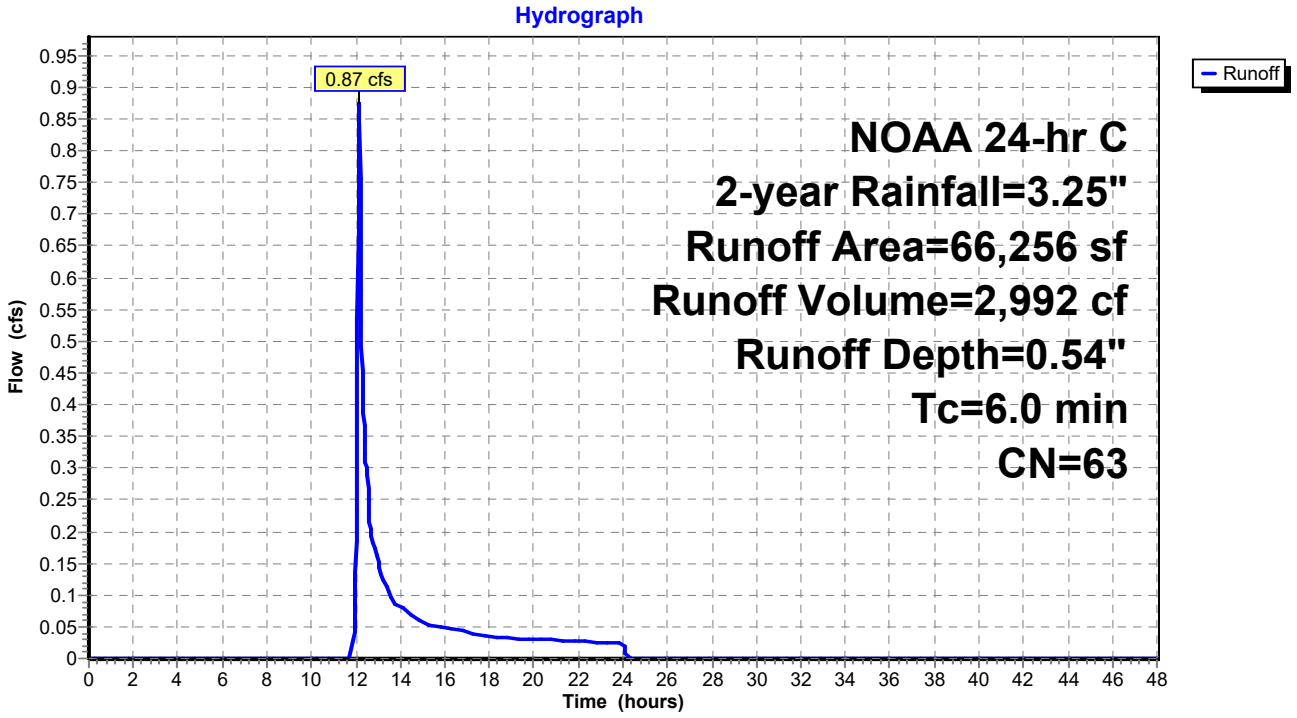
Runoff = 0.87 cfs @ 12.14 hrs, Volume= 2,992 cf, Depth= 0.54"
Routed to Reach DP1 : Jackson Road Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-year Rainfall=3.25"

Area (sf)	CN	Description
26,580	98	Roofs, HSG A
942	98	Paved parking, HSG A
1,495	36	Woods, Fair, HSG A
37,239	39	>75% Grass cover, Good, HSG A
66,256	63	Weighted Average
38,734		58.46% Pervious Area
27,522		41.54% Impervious Area

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

Subcatchment PR-1A: PR-1A



Hydrograph for Subcatchment PR-1A: PR-1A

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.04	0.00	0.00
2.00	0.07	0.00	0.00
3.00	0.11	0.00	0.00
4.00	0.16	0.00	0.00
5.00	0.21	0.00	0.00
6.00	0.26	0.00	0.00
7.00	0.32	0.00	0.00
8.00	0.39	0.00	0.00
9.00	0.47	0.00	0.00
10.00	0.59	0.00	0.00
11.00	0.78	0.00	0.00
12.00	1.55	0.02	**0.18**
13.00	2.47	0.23	**0.15**
14.00	2.66	0.30	0.08
15.00	2.78	0.34	0.06
16.00	2.86	0.38	0.05
17.00	2.93	0.41	0.04
18.00	2.99	0.43	0.03
19.00	3.04	0.45	0.03
20.00	3.09	0.47	0.03
21.00	3.14	0.49	0.03
22.00	3.18	0.51	0.03
23.00	3.21	0.53	0.03
24.00	**3.25**	**0.54**	0.03
25.00	3.25	0.54	0.00
26.00	3.25	0.54	0.00
27.00	3.25	0.54	0.00
28.00	3.25	0.54	0.00
29.00	3.25	0.54	0.00
30.00	3.25	0.54	0.00
31.00	3.25	0.54	0.00
32.00	3.25	0.54	0.00
33.00	3.25	0.54	0.00
34.00	3.25	0.54	0.00
35.00	3.25	0.54	0.00
36.00	3.25	0.54	0.00
37.00	3.25	0.54	0.00
38.00	3.25	0.54	0.00
39.00	3.25	0.54	0.00
40.00	3.25	0.54	0.00
41.00	3.25	0.54	0.00
42.00	3.25	0.54	0.00
43.00	3.25	0.54	0.00
44.00	3.25	0.54	0.00
45.00	3.25	0.54	0.00
46.00	3.25	0.54	0.00
47.00	3.25	0.54	0.00
48.00	3.25	0.54	0.00

Summary for Subcatchment PR-1B: PR-1B

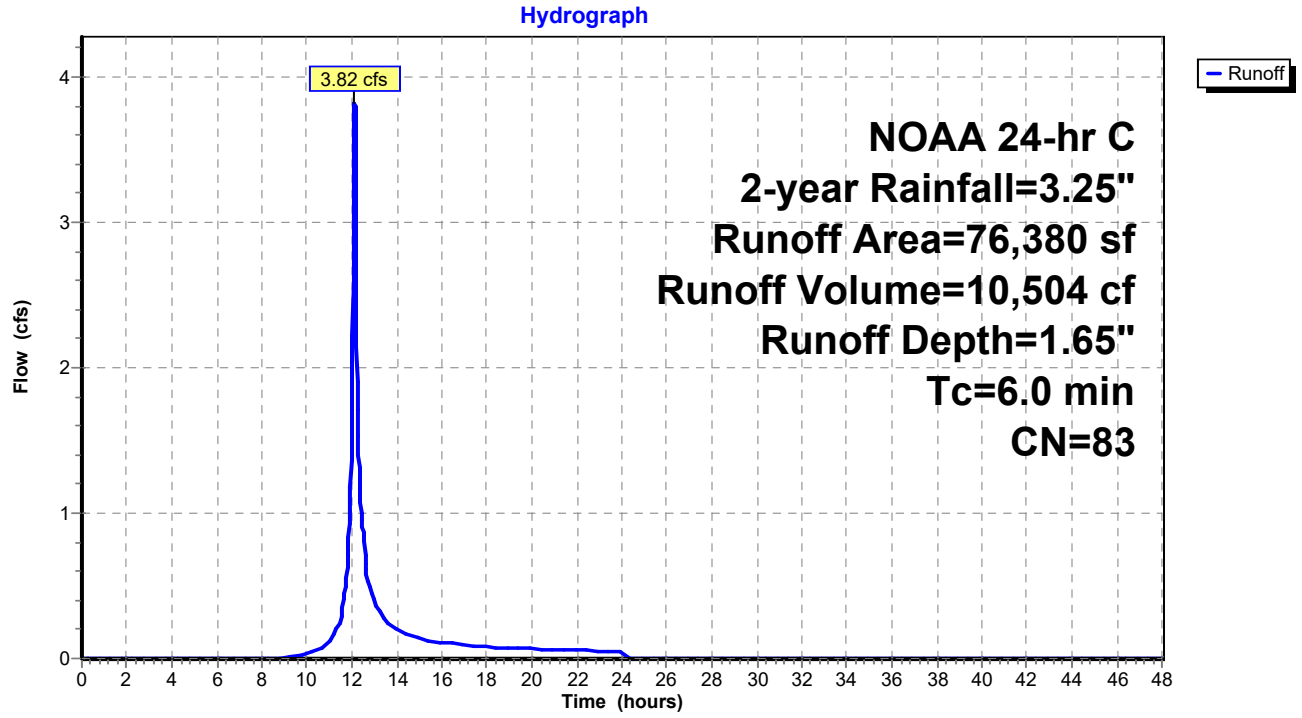
Runoff = 3.82 cfs @ 12.13 hrs, Volume= 10,504 cf, Depth= 1.65"
Routed to Pond SS-1 : Underground Storage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-year Rainfall=3.25"

Area (sf)	CN	Description
15,538	98	Roofs, HSG A
41,675	98	Paved parking, HSG A
3,639	36	Woods, Fair, HSG A
15,528	39	>75% Grass cover, Good, HSG A
76,380	83	Weighted Average
19,167		25.09% Pervious Area
57,213		74.91% Impervious Area

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

Subcatchment PR-1B: PR-1B



Hydrograph for Subcatchment PR-1B: PR-1B

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.04	0.00	0.00
2.00	0.07	0.00	0.00
3.00	0.11	0.00	0.00
4.00	0.16	0.00	0.00
5.00	0.21	0.00	0.00
6.00	0.26	0.00	0.00
7.00	0.32	0.00	0.00
8.00	0.39	0.00	0.00
9.00	0.47	0.00	0.01
10.00	0.59	0.01	0.04
11.00	0.78	0.06	0.12
12.00	1.55	0.41	**1.82**
13.00	2.47	1.03	**0.40**
14.00	2.66	1.18	0.20
15.00	2.78	1.27	0.14
16.00	2.86	1.34	0.11
17.00	2.93	1.39	0.09
18.00	2.99	1.44	0.08
19.00	3.04	1.48	0.07
20.00	3.09	1.52	0.07
21.00	3.14	1.56	0.06
22.00	3.18	1.59	0.06
23.00	3.21	1.62	0.05
24.00	**3.25**	**1.65**	0.06
25.00	3.25	1.65	0.00
26.00	3.25	1.65	0.00
27.00	3.25	1.65	0.00
28.00	3.25	1.65	0.00
29.00	3.25	1.65	0.00
30.00	3.25	1.65	0.00
31.00	3.25	1.65	0.00
32.00	3.25	1.65	0.00
33.00	3.25	1.65	0.00
34.00	3.25	1.65	0.00
35.00	3.25	1.65	0.00
36.00	3.25	1.65	0.00
37.00	3.25	1.65	0.00
38.00	3.25	1.65	0.00
39.00	3.25	1.65	0.00
40.00	3.25	1.65	0.00
41.00	3.25	1.65	0.00
42.00	3.25	1.65	0.00
43.00	3.25	1.65	0.00
44.00	3.25	1.65	0.00
45.00	3.25	1.65	0.00
46.00	3.25	1.65	0.00
47.00	3.25	1.65	0.00
48.00	3.25	1.65	0.00

Summary for Subcatchment PR-1C: PR-1C

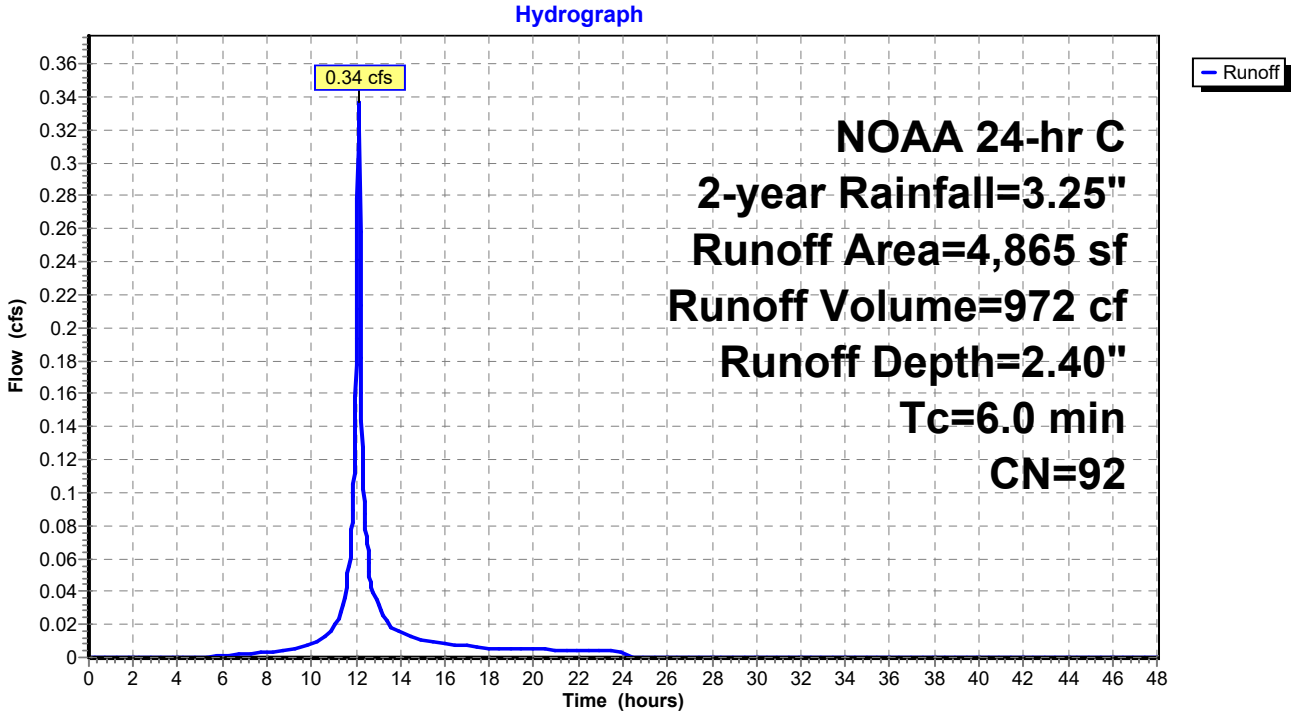
Runoff = 0.34 cfs @ 12.13 hrs, Volume= 972 cf, Depth= 2.40"
Routed to Reach DP1 : Jackson Road Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-year Rainfall=3.25"

Area (sf)	CN	Description
4,427	98	Paved parking, HSG A
438	30	Woods, Good, HSG A
4,865	92	Weighted Average
438		9.00% Pervious Area
4,427		91.00% Impervious Area

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

Subcatchment PR-1C: PR-1C



Hydrograph for Subcatchment PR-1C: PR-1C

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.04	0.00	0.00
2.00	0.07	0.00	0.00
3.00	0.11	0.00	0.00
4.00	0.16	0.00	0.00
5.00	0.21	0.00	0.00
6.00	0.26	0.01	0.00
7.00	0.32	0.02	0.00
8.00	0.39	0.04	0.00
9.00	0.47	0.08	0.00
10.00	0.59	0.14	0.01
11.00	0.78	0.25	0.02
12.00	1.55	0.84	**0.18**
13.00	2.47	1.67	**0.03**
14.00	2.66	1.84	0.02
15.00	2.78	1.95	0.01
16.00	2.86	2.03	0.01
17.00	2.93	2.10	0.01
18.00	2.99	2.15	0.01
19.00	3.04	2.20	0.01
20.00	3.09	2.25	0.00
21.00	3.14	2.29	0.00
22.00	3.18	2.33	0.00
23.00	3.21	2.36	0.00
24.00	**3.25**	**2.40**	0.00
25.00	3.25	2.40	0.00
26.00	3.25	2.40	0.00
27.00	3.25	2.40	0.00
28.00	3.25	2.40	0.00
29.00	3.25	2.40	0.00
30.00	3.25	2.40	0.00
31.00	3.25	2.40	0.00
32.00	3.25	2.40	0.00
33.00	3.25	2.40	0.00
34.00	3.25	2.40	0.00
35.00	3.25	2.40	0.00
36.00	3.25	2.40	0.00
37.00	3.25	2.40	0.00
38.00	3.25	2.40	0.00
39.00	3.25	2.40	0.00
40.00	3.25	2.40	0.00
41.00	3.25	2.40	0.00
42.00	3.25	2.40	0.00
43.00	3.25	2.40	0.00
44.00	3.25	2.40	0.00
45.00	3.25	2.40	0.00
46.00	3.25	2.40	0.00
47.00	3.25	2.40	0.00
48.00	3.25	2.40	0.00

Summary for Subcatchment PR-1D: PR-1D

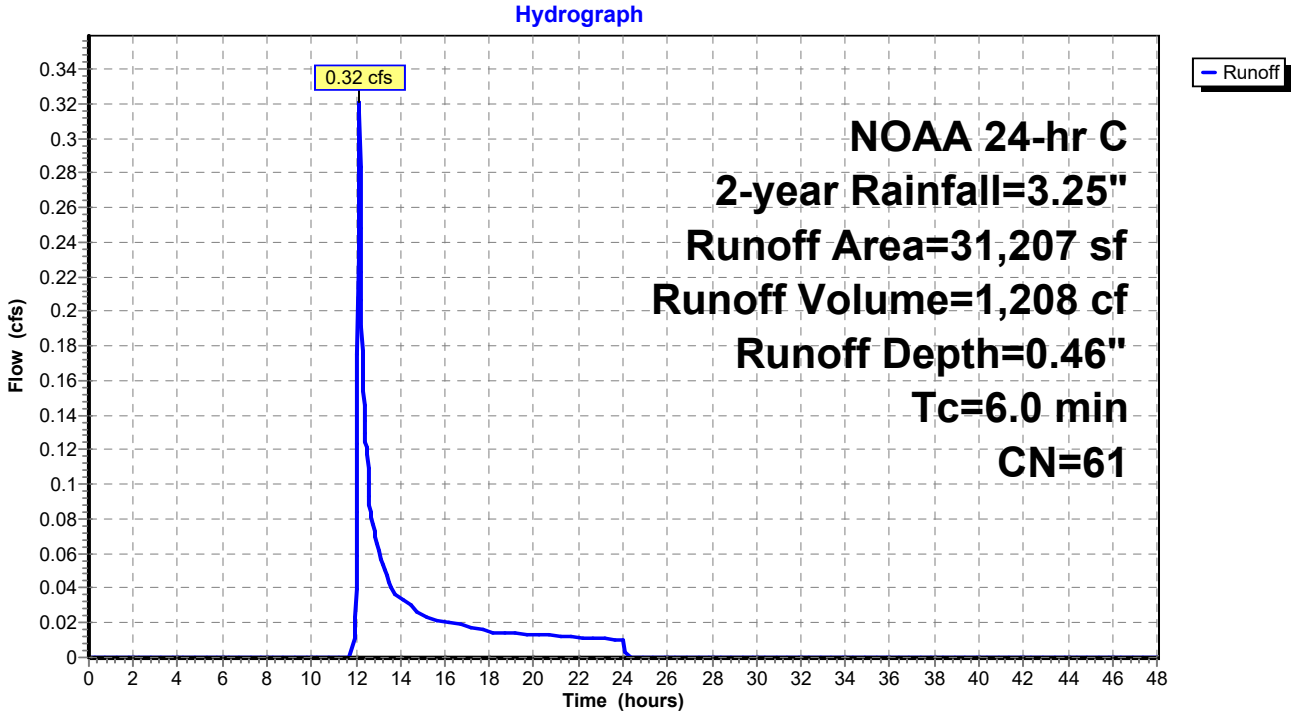
Runoff = 0.32 cfs @ 12.15 hrs, Volume= 1,208 cf, Depth= 0.46"
Routed to Reach DP1 : Jackson Road Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-year Rainfall=3.25"

Area (sf)	CN	Description
11,566	98	Paved parking, HSG A
19,641	39	>75% Grass cover, Good, HSG A
31,207	61	Weighted Average
19,641		62.94% Pervious Area
11,566		37.06% Impervious Area

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

Subcatchment PR-1D: PR-1D



Hydrograph for Subcatchment PR-1D: PR-1D

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.04	0.00	0.00
2.00	0.07	0.00	0.00
3.00	0.11	0.00	0.00
4.00	0.16	0.00	0.00
5.00	0.21	0.00	0.00
6.00	0.26	0.00	0.00
7.00	0.32	0.00	0.00
8.00	0.39	0.00	0.00
9.00	0.47	0.00	0.00
10.00	0.59	0.00	0.00
11.00	0.78	0.00	0.00
12.00	1.55	0.01	**0.04**
13.00	2.47	0.19	**0.06**
14.00	2.66	0.24	0.03
15.00	2.78	0.28	0.02
16.00	2.86	0.31	0.02
17.00	2.93	0.34	0.02
18.00	2.99	0.36	0.01
19.00	3.04	0.38	0.01
20.00	3.09	0.40	0.01
21.00	3.14	0.42	0.01
22.00	3.18	0.43	0.01
23.00	3.21	0.45	0.01
24.00	**3.25**	**0.46**	0.01
25.00	3.25	0.46	0.00
26.00	3.25	0.46	0.00
27.00	3.25	0.46	0.00
28.00	3.25	0.46	0.00
29.00	3.25	0.46	0.00
30.00	3.25	0.46	0.00
31.00	3.25	0.46	0.00
32.00	3.25	0.46	0.00
33.00	3.25	0.46	0.00
34.00	3.25	0.46	0.00
35.00	3.25	0.46	0.00
36.00	3.25	0.46	0.00
37.00	3.25	0.46	0.00
38.00	3.25	0.46	0.00
39.00	3.25	0.46	0.00
40.00	3.25	0.46	0.00
41.00	3.25	0.46	0.00
42.00	3.25	0.46	0.00
43.00	3.25	0.46	0.00
44.00	3.25	0.46	0.00
45.00	3.25	0.46	0.00
46.00	3.25	0.46	0.00
47.00	3.25	0.46	0.00
48.00	3.25	0.46	0.00

Summary for Subcatchment PR-1E: PR-1E

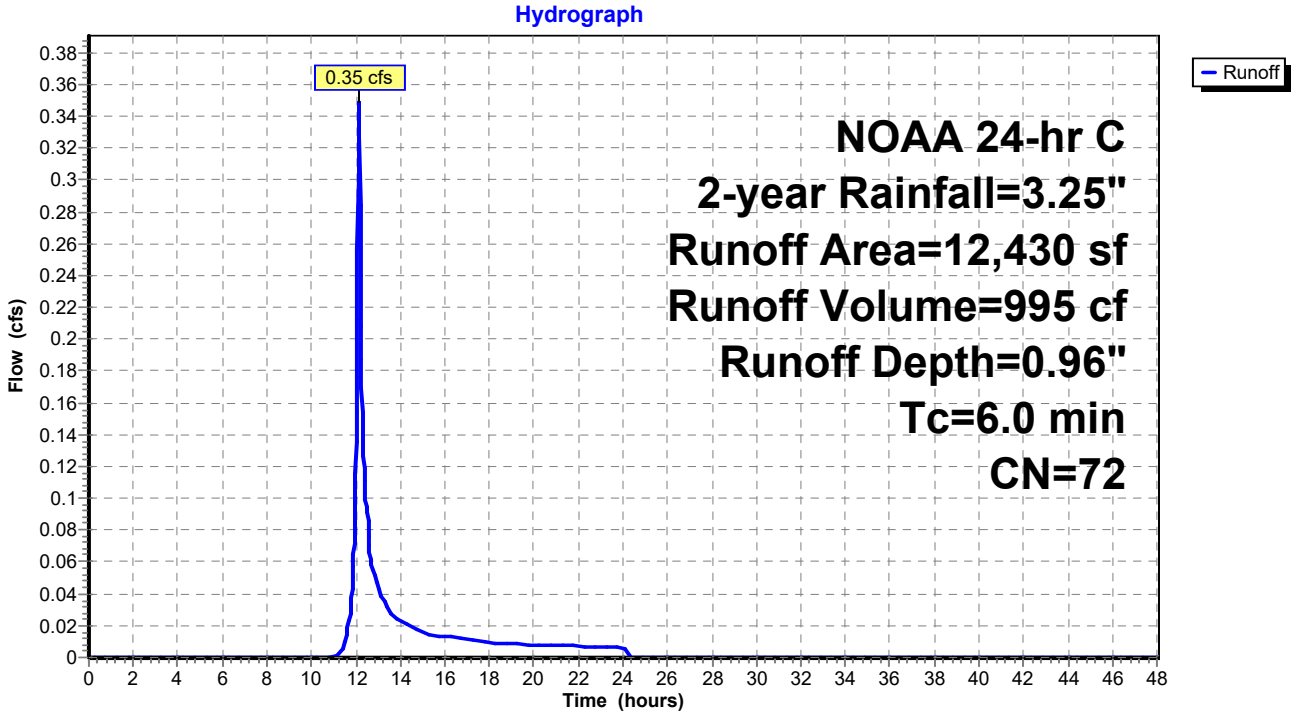
Runoff = 0.35 cfs @ 12.14 hrs, Volume= 995 cf, Depth= 0.96"
Routed to Reach DP1 : Jackson Road Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-year Rainfall=3.25"

Area (sf)	CN	Description
6,880	98	Paved parking, HSG A
5,550	39	>75% Grass cover, Good, HSG A
12,430	72	Weighted Average
5,550		44.65% Pervious Area
6,880		55.35% Impervious Area

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

Subcatchment PR-1E: PR-1E



Hydrograph for Subcatchment PR-1E: PR-1E

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.04	0.00	0.00
2.00	0.07	0.00	0.00
3.00	0.11	0.00	0.00
4.00	0.16	0.00	0.00
5.00	0.21	0.00	0.00
6.00	0.26	0.00	0.00
7.00	0.32	0.00	0.00
8.00	0.39	0.00	0.00
9.00	0.47	0.00	0.00
10.00	0.59	0.00	0.00
11.00	0.78	0.00	0.00
12.00	1.55	0.13	**0.14**
13.00	2.47	0.51	**0.04**
14.00	2.66	0.61	0.02
15.00	2.78	0.68	0.02
16.00	2.86	0.73	0.01
17.00	2.93	0.77	0.01
18.00	2.99	0.80	0.01
19.00	3.04	0.83	0.01
20.00	3.09	0.86	0.01
21.00	3.14	0.89	0.01
22.00	3.18	0.92	0.01
23.00	3.21	0.94	0.01
24.00	**3.25**	**0.96**	0.01
25.00	3.25	0.96	0.00
26.00	3.25	0.96	0.00
27.00	3.25	0.96	0.00
28.00	3.25	0.96	0.00
29.00	3.25	0.96	0.00
30.00	3.25	0.96	0.00
31.00	3.25	0.96	0.00
32.00	3.25	0.96	0.00
33.00	3.25	0.96	0.00
34.00	3.25	0.96	0.00
35.00	3.25	0.96	0.00
36.00	3.25	0.96	0.00
37.00	3.25	0.96	0.00
38.00	3.25	0.96	0.00
39.00	3.25	0.96	0.00
40.00	3.25	0.96	0.00
41.00	3.25	0.96	0.00
42.00	3.25	0.96	0.00
43.00	3.25	0.96	0.00
44.00	3.25	0.96	0.00
45.00	3.25	0.96	0.00
46.00	3.25	0.96	0.00
47.00	3.25	0.96	0.00
48.00	3.25	0.96	0.00

Summary for Subcatchment PR-1F: PR-1F

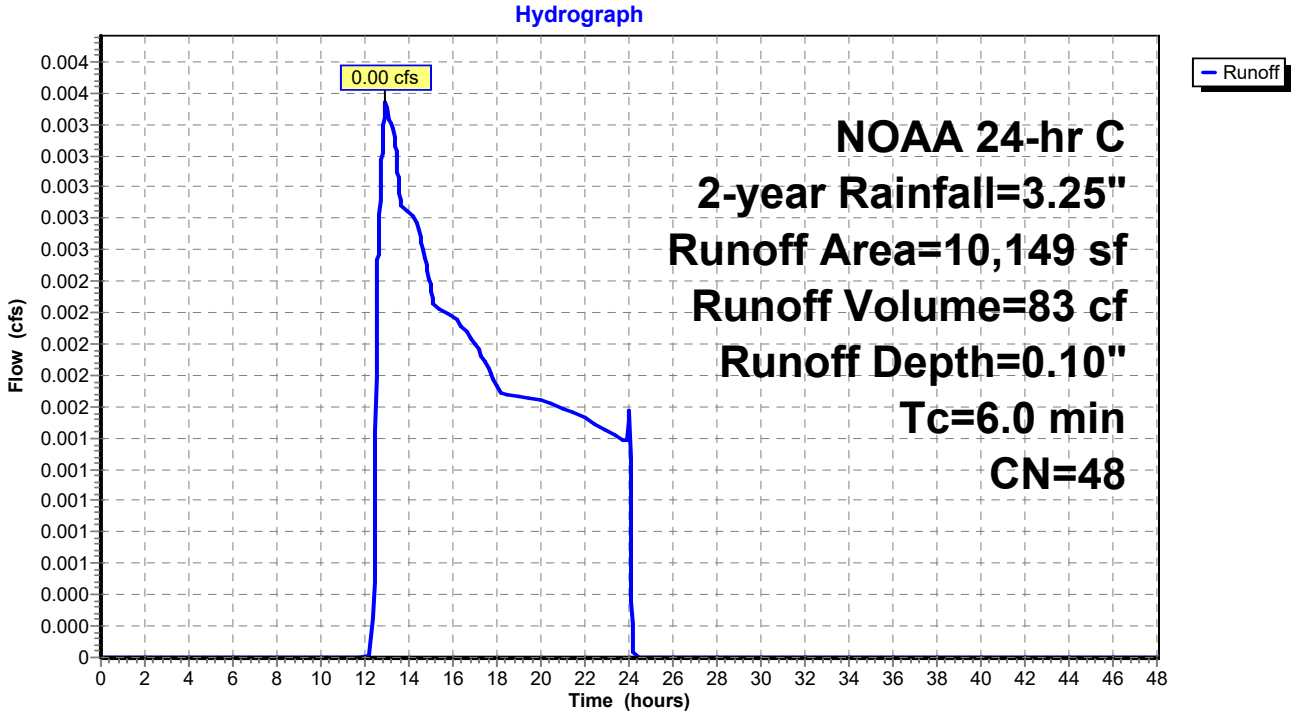
Runoff = 0.00 cfs @ 12.95 hrs, Volume= 83 cf, Depth= 0.10"
Routed to Pond SS-1 : Underground Storage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-year Rainfall=3.25"

Area (sf)	CN	Description
1,569	98	Paved parking, HSG A
8,580	39	>75% Grass cover, Good, HSG A
10,149	48	Weighted Average
8,580		84.54% Pervious Area
1,569		15.46% Impervious Area

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

Subcatchment PR-1F: PR-1F



Hydrograph for Subcatchment PR-1F: PR-1F

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.04	0.00	0.00
2.00	0.07	0.00	0.00
3.00	0.11	0.00	0.00
4.00	0.16	0.00	0.00
5.00	0.21	0.00	0.00
6.00	0.26	0.00	0.00
7.00	0.32	0.00	0.00
8.00	0.39	0.00	0.00
9.00	0.47	0.00	0.00
10.00	0.59	0.00	0.00
11.00	0.78	0.00	0.00
12.00	1.55	0.00	**0.00**
13.00	2.47	0.01	**0.00**
14.00	2.66	0.02	0.00
15.00	2.78	0.03	0.00
16.00	2.86	0.04	0.00
17.00	2.93	0.05	0.00
18.00	2.99	0.06	0.00
19.00	3.04	0.07	0.00
20.00	3.09	0.07	0.00
21.00	3.14	0.08	0.00
22.00	3.18	0.09	0.00
23.00	3.21	0.09	0.00
24.00	**3.25**	**0.10**	0.00
25.00	3.25	0.10	0.00
26.00	3.25	0.10	0.00
27.00	3.25	0.10	0.00
28.00	3.25	0.10	0.00
29.00	3.25	0.10	0.00
30.00	3.25	0.10	0.00
31.00	3.25	0.10	0.00
32.00	3.25	0.10	0.00
33.00	3.25	0.10	0.00
34.00	3.25	0.10	0.00
35.00	3.25	0.10	0.00
36.00	3.25	0.10	0.00
37.00	3.25	0.10	0.00
38.00	3.25	0.10	0.00
39.00	3.25	0.10	0.00
40.00	3.25	0.10	0.00
41.00	3.25	0.10	0.00
42.00	3.25	0.10	0.00
43.00	3.25	0.10	0.00
44.00	3.25	0.10	0.00
45.00	3.25	0.10	0.00
46.00	3.25	0.10	0.00
47.00	3.25	0.10	0.00
48.00	3.25	0.10	0.00

Summary for Subcatchment PR-2: PR-2

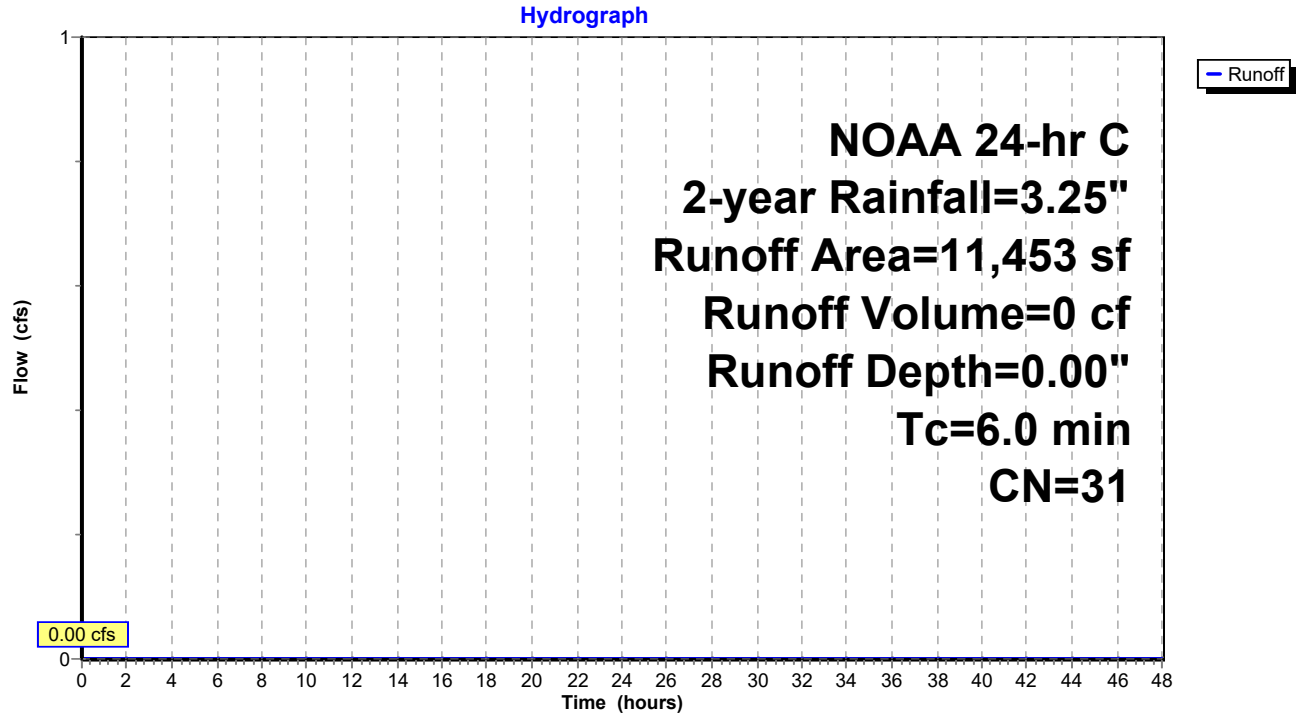
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach DP2 : Off Site-Woods

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-year Rainfall=3.25"

Area (sf)	CN	Description
10,513	30	Woods, Good, HSG A
940	39	>75% Grass cover, Good, HSG A
11,453	31	Weighted Average
11,453		100.00% Pervious Area

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

Subcatchment PR-2: PR-2



Hydrograph for Subcatchment PR-2: PR-2

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	**0.00**	**0.00**
1.00	0.04	0.00	0.00
2.00	0.07	0.00	0.00
3.00	0.11	0.00	0.00
4.00	0.16	0.00	0.00
5.00	0.21	0.00	0.00
6.00	0.26	0.00	0.00
7.00	0.32	0.00	0.00
8.00	0.39	0.00	0.00
9.00	0.47	0.00	0.00
10.00	0.59	0.00	0.00
11.00	0.78	0.00	0.00
12.00	1.55	0.00	0.00
13.00	2.47	0.00	0.00
14.00	2.66	0.00	0.00
15.00	2.78	0.00	0.00
16.00	2.86	0.00	0.00
17.00	2.93	0.00	0.00
18.00	2.99	0.00	0.00
19.00	3.04	0.00	0.00
20.00	3.09	0.00	0.00
21.00	3.14	0.00	0.00
22.00	3.18	0.00	0.00
23.00	3.21	0.00	0.00
24.00	**3.25**	0.00	0.00
25.00	3.25	0.00	0.00
26.00	3.25	0.00	0.00
27.00	3.25	0.00	0.00
28.00	3.25	0.00	0.00
29.00	3.25	0.00	0.00
30.00	3.25	0.00	0.00
31.00	3.25	0.00	0.00
32.00	3.25	0.00	0.00
33.00	3.25	0.00	0.00
34.00	3.25	0.00	0.00
35.00	3.25	0.00	0.00
36.00	3.25	0.00	0.00
37.00	3.25	0.00	0.00
38.00	3.25	0.00	0.00
39.00	3.25	0.00	0.00
40.00	3.25	0.00	0.00
41.00	3.25	0.00	0.00
42.00	3.25	0.00	0.00
43.00	3.25	0.00	0.00
44.00	3.25	0.00	0.00
45.00	3.25	0.00	0.00
46.00	3.25	0.00	0.00
47.00	3.25	0.00	0.00
48.00	3.25	0.00	0.00

Summary for Subcatchment PR-3: PR-3

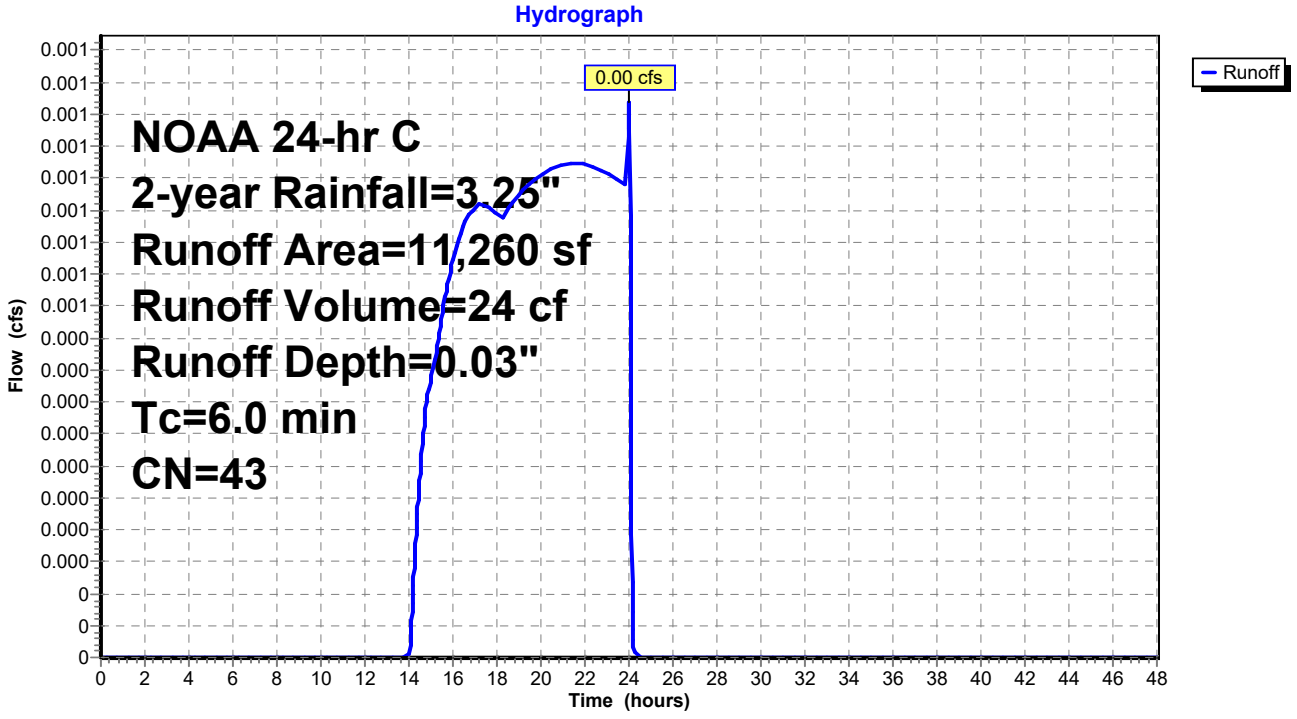
Runoff = 0.00 cfs @ 24.02 hrs, Volume= 24 cf, Depth= 0.03"
Routed to Reach DP3 : Waban Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-year Rainfall=3.25"

Area (sf)	CN	Description
700	98	Paved parking, HSG A
10,560	39	>75% Grass cover, Good, HSG A
11,260	43	Weighted Average
10,560		93.78% Pervious Area
700		6.22% Impervious Area

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

Subcatchment PR-3: PR-3



Hydrograph for Subcatchment PR-3: PR-3

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.04	0.00	0.00
2.00	0.07	0.00	0.00
3.00	0.11	0.00	0.00
4.00	0.16	0.00	0.00
5.00	0.21	0.00	0.00
6.00	0.26	0.00	0.00
7.00	0.32	0.00	0.00
8.00	0.39	0.00	0.00
9.00	0.47	0.00	0.00
10.00	0.59	0.00	0.00
11.00	0.78	0.00	0.00
12.00	1.55	0.00	0.00
13.00	2.47	0.00	0.00
14.00	2.66	0.00	0.00
15.00	2.78	0.00	0.00
16.00	2.86	0.00	0.00
17.00	2.93	0.01	0.00
18.00	2.99	0.01	0.00
19.00	3.04	0.01	0.00
20.00	3.09	0.01	0.00
21.00	3.14	0.02	0.00
22.00	3.18	0.02	0.00
23.00	3.21	0.02	0.00
24.00	**3.25**	**0.03**	**0.00**
25.00	3.25	0.03	**0.00**
26.00	3.25	0.03	0.00
27.00	3.25	0.03	0.00
28.00	3.25	0.03	0.00
29.00	3.25	0.03	0.00
30.00	3.25	0.03	0.00
31.00	3.25	0.03	0.00
32.00	3.25	0.03	0.00
33.00	3.25	0.03	0.00
34.00	3.25	0.03	0.00
35.00	3.25	0.03	0.00
36.00	3.25	0.03	0.00
37.00	3.25	0.03	0.00
38.00	3.25	0.03	0.00
39.00	3.25	0.03	0.00
40.00	3.25	0.03	0.00
41.00	3.25	0.03	0.00
42.00	3.25	0.03	0.00
43.00	3.25	0.03	0.00
44.00	3.25	0.03	0.00
45.00	3.25	0.03	0.00
46.00	3.25	0.03	0.00
47.00	3.25	0.03	0.00
48.00	3.25	0.03	0.00

Summary for Subcatchment PR-4: PR-4

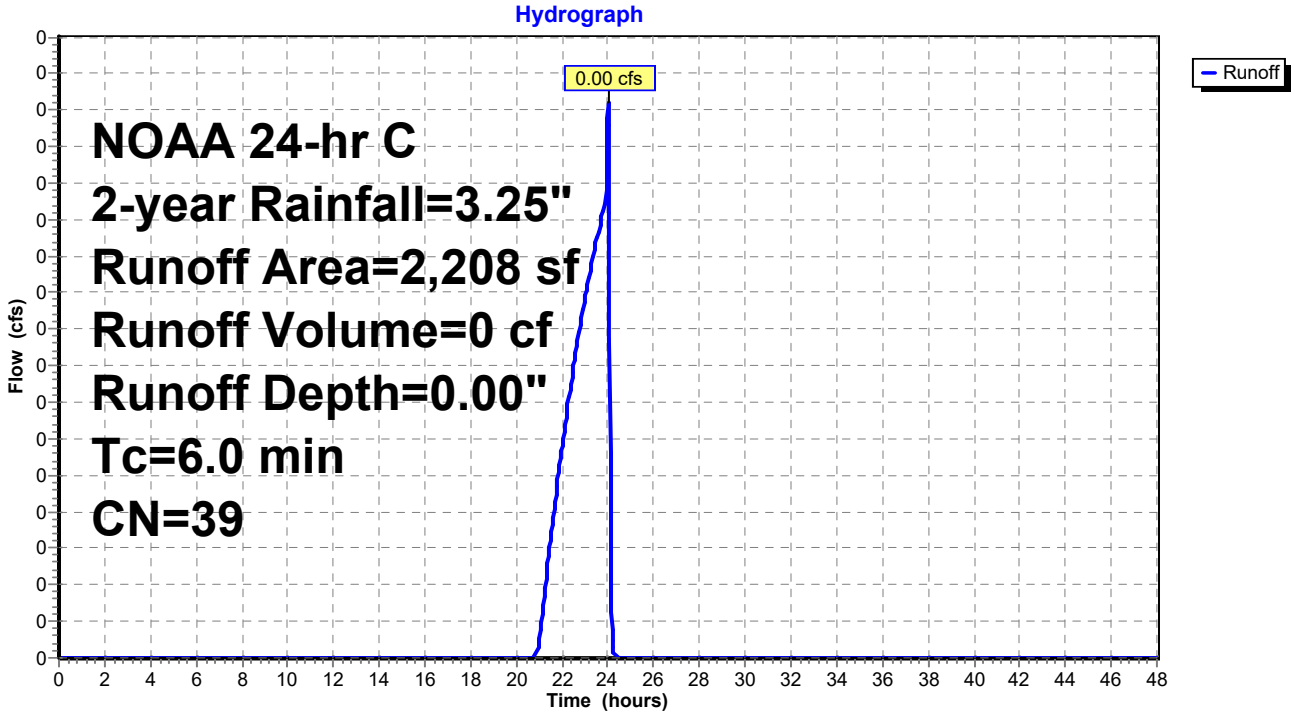
Runoff = 0.00 cfs @ 24.02 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach DP4 : Off Site

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr C 2-year Rainfall=3.25"

Area (sf)	CN	Description
2,208	39	>75% Grass cover, Good, HSG A
2,208		100.00% Pervious Area

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

Subcatchment PR-4: PR-4



Hydrograph for Subcatchment PR-4: PR-4

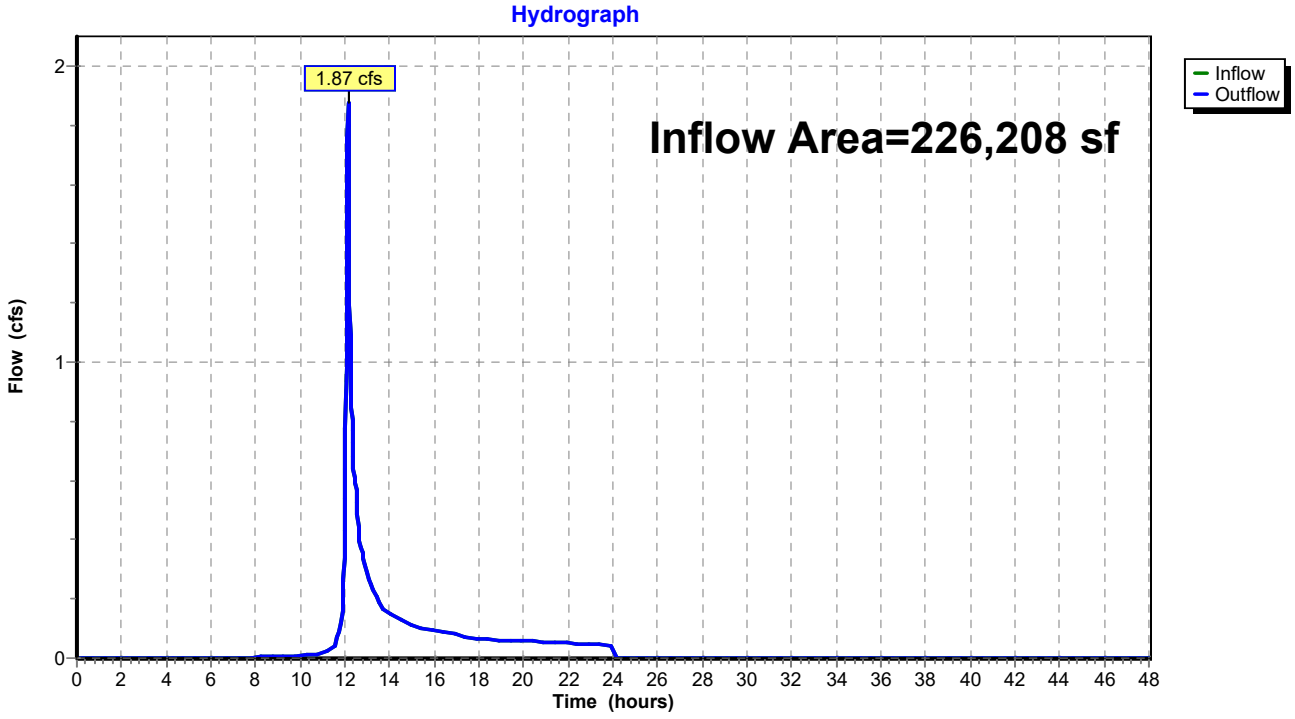
Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.04	0.00	0.00
2.00	0.07	0.00	0.00
3.00	0.11	0.00	0.00
4.00	0.16	0.00	0.00
5.00	0.21	0.00	0.00
6.00	0.26	0.00	0.00
7.00	0.32	0.00	0.00
8.00	0.39	0.00	0.00
9.00	0.47	0.00	0.00
10.00	0.59	0.00	0.00
11.00	0.78	0.00	0.00
12.00	1.55	0.00	0.00
13.00	2.47	0.00	0.00
14.00	2.66	0.00	0.00
15.00	2.78	0.00	0.00
16.00	2.86	0.00	0.00
17.00	2.93	0.00	0.00
18.00	2.99	0.00	0.00
19.00	3.04	0.00	0.00
20.00	3.09	0.00	0.00
21.00	3.14	0.00	0.00
22.00	3.18	0.00	0.00
23.00	3.21	0.00	0.00
24.00	**3.25**	**0.00**	**0.00**
25.00	3.25	0.00	**0.00**
26.00	3.25	0.00	0.00
27.00	3.25	0.00	0.00
28.00	3.25	0.00	0.00
29.00	3.25	0.00	0.00
30.00	3.25	0.00	0.00
31.00	3.25	0.00	0.00
32.00	3.25	0.00	0.00
33.00	3.25	0.00	0.00
34.00	3.25	0.00	0.00
35.00	3.25	0.00	0.00
36.00	3.25	0.00	0.00
37.00	3.25	0.00	0.00
38.00	3.25	0.00	0.00
39.00	3.25	0.00	0.00
40.00	3.25	0.00	0.00
41.00	3.25	0.00	0.00
42.00	3.25	0.00	0.00
43.00	3.25	0.00	0.00
44.00	3.25	0.00	0.00
45.00	3.25	0.00	0.00
46.00	3.25	0.00	0.00
47.00	3.25	0.00	0.00
48.00	3.25	0.00	0.00

Summary for Reach 14R: Total Proposed

Inflow Area = 226,208 sf, 48.57% Impervious, Inflow Depth = 0.33" for 2-year event
Inflow = 1.87 cfs @ 12.14 hrs, Volume= 6,192 cf
Outflow = 1.87 cfs @ 12.14 hrs, Volume= 6,192 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 14R: Total Proposed



Hydrograph for Reach 14R: Total Proposed

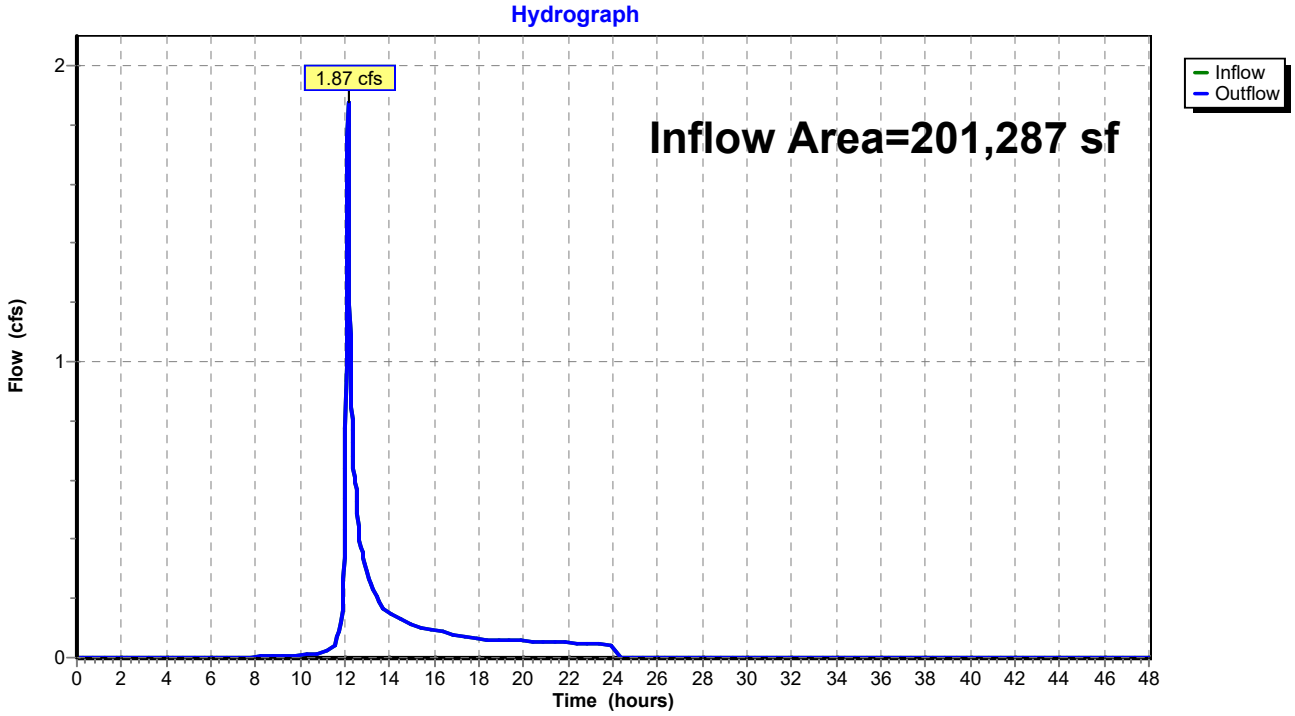
Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	0.00		0.00
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.00		0.00
10.00	0.01		0.01
11.00	0.02		0.02
12.00	**0.54**		**0.54**
13.00	**0.29**		**0.29**
14.00	0.15		0.15
15.00	0.11		0.11
16.00	0.09		0.09
17.00	0.08		0.08
18.00	0.06		0.06
19.00	0.06		0.06
20.00	0.06		0.06
21.00	0.05		0.05
22.00	0.05		0.05
23.00	0.05		0.05
24.00	0.05		0.05
25.00	0.00		0.00
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Reach DP1: Jackson Road Culvert

Inflow Area = 201,287 sf, 54.24% Impervious, Inflow Depth = 0.37" for 2-year event
Inflow = 1.87 cfs @ 12.14 hrs, Volume= 6,168 cf
Outflow = 1.87 cfs @ 12.14 hrs, Volume= 6,168 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach 14R : Total Proposed

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach DP1: Jackson Road Culvert



Hydrograph for Reach DP1: Jackson Road Culvert

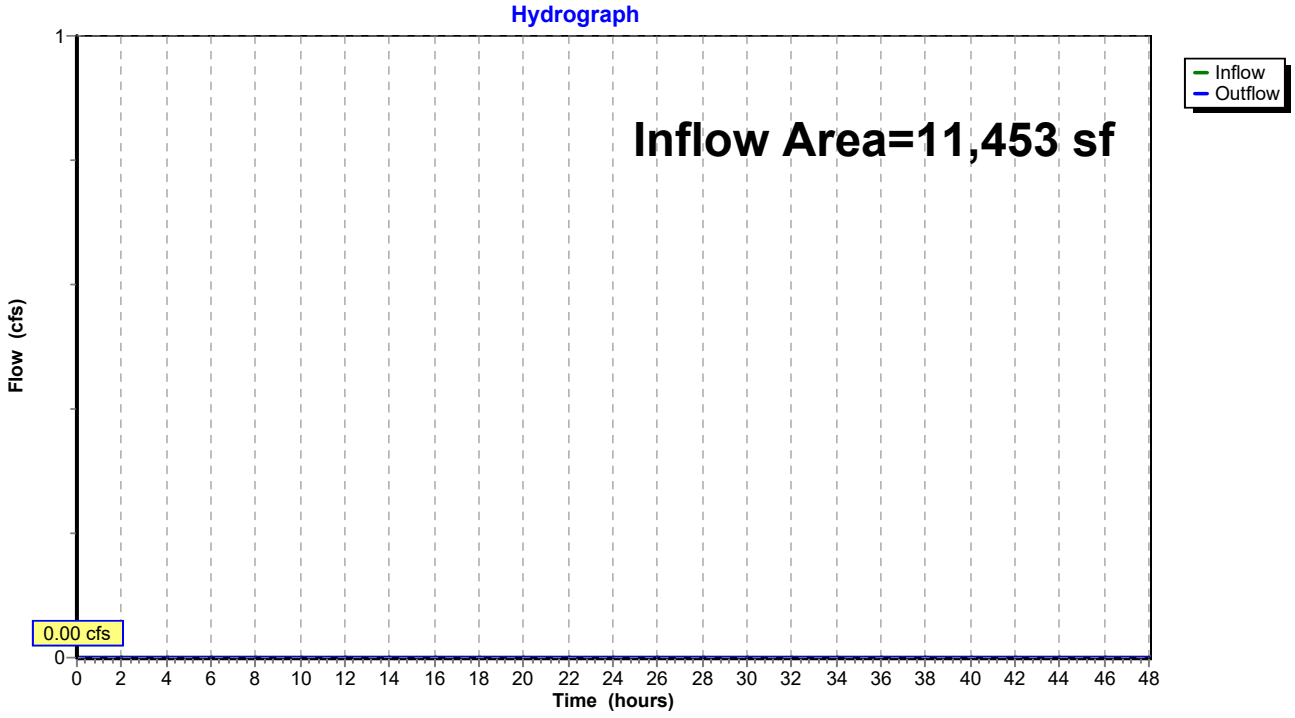
Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	0.00		0.00
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.00		0.00
10.00	0.01		0.01
11.00	0.02		0.02
12.00	**0.54**		**0.54**
13.00	**0.29**		**0.29**
14.00	0.15		0.15
15.00	0.11		0.11
16.00	0.09		0.09
17.00	0.08		0.08
18.00	0.06		0.06
19.00	0.06		0.06
20.00	0.06		0.06
21.00	0.05		0.05
22.00	0.05		0.05
23.00	0.05		0.05
24.00	0.05		0.05
25.00	0.00		0.00
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Reach DP2: Off Site-Woods

Inflow Area = 11,453 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach 14R : Total Proposed

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach DP2: Off Site-Woods



Hydrograph for Reach DP2: Off Site-Woods

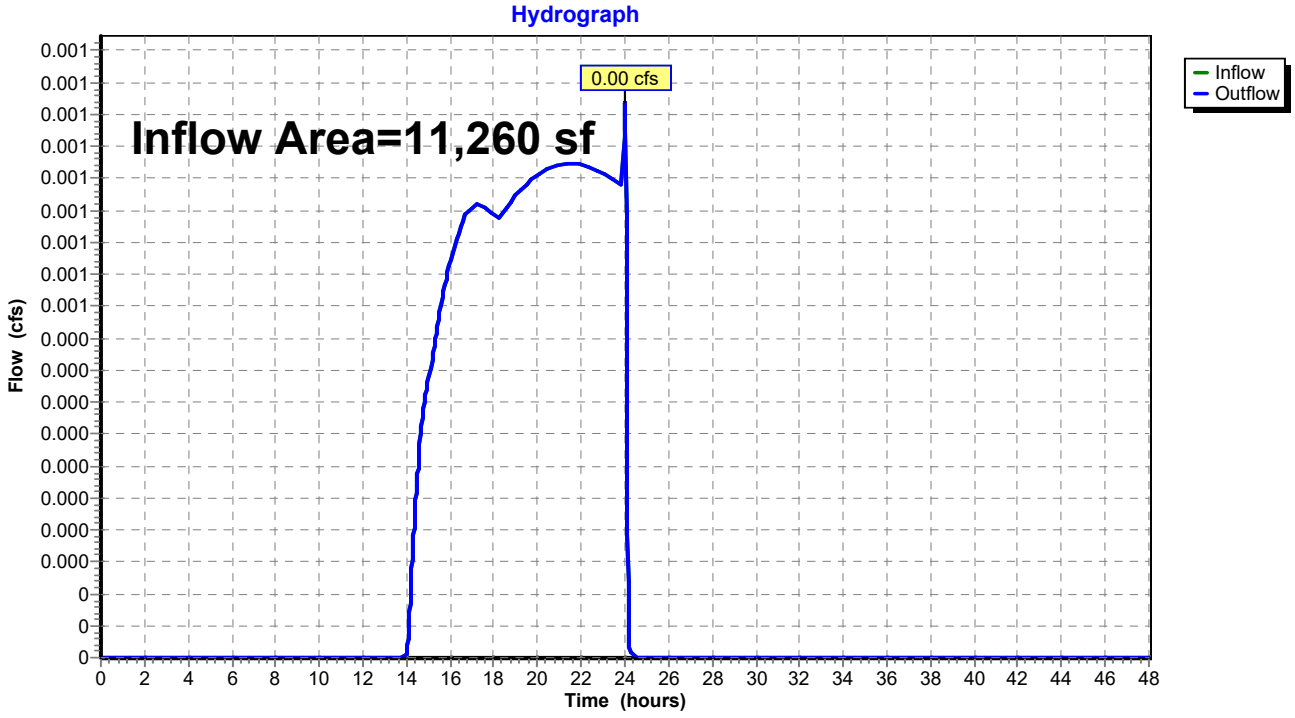
Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	**0.00**		**0.00**
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.00		0.00
10.00	0.00		0.00
11.00	0.00		0.00
12.00	0.00		0.00
13.00	0.00		0.00
14.00	0.00		0.00
15.00	0.00		0.00
16.00	0.00		0.00
17.00	0.00		0.00
18.00	0.00		0.00
19.00	0.00		0.00
20.00	0.00		0.00
21.00	0.00		0.00
22.00	0.00		0.00
23.00	0.00		0.00
24.00	0.00		0.00
25.00	0.00		0.00
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Reach DP3: Waban Street

Inflow Area = 11,260 sf, 6.22% Impervious, Inflow Depth = 0.03" for 2-year event
Inflow = 0.00 cfs @ 24.02 hrs, Volume= 24 cf
Outflow = 0.00 cfs @ 24.02 hrs, Volume= 24 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach 14R : Total Proposed

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach DP3: Waban Street



Hydrograph for Reach DP3: Waban Street

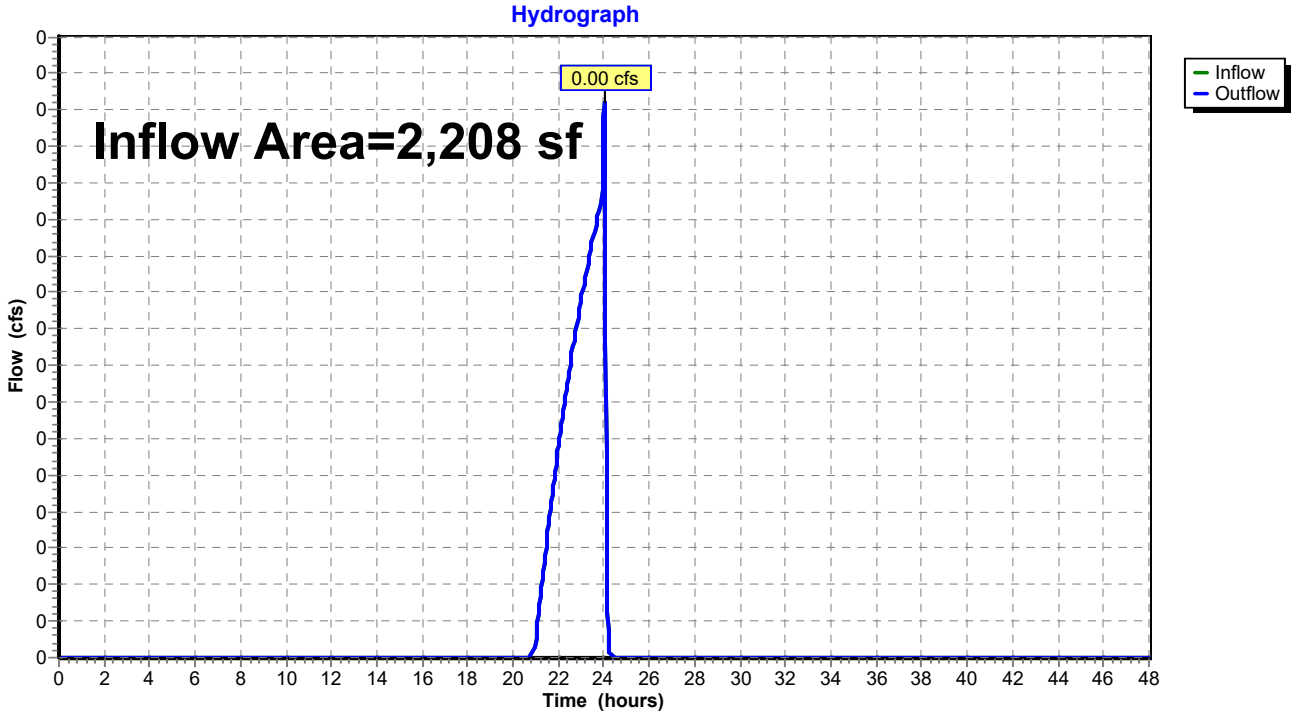
Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	0.00		0.00
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.00		0.00
10.00	0.00		0.00
11.00	0.00		0.00
12.00	0.00		0.00
13.00	0.00		0.00
14.00	0.00		0.00
15.00	0.00		0.00
16.00	0.00		0.00
17.00	0.00		0.00
18.00	0.00		0.00
19.00	0.00		0.00
20.00	0.00		0.00
21.00	0.00		0.00
22.00	0.00		0.00
23.00	0.00		0.00
24.00	**0.00**		**0.00**
25.00	**0.00**		**0.00**
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Reach DP4: Off Site

Inflow Area = 2,208 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 24.02 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 24.02 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Routed to Reach 14R : Total Proposed

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach DP4: Off Site



Hydrograph for Reach DP4: Off Site

Time (hours)	Inflow (cfs)	Elevation (feet)	Outflow (cfs)
0.00	0.00		0.00
1.00	0.00		0.00
2.00	0.00		0.00
3.00	0.00		0.00
4.00	0.00		0.00
5.00	0.00		0.00
6.00	0.00		0.00
7.00	0.00		0.00
8.00	0.00		0.00
9.00	0.00		0.00
10.00	0.00		0.00
11.00	0.00		0.00
12.00	0.00		0.00
13.00	0.00		0.00
14.00	0.00		0.00
15.00	0.00		0.00
16.00	0.00		0.00
17.00	0.00		0.00
18.00	0.00		0.00
19.00	0.00		0.00
20.00	0.00		0.00
21.00	0.00		0.00
22.00	0.00		0.00
23.00	0.00		0.00
24.00	**0.00**		**0.00**
25.00	**0.00**		**0.00**
26.00	0.00		0.00
27.00	0.00		0.00
28.00	0.00		0.00
29.00	0.00		0.00
30.00	0.00		0.00
31.00	0.00		0.00
32.00	0.00		0.00
33.00	0.00		0.00
34.00	0.00		0.00
35.00	0.00		0.00
36.00	0.00		0.00
37.00	0.00		0.00
38.00	0.00		0.00
39.00	0.00		0.00
40.00	0.00		0.00
41.00	0.00		0.00
42.00	0.00		0.00
43.00	0.00		0.00
44.00	0.00		0.00
45.00	0.00		0.00
46.00	0.00		0.00
47.00	0.00		0.00
48.00	0.00		0.00

Summary for Pond SS-1: Underground Storage

Inflow Area = 86,529 sf, 67.93% Impervious, Inflow Depth = 1.47" for 2-year event
Inflow = 3.82 cfs @ 12.13 hrs, Volume= 10,588 cf
Outflow = 0.45 cfs @ 11.72 hrs, Volume= 10,588 cf, Atten= 88%, Lag= 0.0 min
Discarded = 0.45 cfs @ 11.72 hrs, Volume= 10,588 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP1 : Jackson Road Culvert

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Peak Elev= 29.36' @ 12.92 hrs Surf.Area= 8,005 sf Storage= 3,525 cf

Plug-Flow detention time= 58.8 min calculated for 10,583 cf (100% of inflow)
Center-of-Mass det. time= 58.7 min (895.9 - 837.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	28.50'	5,319 cf	**77.50'W x 103.30'L x 3.50'H Field A** 28,019 cf Overall - 10,291 cf Embedded = 17,729 cf x 30.0% Voids
#2A	29.00'	10,291 cf	**ADS_StormTech SC-740 +Cap** x 224 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 224 Chambers in 16 Rows
		15,609 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	30.20'	**12.0" Round CMP_Round 12"** L= 5.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 30.20' / 30.10' S= 0.0200 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#3	Device 2	31.25'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.45 cfs @ 11.72 hrs HW=28.54' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.45 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=28.50' (Free Discharge)
2=CMP_Round 12" (Controls 0.00 cfs)
3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond SS-1: Underground Storage - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

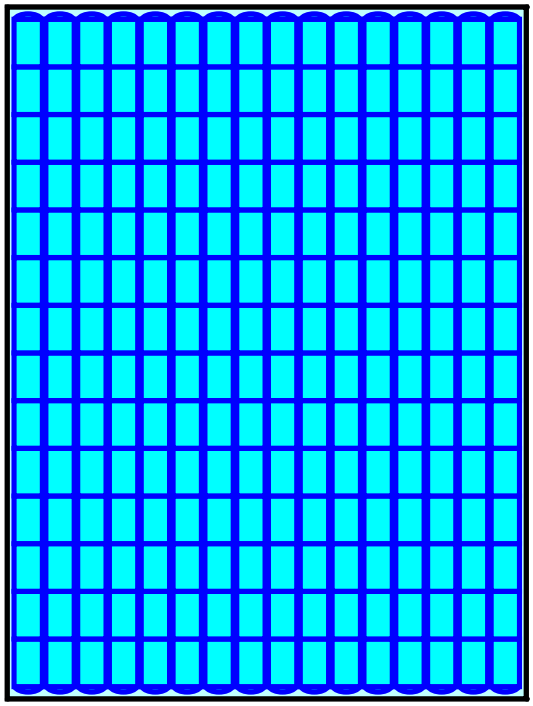
14 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 101.30' Row Length +12.0" End Stone x 2 = 103.30' Base Length
16 Rows x 51.0" Wide + 6.0" Spacing x 15 + 12.0" Side Stone x 2 = 77.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

224 Chambers x 45.9 cf = 10,290.6 cf Chamber Storage

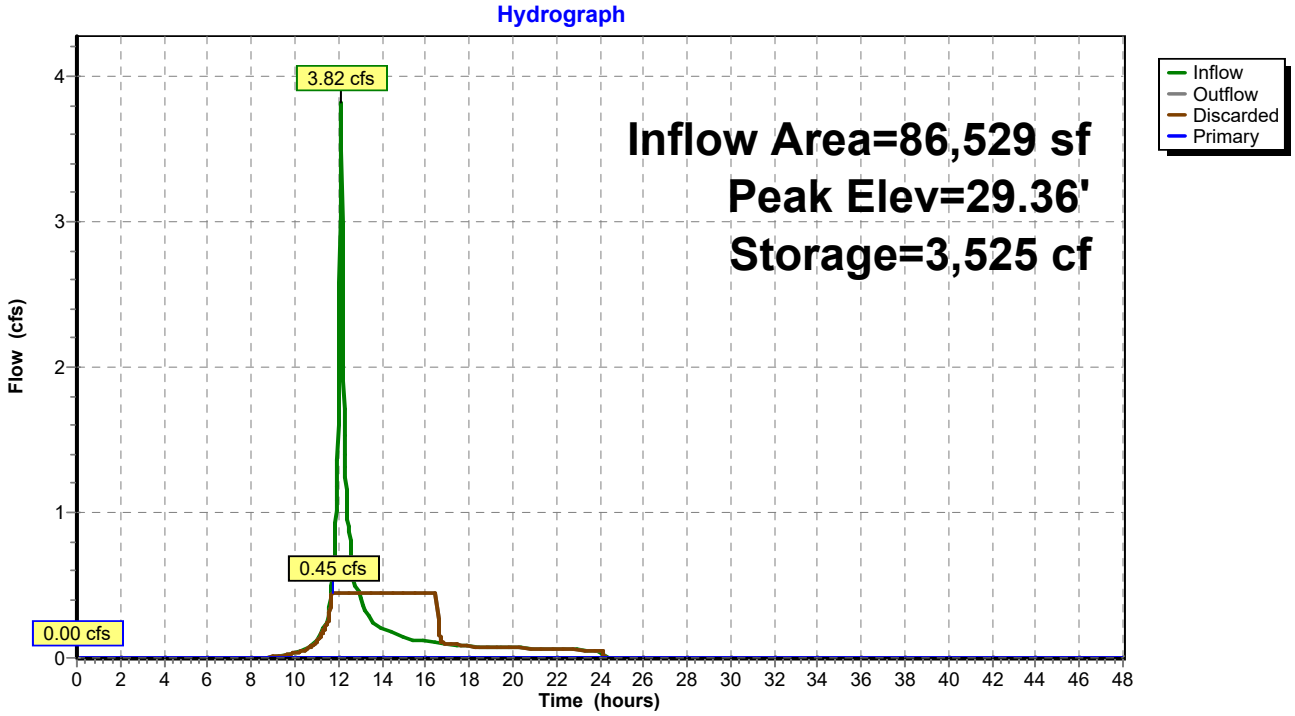
28,019.2 cf Field - 10,290.6 cf Chambers = 17,728.7 cf Stone x 30.0% Voids = 5,318.6 cf Stone Storage

Chamber Storage + Stone Storage = 15,609.2 cf = 0.358 af
Overall Storage Efficiency = 55.7%
Overall System Size = 103.30' x 77.50' x 3.50'

224 Chambers
1,037.7 cy Field
656.6 cy Stone



Pond SS-1: Underground Storage



Hydrograph for Pond SS-1: Underground Storage

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.00	0	28.50	0.00	0.00	**0.00**
1.00	0.00	0	28.50	0.00	0.00	0.00
2.00	0.00	0	28.50	0.00	0.00	0.00
3.00	0.00	0	28.50	0.00	0.00	0.00
4.00	0.00	0	28.50	0.00	0.00	0.00
5.00	0.00	0	28.50	0.00	0.00	0.00
6.00	0.00	0	28.50	0.00	0.00	0.00
7.00	0.00	0	28.50	0.00	0.00	0.00
8.00	0.00	0	28.50	0.00	0.00	0.00
9.00	0.01	1	28.50	0.01	0.01	0.00
10.00	0.04	6	28.50	0.03	0.03	0.00
11.00	0.12	21	28.51	**0.11**	**0.11**	0.00
12.00	**1.82**	**574**	**28.74**	**0.45**	**0.45**	0.00
13.00	**0.41**	**3,519**	**29.36**	0.45	0.45	0.00
14.00	0.20	2,898	29.26	0.45	0.45	0.00
15.00	0.14	1,906	29.11	0.45	0.45	0.00
16.00	0.11	741	28.81	0.45	0.45	0.00
17.00	0.10	18	28.51	0.10	0.10	0.00
18.00	0.08	15	28.51	0.08	0.08	0.00
19.00	0.07	14	28.51	0.07	0.07	0.00
20.00	0.07	13	28.51	0.07	0.07	0.00
21.00	0.06	12	28.51	0.06	0.06	0.00
22.00	0.06	11	28.50	0.06	0.06	0.00
23.00	0.05	10	28.50	0.05	0.05	0.00
24.00	0.06	10	28.50	0.05	0.05	0.00
25.00	0.00	0	28.50	0.00	0.00	0.00
26.00	0.00	0	28.50	0.00	0.00	0.00
27.00	0.00	0	28.50	0.00	0.00	0.00
28.00	0.00	0	28.50	0.00	0.00	0.00
29.00	0.00	0	28.50	0.00	0.00	0.00
30.00	0.00	0	28.50	0.00	0.00	0.00
31.00	0.00	0	28.50	0.00	0.00	0.00
32.00	0.00	0	28.50	0.00	0.00	0.00
33.00	0.00	0	28.50	0.00	0.00	0.00
34.00	0.00	0	28.50	0.00	0.00	0.00
35.00	0.00	0	28.50	0.00	0.00	0.00
36.00	0.00	0	28.50	0.00	0.00	0.00
37.00	0.00	0	28.50	0.00	0.00	0.00
38.00	0.00	0	28.50	0.00	0.00	0.00
39.00	0.00	0	28.50	0.00	0.00	0.00
40.00	0.00	0	28.50	0.00	0.00	0.00
41.00	0.00	0	28.50	0.00	0.00	0.00
42.00	0.00	0	28.50	0.00	0.00	0.00
43.00	0.00	0	28.50	0.00	0.00	0.00
44.00	0.00	0	28.50	0.00	0.00	0.00
45.00	0.00	0	28.50	0.00	0.00	0.00
46.00	0.00	0	28.50	0.00	0.00	0.00
47.00	0.00	0	28.50	0.00	0.00	0.00
48.00	0.00	0	28.50	0.00	0.00	0.00

Events for Subcatchment PR-1A: PR-1A

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-inch	2.00	0.04	562	0.10
2-year	3.25	0.87	2,992	0.54
10-year	5.13	3.10	8,789	1.59
25-year	6.31	4.77	13,227	2.40
100-year	**8.12**	**7.56**	**20,778**	**3.76**

Events for Subcatchment PR-1B: PR-1B

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-inch	2.00	1.58	4,424	0.70
2-year	3.25	3.82	10,504	1.65
10-year	5.13	7.48	20,953	3.29
25-year	6.31	9.82	27,878	4.38
100-year	**8.12**	**13.37**	**38,776**	**6.09**

Events for Subcatchment PR-1C: PR-1C

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-inch	2.00	0.18	502	1.24
2-year	3.25	0.34	972	2.40
10-year	5.13	0.57	1,709	4.22
25-year	6.31	0.72	2,179	5.37
100-year	**8.12**	**0.94**	**2,904**	**7.16**

Events for Subcatchment PR-1D: PR-1D

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-inch	2.00	0.01	190	0.07
2-year	3.25	0.32	1,208	0.46
10-year	5.13	1.31	3,765	1.45
25-year	6.31	2.07	5,762	2.22
100-year	**8.12**	**3.34**	**9,197**	**3.54**

Events for Subcatchment PR-1E: PR-1E

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-inch	2.00	0.08	303	0.29
2-year	3.25	0.35	995	0.96
10-year	5.13	0.87	2,381	2.30
25-year	6.31	1.22	3,365	3.25
100-year	**8.12**	**1.79**	**4,972**	**4.80**

Events for Subcatchment PR-1F: PR-1F

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-inch	2.00	0.00	0	0.00
2-year	3.25	0.00	83	0.10
10-year	5.13	0.13	538	0.64
25-year	6.31	0.30	969	1.15
100-year	**8.12**	**0.61**	**1,786**	**2.11**

Events for Subcatchment PR-2: PR-2

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-inch	2.00	0.00	0	0.00
2-year	3.25	0.00	0	0.00
10-year	5.13	0.00	19	0.02
25-year	6.31	0.00	137	0.14
100-year	**8.12**	**0.04**	**495**	**0.52**

Events for Subcatchment PR-3: PR-3

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-inch	2.00	0.00	0	0.00
2-year	3.25	0.00	24	0.03
10-year	5.13	0.04	366	0.39
25-year	6.31	0.18	743	0.79
100-year	**8.12**	**0.47**	**1,499**	**1.60**

Events for Subcatchment PR-4: PR-4

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-inch	2.00	0.00	0	0.00
2-year	3.25	0.00	0	0.00
10-year	5.13	0.00	42	0.23
25-year	6.31	0.01	99	0.54
100-year	**8.12**	**0.06**	**222**	**1.21**

Events for Reach 14R: Total Proposed

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-inch	0.26	0.26	**0.00**	**0**
2-year	1.87	1.87	0.00	0
10-year	5.88	5.88	0.00	0
25-year	8.96	8.96	0.00	0
100-year	**14.17**	**14.17**	0.00	0

Events for Reach DP1: Jackson Road Culvert

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-inch	0.26	0.26	**0.00**	**0**
2-year	1.87	1.87	0.00	0
10-year	5.85	5.85	0.00	0
25-year	8.78	8.78	0.00	0
100-year	**13.63**	**13.63**	0.00	0

Events for Reach DP2: Off Site-Woods

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-inch	0.00	0.00	**0.00**	**0**
2-year	0.00	0.00	0.00	0
10-year	0.00	0.00	0.00	0
25-year	0.00	0.00	0.00	0
100-year	**0.04**	**0.04**	0.00	0

Events for Reach DP3: Waban Street

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-inch	0.00	0.00	**0.00**	**0**
2-year	0.00	0.00	0.00	0
10-year	0.04	0.04	0.00	0
25-year	0.18	0.18	0.00	0
100-year	**0.47**	**0.47**	0.00	0

Events for Reach DP4: Off Site

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-inch	0.00	0.00	**0.00**	**0**
2-year	0.00	0.00	0.00	0
10-year	0.00	0.00	0.00	0
25-year	0.01	0.01	0.00	0
100-year	**0.06**	**0.06**	0.00	0

Events for Pond SS-1: Underground Storage

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-inch	1.58	0.45	**0.45**	0.00	28.83	790
2-year	3.82	0.45	0.45	0.00	29.36	3,525
10-year	7.60	0.45	0.45	0.00	30.40	9,768
25-year	10.10	0.75	0.45	0.31	31.32	13,934
100-year	**14.01**	**3.64**	0.45	**3.19**	**31.84**	**15,233**

APPENDIX C

Soil Investigations

NRCS Soil Maps and Descriptions
Geotechnical Report

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 Middlesex County, Massachusetts

April 11, 2022

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.

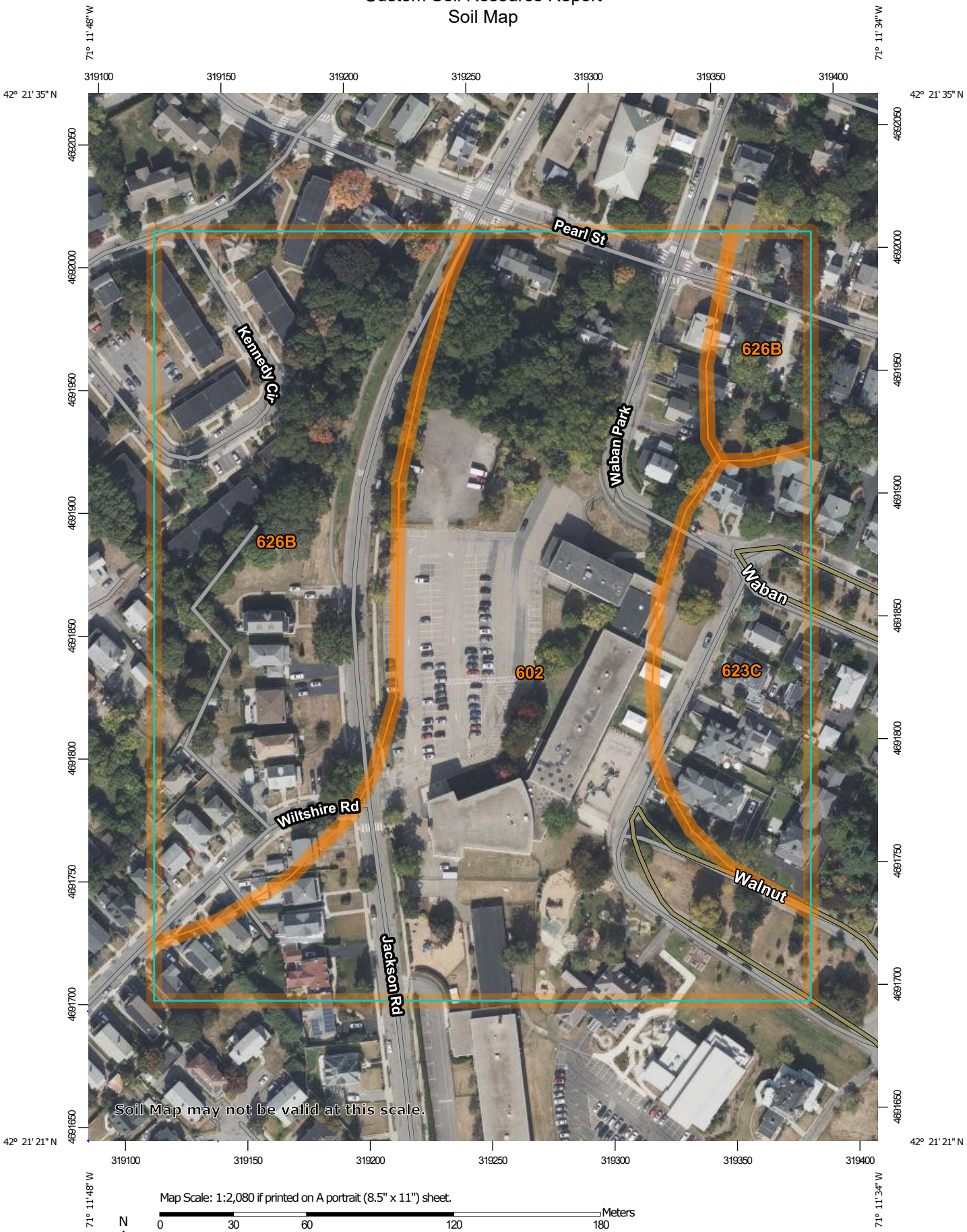
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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: 1:2,080 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil 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 1:25,000.

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 21, Sep 2, 2021

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

Date(s) aerial images were photographed: Sep 25, 2020—Oct 4, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
602	Urban land	10.8	51.9%
623C	Woodbridge-Urban land complex, 3 to 15 percent slopes	2.4	11.6%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	7.6	36.5%
Totals for Area of Interest		**20.8**	**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.

Middlesex County, Massachusetts

602—Urban land

Map Unit Setting

National map unit symbol: 9950
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Minor Components

Udorthents, wet substratum

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

Rock outcrop

Percent of map unit: 5 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

Udorthents, loamy

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

623C—Woodbridge-Urban land complex, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w68b
Elevation: 0 to 550 feet
Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Woodbridge and similar soils: 58 percent
Urban land: 28 percent
Minor components: 14 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope, footslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 18 inches: fine sandy loam
Bw2 - 18 to 30 inches: fine sandy loam
Cd - 30 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 30 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 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Paxton

Percent of map unit: 9 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury

Percent of map unit: 5 percent
Landform: Hills, drainageways, drumlins, depressions, ground moraines
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

626B—Merrimac-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyr9
Elevation: 0 to 820 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Merrimac and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Outwash plains, outwash terraces, moraines, eskers, kames

Landform position (two-dimensional): Backslope, footslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat 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
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, crest, head slope, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent
Landform: Outwash terraces, dunes, outwash plains, deltas
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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

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

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

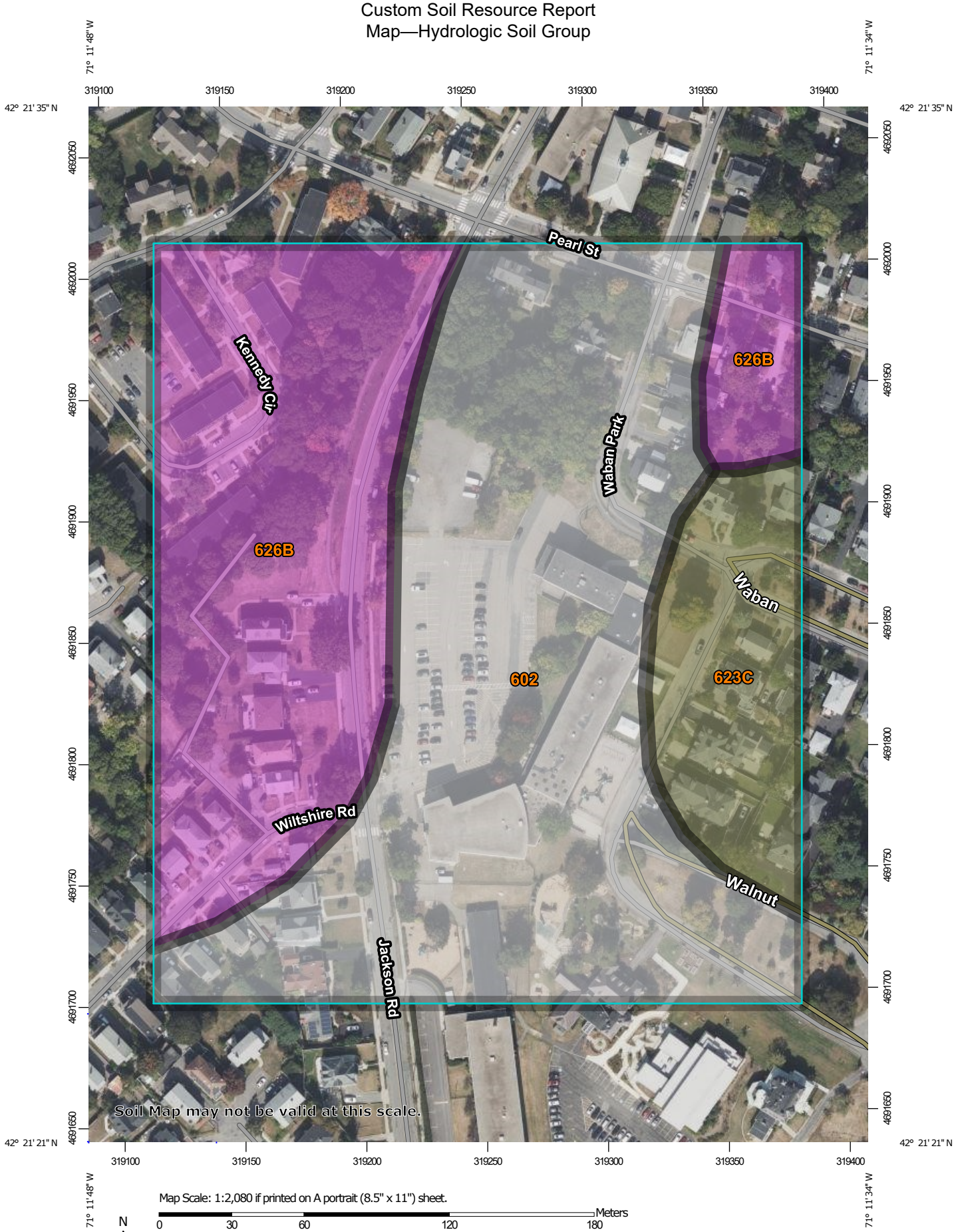
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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

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

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

Custom Soil Resource Report
Map—Hydrologic Soil Group



Map Scale: 1:2,080 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 21, Sep 2, 2021

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

Date(s) aerial images were photographed: Sep 25, 2020—Oct 4, 2020

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

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
602	Urban land		10.8	51.9%
623C	Woodbridge-Urban land complex, 3 to 15 percent slopes	C/D	2.4	11.6%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	7.6	36.5%
Totals for Area of Interest			**20.8**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

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GEOTECHNICAL ENGINEERING REPORT
PROPOSED LINCOLN-ELIOT ELEMENTARY SCHOOL EXPANSION
150 JACKSON ROAD
NEWTON, MASSACHUSETTS

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EXECUTIVE SUMMARY

Ransom Consulting, LLC (Ransom) has prepared this Geotechnical Engineering Report for Arrowstreet, Inc. (Arrowstreet) for the proposed Lincoln-Eliot Elementary School expansion and renovations project, located at 150 Jackson Road in Newton, Massachusetts (the "Site"). This geotechnical report has been prepared in general accordance with our proposed scope of work, dated November 16, 2018, and revised February 17, 2022.

The Site includes a single parcel of land identified by the City of Newton as Property 12003 0004AQ and includes approximately 5.71 acres. The Site is currently developed with a two and three-story brick and concrete building with a small additional lower (basement) level. The school building encompasses an approximate gross building area of 99,451 square feet. The school building was constructed in 1965. The Site is currently occupied by the Newton Early Childhood Program with associated parking areas and recreation areas.

Ransom understands that construction is planned for the existing building including razing the northern wing and constructing a new wing and interior renovations to the remainder of the building, as well as improvements to the parking, playgrounds and the addition of an athletic field.

The geotechnical subsurface exploration program was conducted for the Site on February 24, 2022. The subsurface exploration program consisted of the advancement of four test borings, designated B201 through B204, and ten test pits, designated TP-02 through TP-11. The test pits were excavated to depths up to approximately 10 feet below the ground surface, and the borings to depths up to approximately 19 feet below the ground surface. Surficial geology maps indicate that the area along Jackson Road generally consists of placed fill materials at the ground surface, overlying glacial till. In general, the subsurface explorations encountered surficial layers of asphalt or topsoil, underlain by fill materials, organic materials, glacial till, and bedrock.

Water-saturated soils were encountered at soil boring B202 and test pit TP-3. Saturated soils, inferred to be indicative of groundwater, were observed at depths of approximately 10 and 5 feet below grade at explorations B202 and TP-3, respectively, corresponding to approximate elevations of 28 and 29 feet above mean sea level (MSL). Based on an assumed finished floor elevation of 45 feet above MSL we do not anticipate encountering groundwater in the proposed foundation excavations. The depth to groundwater should be considered when designing the proposed foundations and utilities. Depending on the final design elevations, groundwater may be encountered during excavation for proposed building foundations and utilities.

The inferred bedrock surface was observed at depths ranging from approximately 0.75 to 19 feet below grade, corresponding to elevations ranging from approximately 23.5 feet to 48 feet above MSL. The elevation of bedrock in the area of the proposed school expansion was approximately 29 to 40 feet above MSL. Assuming a finished floor elevation of 45 feet above MSL, bedrock is not anticipated to be encountered in foundation excavations. The depth to bedrock should be considered when designing the proposed building and utilities. Depending on the final design elevations, bedrock may be encountered during excavation for proposed building foundations and utilities. The bedrock surface is likely irregular, and areas of bedrock shallower than the elevations in the Site explorations should be anticipated during construction.

The fill materials and organic materials are considered unsuitable for providing support to the proposed building foundation elements. Unsuitable soils will require removal and replacement with compacted

structural fill within all areas proposed for new buildings/expansions. Unsuitable soils were generally encountered to depths up to approximately 3 to 8 feet below grade. These soils could likely be left in place below areas proposed for parking and play areas, provided that they are found to perform well during proof-rolling activities that should be conducted at the time of construction.

The native glacial till soils are considered to be the uppermost suitable bearing strata at the Site. With proper site preparation, the proposed building foundations could be supported on continuous and spread footings that bear directly on the native glacial till soils and/or compacted structural fill placed above the undisturbed, inorganic, native soils or bedrock. Foundation elements for buildings should be proportioned using a maximum allowable contact pressure of 3,500 pounds per square foot (psf).

Fill materials and organic materials were encountered within the footprint of the proposed building expansion. The fill materials and organic materials have the potential for non-uniform settlement that may exceed tolerable settlement limits. These unsuitable soils within the footprint of proposed structures should be excavated and replaced with compacted structural fill. Floor slabs should be underlain by a minimum of 12 inches of compacted structural fill.

To avoid adverse impacts on existing buildings, any new foundation elements needed to support new structures or building expansions should be located outside the zone of influence of the existing building foundations. For this purpose, the zone of influence should be considered the zone beneath lines extending downward and outward at a slope of one horizontal to one vertical (1H:1V) from the outside edges of the footings. If new footings must be located near or within this zone, the need for possible underpinning of the existing foundations or other special construction considerations should be evaluated.

Conversely, if proposed foundation elements are located at a higher elevation than existing building foundations, they could impose significant lateral loads on the existing foundation walls. We assume that the existing walls were not designed to resist these additional loads, and therefore, adjacent new footings will have to be lower than the existing building foundation walls to avoid application of additional lateral loads to the existing walls.

For the purposes of seismic design, the soil profile constitutes a “stiff soil profile” and we assign a seismic site class of “D” to the Site. It is our opinion that the Site soils are not susceptible to liquefaction.

Ransom should be provided the opportunity to review the final plans and specifications to confirm that the recommendations made in this report were interpreted and implemented as intended.

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1.0 INTRODUCTION

Ransom Consulting, LLC (Ransom) has prepared this Geotechnical Engineering Report for Arrowstreet, Inc. (Arrowstreet) for the proposed Lincoln-Eliot Elementary School expansion/renovation project at the property located at 15 Walnut Park (also known as 150 Jackson Road) in Newton, Massachusetts (the "Site"). This geotechnical report has been prepared in general accordance with our proposed scope of work titled "Proposed Scope of Work and Cost Estimate", dated November 16, 2018, and revised February 17, 2022. The general location of the Site can be seen on Figure 1.

This geotechnical engineering evaluation was performed to obtain site-specific subsurface soil information and to make geotechnical evaluations and recommendations for the proposed expansion. As completed, Ransom's scope of services included the following items:

1. Subcontracting and coordinating with a drilling contractor, excavator, and private utility locator, marking the Site for utility clearance, and contacting the Dig Safe utility clearance system as required by law.

2. Providing technical monitoring for the subsurface explorations, collecting soil samples, and preparing exploration logs.

3. Evaluating the data with respect to the proposed redevelopment and preparing this report of our findings, evaluations, and recommendations for the proposed design and construction.

2.0 SITE AND PROJECT DESCRIPTIONS

The Site is currently the location of the Newton Early Childhood Program and includes a single parcel of land located in Newton, Massachusetts. The parcel is identified by the City of Newton as Property 12003 0004AQ and includes approximately 5.71 acres. A Site Location Map and Subsurface Exploration Plan are provided as Figures 1 and 2, respectively.

2.1 Existing Conditions

The Site is currently developed with a two and three-story brick and concrete building with a small additional lower (basement) level. The school building encompasses an approximate gross building area of 99,451 square feet. The school building was constructed in 1965. The Site is currently occupied by the Newton Early Childhood Program with associated parking areas and recreation areas.

Site topography generally slopes downward to the west and northwest towards Jackson Road. Based on the Newton, Massachusetts United States Geological Survey (USGS) 7.5-minute Quadrangle and the "Existing Conditions Plan" provided by Nitsch Engineering, dated April 2019, Site elevations vary from approximately 29 feet above Mean Sea Level (MSL) in the northwestern gravel lot to approximately 60 feet above MSL neighboring the easternmost portions of the Site building.

2.2 Proposed Redevelopment

Ransom understands that construction is planned for the school building including interior renovations and razing the northern wing and constructing a new wing as well as improvements to the parking, playgrounds and the addition of an athletic field.

At the time of this report, a proposed grading plan had not been developed. We anticipate that the finished floor elevation of the expansion will approximately match the existing grades in the area at elevation 45 feet above MSL. Ransom assumes minor grade cuts and fills may be required for improvements to the parking, playgrounds, and addition of an athletic field.

3.0 SUBSURFACE INVESTIGATION

The geotechnical subsurface exploration program was conducted for the Site on February 24, 2022. The subsurface exploration program consisted of the advancement of four test borings, designated B201 through B204, and ten test pits, designated TP-02 through TP-11, as shown on Figure 2. The explorations were not surveyed; their locations and elevations should be considered approximate.

3.1 Subsurface Explorations

The test borings were performed by Technical Drilling Services (TDS) of Sterling, Massachusetts, with a track-mounted drill rig using a 2.75-inch, inside-diameter, hollow-stem auger. Split barrel sampling with standard penetration testing (SPT, ASTM D 1586) was conducted using an automatic drive hammer continuously from the ground surface to depths of approximately 6 feet below the ground surface (bgs) and at 5-foot intervals thereafter to the bottom of the borings or as advised by Ransom's field representative.

The test pits were performed by Trident Environmental Group, LLC (Trident) of Norfolk, Massachusetts with a Caterpillar 305C CR mini excavator with a maximum reach of approximately 10 feet. Test pits were completed to the max reach of the excavator or until refusal, whichever came first. All soils removed during the completion of the test pits were returned to the excavations and compacted with the excavator bucket to grade. The two test pits completed in the asphalt paved parking lot (TP-02 and TP-03), were saw cut through the asphalt as to not damage surface conditions outside of the test pit area. Following completion of these test pits, they were backfilled, compacted with the excavator bucket and topped with gravel, at which point asphalt repairs were completed by the Newton Department of Public Works (Newton DPW).

A Ransom representative monitored subsurface exploration activities, prepared exploration logs, and measured the depths to groundwater. Soil samples were placed in sealed containers and returned to Ransom's office for further evaluation. Soil samples were visually classified using modified Burmister Soil Classification System descriptors. Exploration logs are included in Appendix A.

3.2 Underground Utility Survey

Prior to conducting the subsurface explorations, Ransom coordinated an underground utility locating survey performed by TPI Environmental (TPI) to confirm the presence or absence of underground utilities in locations proposed for subsurface explorations. Ransom monitored the survey that was performed on February 22, 2022. The survey was completed by TPI using both ground-penetrating radar (GPR) and electromagnetic (EM) conductivity technologies.

4.0 SUBSURFACE CONDITIONS

Surficial geology maps indicate that the area along Jackson Road generally consists of placed fill materials at the ground surface, overlying glacial till. Subsurface conditions at the Site were characterized by advancing test borings and test pits into the unconsolidated overburden soil formations at accessible locations at the Site. Figure 2 illustrates the existing Site features and approximate exploration locations.

4.1 Subsurface Soils

The explorations were advanced to depths ranging from approximately 2 to 19 feet below grade corresponding to elevations ranging from approximately 23.5 to 48 feet above MSL. Subsurface conditions generally consisted of surficial layers of asphalt or topsoil, underlain by fill materials, organic materials, glacial till, and bedrock.

The general characteristics of the subsurface layers are described below in order of increasing depth encountered below the ground surface.

Surficial Materials

The explorations encountered asphalt pavement at four of the test pit locations. The asphalt was observed to be approximately 2 to 4 inches thick. The asphalt was saw cut prior to the test pit excavations. A layer of topsoil was encountered at each of the test pits and the soil borings with the exception of test pit TP-07 (fill material observed at surface). The topsoil was observed to be approximately 4 to 9 inches thick.

Fill Material

Fill materials were encountered at 9 of the 14 exploration locations, consisting of brown, coarse to fine-grained sand and gravel, with little silt, containing cobbles, brick, ruble, asphalt, metal, and/or slag. The fill materials were generally observed from beneath the surface materials extending to depths ranging from approximately 2 to 7 feet below grade, and generally in a medium dense to dense condition based on SPT testing.

Organic Materials

A layer of organic materials was observed in explorations B203, TP-02, TP-03, TP-05, TP-06, TP-08, and TP-09. The organic material was observed below the fill materials at depths of approximately 3 to 7 feet below grade, with a thickness ranging from approximately 3 inches to 1.5 feet. The organic materials are generally described as dark brown fine sand and silt with organics and varying amounts of cobbles. The presence of organic materials was more common at areas of the Site nearest Jackson Road. We believe the organic layer is likely indicative of the former ground surface prior to filling.

Glacial Till

A native glacial till deposit was encountered directly underlying the fill materials and organic materials (where present) at each exploration location. The glacial till deposit generally consisted of brown to gray, fine to medium sand with some silt and varying amounts of clay and gravel. The glacial till soils were generally observed to be in a medium dense to very dense condition based on SPT testing. The glacial till

deposit is classified as silty sand or silty sand with gravel (SM) in general accordance with the Unified Soil Classification System (USCS).

4.2 Refusal/Bedrock

Refusal, the depth at which the drilling or excavating equipment was not able to penetrate the deeper geologic formations, was encountered at each of the test borings at depths ranging from approximately 4 to 19 feet below grade, corresponding to elevations ranging from approximately 29 to 40 feet above MSL. Refusal was encountered at 9 of the 10 test pit locations, at depths ranging from approximately 8 inches to 9.5 feet below grade, corresponding to elevations ranging from approximately 23.5 to 48 feet above MSL. Test pit TP-06 was completed to the extent of the reach of the excavator at 10 feet below grade without refusal. Drilling/excavator refusal is inferred to represent the bedrock surface or large boulders. The observed refusal depths and elevations are presented in the table below.

Table 1 –Refusal Elevations

Test Pit ID	Estimated Ground Surface Elevation (feet)	Approximate Refusal Depth (feet)	Approximate Refusal Elevation (feet above MSL)
B201	53	15.25	37.75
B202	48	19	29
B203	45	13	32
B204	44	4.3	39.7
TP-2	33	9.5	23.5
TP-3	34	5	29
TP-4	37	5.5	31.5
TP-5	39	6	33
TP-6	32	NE (>10)	NE (<22)
TP-7	35	6	29
TP-8	50	9	41
TP-9	50	4	46
TP-10	50	0.75	48
TP-11	50	2.5	47.5

Notes:

1. Estimated ground surface elevations obtained from aerial imagery. Elevations should be considered approximate.
2. NE = Not Encountered.

4.3 Groundwater

Water-saturated soils were encountered at soil boring B202 and test pit TP-3. Saturated soils, inferred to be indicative of groundwater, were observed at depths of approximately 10 and 5 feet below grade at

explorations B202 and TP-3, respectively, corresponding to approximate elevations of 28 and 29 feet above MSL.

Groundwater levels at the Site will fluctuate due to season, temperature, precipitation, nearby underground utilities, and construction activity. Therefore, water levels at other times may differ from the observations and measurements made during this evaluation.

5.0 ENGINEERING EVALUATIONS

The subsurface explorations encountered surficial layers of topsoil or asphalt overlying fill materials, organic materials, glacial till, and bedrock. The controlling geotechnical features for the development of the Site are:

1. Foundation-Bearing Soils - The naturally-occurring glacial till soils are considered the uppermost suitable bearing stratum for the proposed foundations at the Site. The proposed structures could be supported on conventional, shallow foundation systems of spread and continuous footings that bear on the naturally occurring glacial till or on structural fill placed and properly compacted above these soils or bedrock.

2. Unsuitable Soils. The fill materials and organic materials are considered unsuitable for providing support to the proposed building foundation elements. Unsuitable soils will require removal and replacement with compacted structural fill within all areas proposed for new buildings/expansions. Unsuitable soils were generally encountered to depths of approximately 3 to 8 feet below grade. These soils could likely be left in place below areas proposed for parking and play areas provided that they are found to perform well during proof-rolling activities that should be conducted at the time of construction.

3. Groundwater - Saturated soils were encountered in just two of the explorations, at depths of approximately 5 to 10 feet below grade, corresponding to elevations of approximately 28 to 29 feet above MSL. Based on an assumed finished floor elevation of 45 feet above MSL we do not anticipate encountering groundwater in the proposed foundation excavations. The depth of groundwater should be considered when designing the proposed buildings and utilities.

4. Bedrock - The inferred bedrock surface was observed at depths ranging from approximately 0.75 to 19 feet below grade, corresponding to elevations ranging from 23.5 feet to 48 feet above MSL. The elevation of bedrock in the area of the proposed school expansion was approximately 29 to 40 feet above MSL. Assuming a finished floor elevation of 45 feet above MSL, bedrock is not anticipated to be encountered in foundation excavations. The depth to bedrock should be considered when designing the proposed foundations and utilities. Depending on the final design elevations, bedrock may be encountered during excavation for proposed building foundations and utilities. The bedrock surface is likely irregular, and areas of bedrock shallower than the elevations in the Site explorations should be anticipated during construction.

Geotechnical engineering evaluations for this project are based on the subsurface conditions interpreted from widely spaced subsurface explorations and the project design information currently available. Should differing information become known prior to or during construction, the following evaluations and recommendations should be reviewed by Ransom and modifications to these recommendations may be necessary.

6.0 DESIGN RECOMMENDATIONS

Based on the subsurface explorations and our geotechnical evaluations, Ransom presents the following recommendations for the design of the proposed renovations and new construction at the proposed Lincoln-Eliot School expansion/renovation at 150 Jackson Road in Newton, Massachusetts.

6.1 Building Foundations

The subsurface conditions generally consist of topsoil or asphalt overlying fill materials, organic materials, glacial till, and bedrock. The native glacial till soils are considered the uppermost suitable bearing strata for foundation elements. Surficial layers, fill materials, and organic materials located within the footprint of proposed buildings/expansions should be excavated and replaced with compacted structural fill. Excavation to remove and replace the unsuitable soils is anticipated to generally be less than 8 feet below grade. With proper site preparation, the proposed building foundations could be supported on continuous and spread footings that bear directly on the native glacial till soils and/or compacted structural fill placed above the undisturbed, inorganic, native soils or bedrock.

Foundation elements for buildings should be proportioned using a maximum allowable contact pressure of 3,500 pounds per square foot (psf). Spread footings should be at least 2 feet wide and continuous footings should be at least 1.5 feet wide. Post-construction total and differential settlements are anticipated to be no more than approximately 1 inch and 0.5 inch, respectively.

Lateral loads may be resisted by friction between the bottoms of footings and supporting subgrades, and by passive earth pressure against the sides of the foundation. A friction coefficient of 0.45 and an equivalent fluid unit weight of 200 pounds per cubic foot (pcf) against the sides of footings should be used.

Exterior footings should be placed a minimum of 4 feet below the lowest existing or proposed adjacent ground surface exposed to freezing. If exposure to freezing is anticipated during or after construction, any interior footings should be lowered to bear 4 feet below the top of the ground floor slab or protected from frost. To avoid adverse impacts on existing buildings, any new foundation elements needed to support new structures or building expansions should be located outside the zone of influence of the existing building foundations . For this purpose, the zone of influence should be considered the zone beneath lines extending downward and outward at a slope of one horizontal to one vertical (1H:1V) from the outside edges of the footings. If new footings must be located near or within this zone, the need for possible underpinning of the existing foundations or other special construction considerations should be evaluated.

Conversely, if proposed foundation elements are located at a higher elevation than existing building foundations, they could impose significant lateral loads on the existing foundation walls. We assume that the existing walls were not designed to resist these additional loads, and therefore, adjacent new footings will have to be lower than the existing building foundation walls to avoid application of additional lateral loads to the existing walls.

6.2 Floor Slabs

Fill materials and organic materials were encountered within the footprint of the proposed building expansion. The fill materials and organic materials have the potential for non-uniform settlement that may exceed tolerable settlement limits. These unsuitable soils within the footprint of proposed structures

should be excavated and replaced with compacted structural fill. Floor slabs should be underlain by a minimum of 12 inches of compacted structural fill. With proper Site preparation, conditions are suitable for a slab-on-grade ground floor. A modulus of subgrade reaction of 200 pounds per cubic inch (pci) should be used to proportion the slabs-on-grade constructed on properly compacted structural fill.

Exterior slabs at entrances should be underlain by at least 4 feet of free-draining material, such as structural fill or crushed stone, to reduce the potential for frost heaving. Surrounding grades should be sloped away from the buildings to reduce available moisture for forming frost and ice.

6.3 Seismic Considerations

For the purposes of seismic design, the soil profile constitutes a "stiff soil profile" and we assign a seismic site class of "D" to the Site. It is our opinion that the Site soils are not susceptible to liquefaction.

6.4 Groundwater and Drainage Issues

Saturated soils were encountered in just two of the explorations, at depths of approximately 5 to 10 feet below grade, corresponding to elevations of approximately 28 to 29 feet above MSL. Based on an assumed finished floor elevation of 45 feet above MSL we do not anticipate encountering groundwater in the proposed foundation excavations. The depth of groundwater should be considered when designing the proposed building and utilities. Depending on the final design elevations, groundwater may be encountered during excavation for proposed building foundations and utilities.

The buildings should be constructed with perimeter foundation drainage systems if the foundation elevations are within 4 feet of the observed groundwater elevation. The perimeter drainage systems should consist of 4-inch-diameter, flexible polyethylene pipe with perforations of ¼ to ½ inch (openings should be oriented downward). The drain lines should be surrounded by a minimum of 6 inches of ¾-inch crushed stone wrapped in a nonwoven geotextile filter fabric (Mirafi 140N or approved equivalent). The foundation drains should be placed adjacent to the exterior sides of the spread footings at a minimum depth of 4 feet below adjacent exterior grades to protect against frost.

Where possible, the foundation drains should be pitched down at a minimum slope of 0.5 percent in the direction of flow. Cleanouts should be provided at every other 90-degree bend in order to provide for future flushing of the system as needed.

The foundation drains should be gravity drained to daylight or to a suitable system outlet. The final outlet of the drainage systems should be designed by the project Civil Engineer in consideration of all applicable municipal, state, and federal regulations.

Roof downspout drains should not be connected to the foundation drain system. Roof downspouts should be separately tight lined to their discharge outlets.

If basement levels are proposed additional moisture control measures such as slab underdrains and/or vapor barriers may be warranted. Ransom should be provided the opportunity to review the final design to reevaluate the need for drainage and moisture control measures at that time.

7.0 EARTHWORK AND CONSTRUCTION RECOMMENDATIONS

Based on the subsurface explorations and our geotechnical evaluations, Ransom presents the following recommendations for the construction of the proposed renovations and new buildings for the proposed Lincoln-Eliot School at 150 Jackson Road in Newton, Massachusetts.

7.1 Subgrade Preparation

The surficial materials, fill materials, and organic materials are considered to be unsuitable for providing support to the proposed structures. The native glacial till soils are considered to be the uppermost suitable bearing strata at this Site.

All topsoil, unsuitable soils, debris, and loose or disturbed soils should be removed from below the building footprints and foundation bearing zones. These unsuitable materials should be completely removed from foundation bearing zones (to the lateral limits defined by a one horizontal to one vertical (1H:1V) line sloped down and away from the bottom edge of foundations to the top of undisturbed native till soils) and replaced with compacted structural fill.

After site stripping has been completed, the subgrade beneath the building footprints and 10 feet beyond, parking lots, loading areas, and driveways should be compacted with at least four complete passes of a 15-ton vibratory drum roller in directions perpendicular to one another. Silty subgrades which are saturated or are observed to pump and weave during rolling should be rolled statically.

Unstable subgrade areas would be characterized by weaving or rutting of more than one inch during proof rolling. Any unstable areas identified should be undercut at least 12 inches, or to competent soil, and replaced with compacted structural fill, crushed stone, or common fill. The depth of undercutting and type of backfill material should be selected with consideration of proposed use (i.e., building or pavement) and soil and weather conditions encountered during construction.

The contractor is responsible for construction means and methods and should anticipate the need for methods to prevent disturbance, softening, or rutting of subgrades, or damage to overlying soils resulting from construction traffic. Care must be taken to avoid disturbing subgrades by keeping construction traffic off of subgrades during wet conditions and/or inclement weather until a firm fill layer has been placed. Subgrade soils that become unstable should be undercut and replaced with structural fill, crushed stone or common fill, as necessary.

Final foundation subgrade preparation should include re-compaction of bearing surfaces. Care should be taken to limit disturbance to bearing surfaces prior to placement of concrete. Any loose, softened, or disturbed material should be removed and replaced with compacted structural fill prior to placement of concrete. Excavated subgrades should not be left exposed overnight unless the forecast calls for above-freezing, clear conditions.

7.2 Temporary Excavations

Construction site safety means and methods, and sequencing of construction activities is the sole responsibility of the contractor. Under no circumstances should the following information be interpreted to mean that Ransom is assuming responsibility for construction site safety, trench protection, or the contractor's responsibilities. Such responsibility is not being implied and should not be inferred.

All temporary excavations should be performed according to Occupational Safety and Health Administration (OSHA) Standards (29 CFR 1926 Subpart P). The fill materials and glacial till soils are OSHA Type C soils and should be cut for temporary unbraced excavations no steeper than 1.5H:1V under dry or dewatered conditions.

7.3 Dewatering and Runoff Control

Saturated soils were encountered in the explorations at depths of approximately 5 to 10 feet below grade, corresponding to elevations of approximately 28 to 29 feet above MSL. It is likely that groundwater will be encountered in some excavations for foundations and utilities. The contractor should be prepared to implement water controls as needed.

Surface water runoff should be directed away from excavations to reduce dewatering efforts and to protect subgrades from becoming soft and unstable. The contractor should anticipate the need for controlling runoff during wet periods; pumping from open sumps will likely provide adequate control of water within excavations during construction.

Earthwork should be completed "in the dry" if possible. Subgrade soils that become unstable should be undercut and replaced with structural fill or crushed stone, as necessary. Excavation side slopes should be monitored for potential seepage and maintained to promote stability, accordingly.

Temporary detention ponds, trenches, ditches, and dewatering sumps should not be made in areas to be filled.

7.4 Placement of Granular Engineered Fills

Engineered fills may be required to achieve the final design grades in areas of the Site. The table below presents recommended gradation specifications for soils used in engineered fills at the Site. Reference is made to materials, described by the Massachusetts Highway Department (MHD) *Standard Specifications for Highways and Bridges*, as possible alternatives. The different granular fill types should be used as follows:

1. Structural Fill should be used for engineered fills below proposed building and foundation areas.

2. Common Fill should be used for engineered fills below roadway, parking, and other non-structural areas.

Type	Size or Sieve	% Passing
Structural Fill MHD M1.03.0a	6" (150 mm) 1/2" (12.5 mm) No. 4 (4.75 µm) No. 50 (300 µm) No. 200 (75 µm)	100 50–85 40–75 8–28 0–10
Common Fill	8" No. 200 (75 µm)	100 0–15 (when placed within 4 feet of finished grade in paved areas)

All granular fills should be placed in 12-inch maximum loose lifts and should be compacted to a minimum of 95 percent of the material's maximum dry density, as determined by ASTM D 1557 (modified proctor test) and confirmed through field density testing (ASTM D 6938 or equivalent method). Lift thickness should be a maximum of 6-inch loose lifts when compacted with hand-guided equipment.

Where subgrades become saturated, unstable, and/or difficult to compact, ¾-inch crushed stone (or approved equivalent) should be placed and compacted in lieu of structural fill. Crushed stone, when used, should be wrapped in a geotextile filter fabric, such as Mirafi 140N or equal. At no time should structural fill or common fill be placed over crushed stone that has not been wrapped in a geotextile filter fabric.

7.5 Reuse of Site Soils

A preliminary assessment of the suitability of using the unconsolidated soils at the Site in the proposed construction is based on the soil classifications and observations at the Site. The suitability of these materials is summarized below.

1. Topsoils and organic materials are suitable only for reuse in landscaped areas.

2. The naturally-occurring glacial till soils that will be excavated are suitable for reuse only as common fill below non-structural areas and landscaped areas. The high fines content will make reusing this material difficult if the moisture content is not controlled.

3. The existing fill materials that will be excavated might be suitable for reuse as common fill below non-structural areas and landscaped areas following additional evaluations, such as grain size analyses, at the time of construction.

Materials to be used as structural fill may need to be imported to the Site. Representative samples of all proposed fills should be submitted for testing during construction to compare their gradation characteristics to the requirements of the project specifications, and to establish their optimum water contents and maximum dry densities (modified Proctor testing, ASTM D 1557). The geotechnical engineer must approve use and reuse of on-site or borrow soils for structural and common fills. Use of fills assumes that the moisture content of the material will be strictly controlled in order to allow for proper placement and compaction.

7.6 Underground Utilities

Bedding placed below utilities should be in accordance with the utility and manufacturer requirements. In general, utilities may be supported directly on a minimum 6-inch-thick layer of compacted structural fill, crushed stone, or other suitable pipe bedding materials. Fill placed as backfill for utilities below building floor slabs should consist of compacted structural fill or crushed stone. Elsewhere, fill placed as backfill for utilities should consist of compacted common fill.

7.7 Construction Quality Control

Ransom should be provided the opportunity to review the final design drawings and specifications to ensure our recommendations presented in this report have been properly interpreted and applied. All fills, backfills, and compaction should be inspected and tested by a qualified firm to make sure the proper materials are placed and adequately compacted. Ransom should review all soil inspection and testing

reports. Ransom should be retained to provide construction observation for the following aspects of site redevelopment:

1. Observe the subsurface conditions as they are exposed and confirm that the exposed conditions are as anticipated in this report;

2. Provide geotechnical observation of foundation, floor slab, and pavement subgrade preparations;

3. Confirm that the soils used as fills and backfills conform to the project specifications; and

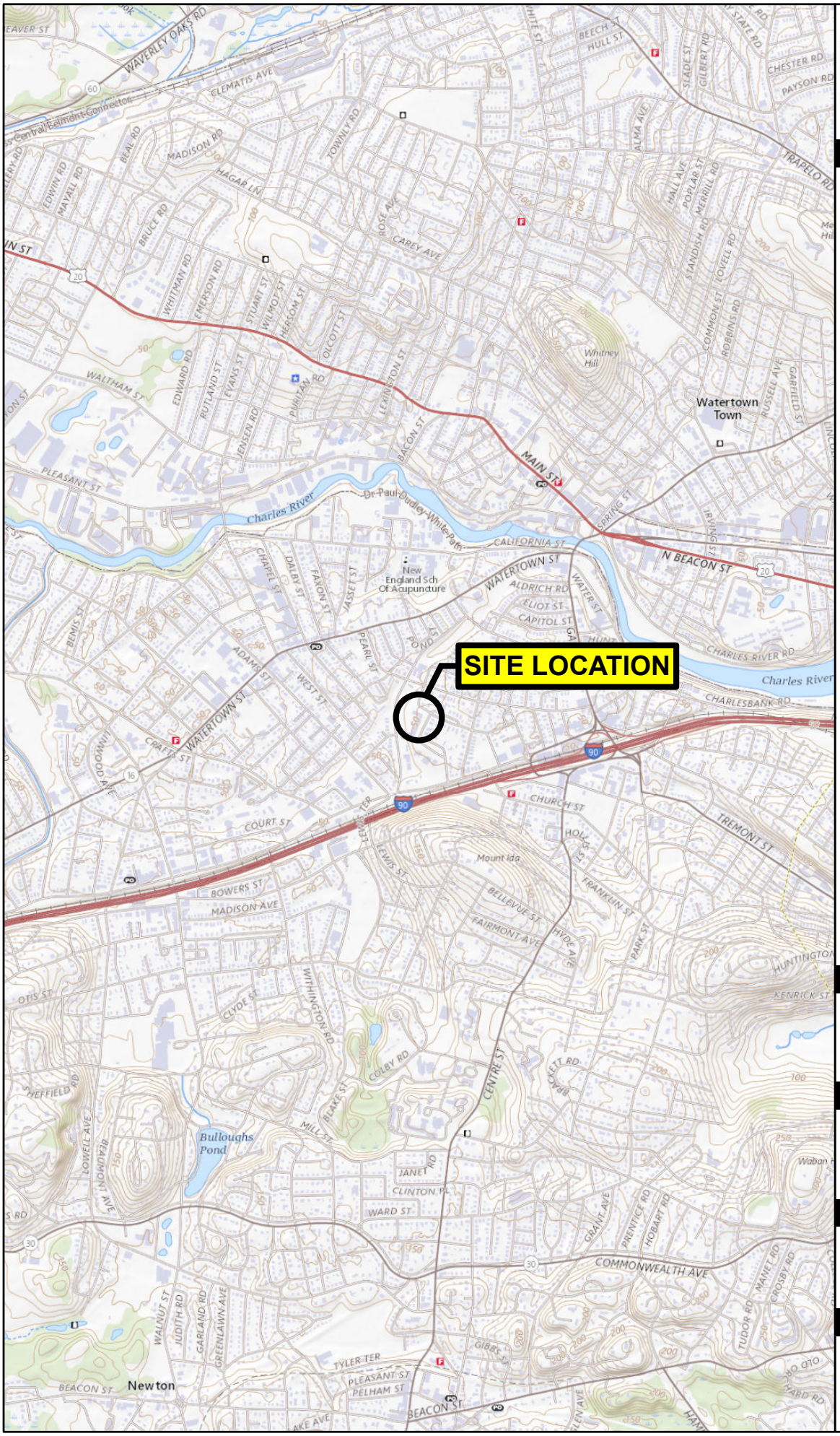
4. Document the preparation of foundation bearing surfaces and other subgrades.

8.0 CLOSING COMMENTS

This report has been prepared for specific application to the proposed expansion and renovations of the existing building for the Lincoln-Eliot Elementary School expansion/renovations at 150 Jackson Road in Newton, Massachusetts as understood by Ransom at the time of this report. In the event that material changes in the design or location of the proposed structures are planned, the conclusions and recommendations contained in this report should not be considered valid unless they have been reviewed and modified or verified in writing by Ransom. Our recommendations are based in part upon data obtained from widely spaced explorations. The nature and extent of variations between explorations will not become evident until construction. If significant variations then appear, it may be necessary to reevaluate the recommendations of this report.

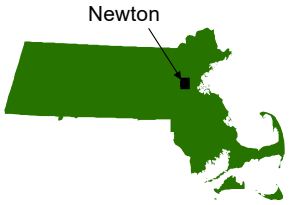
We recommend that Ransom be provided the opportunity to review the final design plans and project specifications in order to confirm that the recommendations made in this report were interpreted and implemented as intended.

The findings, recommendations, specifications, and professional opinions contained within this project geotechnical report have been prepared in accordance with generally accepted professional geotechnical engineering practice. No other warranties are implied or expressed.



RANSOM Consulting, LLC

Regional Locator Map



Notes

1. Data Source: USGS. The National Map
2. USGS Quad Name: Newton, Massachusetts
3. Latitude: 42°21'28.622"N Longitude: 71°11'39.065"W

Scale and Orientation

0 1,000 2,000

1 inch = 2,000 feet

Prepared For

Arrowstreet, Inc.
10 Post Office Square
Suite 700N
Boston, Massachusetts

Site Address

Proposed Lincoln Eliot Elementary School
150 Jackson Road
Newton, MA

222.01003 | March 2022

Figure 1

Site Location Map

X:\Ransom_NewEngland\Massachusetts\Newton_MA\LincolnEliotElemSchool\LEES_NewtonMA_F1_SLM.mxd

RANSOM Consulting, LLC

Legend & Notes

- Site Boundary
- Soil Boring
- Test Pit

Notes

1. Site Plan based on MassGIS. USGS Orthos. 2021.
2. Some features are approximate in location and scale
3. This plan has been prepared for Arrowstreet, Inc. . All other uses are not authorized unless written permission is obtained from Ransom Consulting, LLC.

Scale & Orientation

0 50 100

1 inch = 100 feet

Prepared For

Arrowstreet, Inc.
10 Post Office Square
Suite 700N
Boston, Massachusetts

Site Address

Lincoln Eliot Elementary School
150 Jackson Road
Newton, MA

222.01003 | March 2022

Figure 2

Subsurface Exploration Location Plan

X:\Ransom_NewEngland\Massachusetts\Newton_MA\LincolnEliotElemSchool\LEES_NewtonMA_F2_SP.mxd

APPENDIX A

Exploration Logs

Geotechnical Engineering Report
Proposed Lincoln-Eliot Elementary School Expansion
150 Jackson Road
Newton, Massachusetts

RANSOM

TEST PIT LOG

Project: Proposed Lincoln Eliot School	Project #: 222.01003.001
TEST PIT IDENTIFICATION: TP-02	
Location: 150 Jackson Road	Ground Elevation: +/-33 feet
Client: Arrowstreet	Datum: NAVD
Contractor: Trident	Operator: Jack N.
Equipment: Caterpillar 305C Excavator	Samples Collected _X_ Yes __ No
Capacity/Reach: ≈10 feet	Time Started: 0830 Time Completed: 0825
Weather: +/-20º, windy	
Logged by: DTC	Date: 2/24/22
Checked by: HED	Date: 3/23/22

TEST PIT INFORMATION

Depth of Stratum Change Feet	Sample No. and Type	Sample Depth Feet	Soil Description
0-3′	S1	0-3′	Brown, coarse SAND and GRAVEL with cobbles, trace silt, moist, some slag and rubble.
3-5′	S2		Brown, silty SAND, some cobbles, little clay, moist.
5-8.5′	S3		Brown, silty CLAY, little gravel and cobbles. Shale fragment at approximately 6-7′, moist, becoming more damp and clayey with depth, but not saturated.
8.5-9.5′	S4		Black, fine SAND with silt and organics, moist.
			Bucket refusal on boulder/ledge, nearly at reach. End of TP-02 at 9.5′ bgs. Backfilled with native, compacted.

Pit Dimensions (Feet): Length 10 Width 3 Depth 9.5	Remarks: Saw cut asphalt (4″ thick). DPW to patch asphalt.

RANSOM

TEST PIT LOG

Project: Proposed Lincoln Eliot School	Project #: 222.01003.001
TEST PIT IDENTIFICATION: TP-03	
Location: 150 Jackson Road	Ground Elevation: +/-34 feet
Client: Arrowstreet	Datum: NAVD
Contractor: Trident	Operator: Jack N.
Equipment: Caterpillar 305C Excavator	Samples Collected _X_ Yes __ No
Capacity/Reach: ≈10 feet	Time Started: 0930 Time Completed: 1010
Weather: +/-20º, windy	
Logged by: DTC	Date: 2/24/22
Checked by: HED	Date: 3/23/22

TEST PIT INFORMATION

Depth of Stratum Change Feet	Sample No. and Type	Sample Depth Feet	Soil Description
0-2.5′	S1		Brown, coarse SAND and GRAVEL fill with slag, metal debris, rubble, etc., moist, cobbles.
			Ledge at 2.5′ in northern extent of test pit, southern portion fragmented and can be broken.
2.5-3.0′	S2		Gray CLAY, large wood debris and ledge cobbles, moist.
5.5′			Becoming wet at 5′, consistency becoming crushed stone intermixed with gray clay ledge/stone appears to be shale/schist based on exposed surfaces with quartz veins/nodes.
			End of test pit at 5.5′ (ledge with wet clay), backfilled with native and compacted.

Pit Dimensions (Feet): Length 10 Width 3 Depth 2.5 (north) to 5.6 (south)	Remarks: Saw cut asphalt (4″ thick). DPW to patch asphalt.

TEST PIT LOG

Project: Proposed Lincoln Eliot School	Project #: 222.01003.001
TEST PIT IDENTIFICATION: TP-04	
Location: 150 Jackson Road	Ground Elevation: +/-37 feet
Client: Arrowstreet	Datum: NAVD
Contractor: Trident	Operator: Jack N.
Equipment: Caterpillar 305C Excavator	Samples Collected _X_ Yes __ No
Capacity/Reach: ≈10 feet	Time Started: 1140 Time Completed: 1210
Weather: +/-20º, windy	
Logged by: DTC	Date: 2/24/22
Checked by: HED	Date: 3/23/22

TEST PIT INFORMATION

Depth of Stratum Change Feet	Sample No. and Type	Sample Depth Feet	Soil Description
0-5.5′	S1		Brown, coarse SAND and GRAVEL (fill), moist with brick, rubble, slag and cobbles. Concrete filled pipe (bollard) at approximately 5′.
			Refusal on ledge/boulder at 5.5′, no groundwater encountered. Backfilled with native and compacted.

Pit Dimensions (Feet): Length 10 Width 3 Depth 5.5	Remarks: Saw cut 2″ asphalt.

RANSOM

TEST PIT LOG

Project: Proposed Lincoln Eliot School	Project #: 222.01003.001
TEST PIT IDENTIFICATION: TP-05	
Location: 150 Jackson Road	Ground Elevation: +/-39 feet
Client: Arrowstreet	Datum: NAVD
Contractor: Trident	Operator: Jack N.
Equipment: Caterpillar 305C Excavator	Samples Collected _X_Yes__No
Capacity/Reach: ≈10 feet	Time Started: 1250 Time Completed:
Weather: +/-30º, windy	
Logged by: DTC	Date: 2/24/22
Checked by: HED	Date: 3/23/22

TEST PIT INFORMATION

Depth of Stratum Change Feet	Sample No. and Type	Sample Depth Feet	Soil Description
0-1.5′			Black, coarse SAND and GRAVEL, some crushed asphalt (fill).
1.5-6′	S1		Brown, coarse SAND and GRAVEL, some cobbles and organics. Larger boulder fragments 4-6′.
			Refusal on boulder/ledge at 6′. Backfilled with native and compacted.

Pit Dimensions (Feet): Length 7 Width 3 Depth 6	Remarks: Saw cut 2″ asphalt.

RANSOM

TEST PIT LOG

Project: Proposed Lincoln Eliot School	Project #: 222.01003.001
TEST PIT IDENTIFICATION: TP-06	
Location: 150 Jackson Road	Ground Elevation: +/-32 feet
Client: Arrowstreet	Datum: NAVD
Contractor: Trident	Operator: Jack N.
Equipment: Caterpillar 305C Excavator	Samples Collected _X_ Yes __ No
Capacity/Reach: ≈10 feet	Time Started: 1015 Time Completed: 1100
Weather: +/-20º, windy, cloudy	
Logged by: DTC	Date: 2/24/22
Checked by: HED	Date: 3/23/22

TEST PIT INFORMATION

Depth of Stratum Change Feet	Sample No. and Type	Sample Depth Feet	Soil Description
0-7′	S1		Brown, moist, coarse SAND and GRAVEL with cobbles, brick rubble, slag, little silty clay, large boulder/ledge cobles at 3′.
7-10′			Rusty, light brown, moist, silty fine SAND with trace cobbles and organic matter. Becoming mixed with large, well-rounded cobbles at 8.5-9′.
			End of test pit 10′ (max reach/sidewalls collapsing). Groundwater not encountered. Backfilled with native and compacted.

Pit Dimensions (Feet): Length 10 Width 3 Depth 10	Remarks:

TEST PIT LOG

Project: Proposed Lincoln Eliot School	Project #: 222.01003.001
TEST PIT IDENTIFICATION: TP-07	
Location: 150 Jackson Road	Ground Elevation: +/-35 feet
Client: Arrowstreet	Datum: NAVD
Contractor: Trident	Operator: Jack N.
Equipment: Caterpillar 305C Excavator	Samples Collected _X_Yes__No
Capacity/Reach: ≈10 feet	Time Started: 1105 Time Completed: 1135
Weather: +/-20º, windy, cloudy	
Logged by: DTC	Date: 2/24/22
Checked by: HED	Date: 2/23/22

TEST PIT INFORMATION

Depth of Stratum Change Feet	Sample No. and Type	Sample Depth Feet	Soil Description
0-6′	S1		Brown, coarse SAND and GRAVEL (fill), dry to moist with cobbles, brick rubble and slag. Becoming mixed with large broken cobble/ledge at approximately 3′, less rubble.
			Refusal on boulder or ledge at 6′, excavator couldn't get through or around. Groundwater not encountered. Backfilled with native and compacted.

Pit Dimensions (Feet): Length 10 Width 3 Depth 6	Remarks: Some asphalt and rubble at surface.

RANSOM

TEST PIT LOG

Project: Proposed Lincoln Eliot School	Project #: 222.01003.001
TEST PIT IDENTIFICATION: TP-08	
Location: 150 Jackson Road	Ground Elevation: +/-50 feet
Client: Arrowstreet	Datum: NAVD
Contractor: Trident	Operator: Jack N.
Equipment: Caterpillar 305C Excavator	Samples Collected _X_ Yes __ No
Capacity/Reach: ≈10 feet	Time Started: 1340 Time Completed: 1400
Weather: +/-30º, cloudy	
Logged by: DTC	Date: 2/24/22
Checked by: HED	Date: 3/23/22

TEST PIT INFORMATION

Depth of Stratum Change Feet	Sample No. and Type	Sample Depth Feet	Soil Description
0-4′	S1		4″ loamy TOPSOIL, over light to dark brown, silty fine SAND with little gravel and cobbles, moist.
4-9′	S2		Brown, clayey SAND, moist with cobbles, rock fragments and organics.
			Refusal on boulder/ledge at 9′ 4″. Backfilled with native and compacted.

Pit Dimensions (Feet): Length 8 Width 3 Depth 9′ 4″	Remarks:

RANSOM

TEST PIT LOG

Project: Proposed Lincoln Eliot School	Project #: 222.01003.001
TEST PIT IDENTIFICATION: TP-09	
Location: 150 Jackson Road	Ground Elevation: +/-50 feet
Client: Arrowstreet	Datum: NAVD
Contractor: Trident	Operator: Jack N.
Equipment: Caterpillar 305C Excavator	Samples Collected _X_ Yes __ No
Capacity/Reach: ≈10 feet	Time Started: 1405 Time Completed: 1420
Weather: +/-30º, cloudy	
Logged by: DTC	Date: 2/24/22
Checked by: HED	Date: 3/23/22

TEST PIT INFORMATION

Depth of Stratum Change Feet	Sample No. and Type	Sample Depth Feet	Soil Description
0-4′	S1		4″ Loamy TOPSOIL, moist, over brown, clayey SAND and GRAVEL with cobbles (pockets of dark brown, silty sand with woody debris and organic matter, only several observed).
			Refusal on boulder/ledge at 4′. Backfilled with native and compacted.

Pit Dimensions (Feet): Length 8 Width 3 Depth 4	Remarks:

RANSOM

TEST PIT LOG

Project: Proposed Lincoln Eliot School	Project #: 222.01003.001
TEST PIT IDENTIFICATION: TP-10	
Location: 150 Jackson Road	Ground Elevation: +/-50 feet
Client: Arrowstreet	Datum: NAVD
Contractor: Trident	Operator: Jack N.
Equipment: Caterpillar 305C Excavator	Samples Collected __Yes X No
Capacity/Reach: ≈10 feet	Time Started: 1420 Time Completed: 1435
Weather: +/-30º, cloudy	
Logged by: DTC	Date: 2/24/22
Checked by: HED	Date: 3/23/22

TEST PIT INFORMATION

Depth of Stratum Change Feet	Sample No. and Type	Sample Depth Feet	Soil Description
0-2’	S1		Ledge encountered 6″ beneath topsoil. Extended north 3′, same conditions. Extended south approximately 5′, ledge dipping south sightly to max of 2′ bgs. Soil consists of 4″ topsoil underlain by brown, clayey sand, moist with cobbles. No sample collected, same as TP-09-S1.
			Refusal on ledge 6″ to 2′ bgs.

Pit Dimensions (Feet): Length 14 Width 3 Depth 6″ to 2′	Remarks:

RANSOM

TEST PIT LOG

Project: Proposed Lincoln Eliot School	Project #: 222.01003.001
TEST PIT IDENTIFICATION: TP-11	
Location: 150 Jackson Road	Ground Elevation: +/-50 feet
Client: Arrowstreet	Datum: NAVD
Contractor: Trident	Operator: Jack N.
Equipment: Caterpillar 305C Excavator	Samples Collected _X_ Yes __ No
Capacity/Reach: ≈10 feet	Time Started: 1437 Time Completed: 1450
Weather: +/-30º, cloudy	
Logged by: DTC	Date: 2/24/22
Checked by: HED	Date: 3/23/22

TEST PIT INFORMATION

Depth of Stratum Change Feet	Sample No. and Type	Sample Depth Feet	Soil Description
0-2.5’	S1		Ledge encountered approximately 8″ bgs in center of test pit, dips to south to approximately 1′ bgs to refusal. Dips north to max depth of 2.5′ bgs to refusal. Soils encountered above ledge (TP-11-S1) consisted of approximately 4″ topsoil underlain by brown, silty sand with gravel and cobbles.
			Refusal 8″ to 2.5′ on ledge. Backfilled and compacted.
Pit Dimensions (Feet): Length 10 Width 3 Depth 0.75″ to 2′			Remarks:

BORING LOG
B201

Project Number: 222.01003.002	Drilling Company: TDS	Total Depth: 15 Feet, 3 Inches
Project: Lincoln Eliot Expansion	Drilling Method: Hollow-stem auger	Datum: NAVD
Site Location: 150 Jackson Road	Drilling Equipment: Track-Mounted Rig	Start/Finish Date: 2/24/22
Newton, Massachusetts	Boring Diameter: 8 inches	Logged by: QSH
Client: Arrowstreet	Surface Elevation (ft): +/-53	Reviewed by: JPJ
Water Levels:	During Drilling: NE	End of Boring: Date:

DESCRIPTION Based on USCS and Modified Burmister Soil Classification System	Soil Profile	SAMPLE*	SAMPLE NUMBER	PENETRATION / RECOVERY	BLOWS (PER 6")	SPT-N VALUE	PID/FID (PPM)	DEPTH (FT.)	WELL CONSTRUCTION
S1 (0-2') TOPSOIL, trace medium gravel.	TOPSOIL		S1	24/7	2-3-1-1	4		1	
								2	
S2 (2-4') Medium dense, brown, fine SAND, some silt, trace fine to medium gravel.	SAND		S2	24/5	5-9-14-11	23		3	
								4	
S3 (4-6') 3" Dense, brown, fine SAND, some silt, trace fine to medium gravel, over 6" tan, fine SAND, little silt, trace fine gravel, over 7" tan/gray, fine to medium SAND, some fine to medium gravel, trace silt.	SAND		S3	24/16	2-10-25-42	35		5	
								6	
Augered to 10'.								7	
								8	
								9	
								10	
S4 (10-12') Medium dense, gray/tan, fine to coarse SAND, some fine to medium gravel, trace silt.	SAND		S4	3/0	8-12-13-11	25		11	
								12	
								13	
								14	
								15	
Auger refusal, end of boring 15' 3".								16	
								17	
								18	
								19	

Notes:

Well Legend:

FS	NF	B	BG	C	
Filter Sand	Native Fill	Bentonite	Bentonite grout	Concrete	PVC Screen

NA=not applicable; NM=not measured; NE=not encountered
*Sample designated with black fill submitted for laboratory analysis.

BORING LOG
B202

Project Number: 222.01003.002	Drilling Company: TDS	Total Depth: 19 Feet
Project: Lincoln Eliot Expansion	Drilling Method: Hollow-stem auger	Datum: NAVD
Site Location: 150 Jackson Road	Drilling Equipment: Track-Mounted Rig	Start/Finish Date: 2/24/22
Newton, Massachusetts	Boring Diameter: 8 inches	Logged by: QSH
Client: Arrowstreet	Surface Elevation (ft): +/-48	Reviewed by: JPJ
Water Levels:	During Drilling: 10-11' End of Boring:	Date:

DESCRIPTION Based on USCS and Modified Burmister Soil Classification System	Soil Profile	SAMPLE*	SAMPLE NUMBER	PENETRATION / RECOVERY	BLOWS (PER 6")	SPT-N VALUE	PID/FID (PPM)	DEPTH (FT.)	WELL CONSTRUCTION
TOPSOIL									
S1 (0-2') 9" TOPSOIL, over 9" tan/brown, fine SAND and SILT, trace fine gravel.			S1	24/18	5-5-6-5	11		1	
								2	
S2 (2-4') Medium dense, tan/brown, fine SAND and SILT, trace fine gravel.	SAND & SILT		S2	24/19	6-7-9-20	16		3	
Augered through boulder.								4	
								5	
S3 (5-7') Dense, 3" Crushed ROCK, over 4" brown, fine to medium SAND, some silt, trace fine gravel, over 6" brown, fine to medium SAND and SILT.	SAND & SILT		S3	24/13	35-32-16-15	48		6	
								7	
Augered to 10'.								8	
								9	
								10	
S4 (10-12') 4" loose, brown, fine SAND and SILT, wet (perched), over 2" brown, fine to medium SAND, some silt, over 5" brown, fine to medium SAND and SILT, over 3" crushed ROCK.	SAND & SILT		S4	24/14	3-2-3-21	5		11	
								12	
Augered to 15'.								13	
								14	
								15	
S5 (15-17') No recovery.			S5	9/0	51-100/3"	>100		16	
								17	
Augered to 19'.								18	
								19	
Spoon refusal, end of boring 19'.									

Notes:

Well Legend:

FS	NF	B	BG	C	
Filter Sand	Native Fill	Bentonite	Bentonite grout	Concrete	PVC Screen

NA=not applicable; NM=not measured; NE=not encountered
*Sample designated with black fill submitted for laboratory analysis.

BORING LOG
B203

Project Number: 222.01003.002	Drilling Company: TDS	Total Depth: 13 Feet
Project: Lincoln Eliot Expansion	Drilling Method: Hollow-stem auger	Datum: NAVD
Site Location: 150 Jackson Road	Drilling Equipment: Track-Mounted Rig	Start/Finish Date: 2/24/22
Newton, Massachusetts	Boring Diameter: 8 inches	Logged by: QSH
Client: Arrowstreet	Surface Elevation (ft): +/-45	Reviewed by: JPJ
Water Levels:	During Drilling: NE	End of Boring: Date:

DESCRIPTION Based on USCS and Modified Burmister Soil Classification System	Soil Profile	SAMPLE*	SAMPLE NUMBER	PENETRATION / RECOVERY	BLOWS (PER 6")	SPT-N VALUE	PID/FID (PPM)	DEPTH (FT.)	WELL CONSTRUCTION
S1 (0-2') 9" TOPSOIL, over 10" tan, fine SAND, some fine to medium gravel, some silt, over 3" SAND and SILT, little fine to medium gravel.	TOPSOIL SAND & SILT		S1	24/22	2-8-17-16	25		1 2	
S2 (2-4') 12" Very dense, tan, fine SAND and SILT, trace fine to medium gravel, over 12" tan, fine SAND and SILT, some fine to medium gravel.	SAND & SILT		S2	24/24	21-59-53-51	112		3 4	
S3 (4-6') 3" Very dense, dark brown SILT, some fine sand and organics, over 2" crushed ROCK, over 3" tan, fine SAND and SILT, over 2" crushed ROCK, over 6" tan, fine to medium SAND and SILT, some fine to medium gravel.	SAND & SILT		S3	24/16	22-29-42-99	71		5 6	
Augered to 10'.								7 8 9 10	
S4 (10-12') 5" Very dense, gray/tan, fine SAND, some silt, some fine gravel (weathered), over 5" fine SAND and SILT, some fine gravel (weathered) over 6" gray, weathered ROCK.	SAND & SILT		S4	24/16	6-35-49-26	84		11 12	
Auger refusal, end of boring 13'.								13 14 15 16 17 18 19	

Notes:

Well Legend:

FS	NF	B	BG	C	
Filter Sand	Native Fill	Bentonite	Bentonite grout	Concrete	PVC Screen

NA=not applicable; NM=not measured; NE=not encountered
*Sample designated with black fill submitted for laboratory analysis.

BORING LOG
B204

Project Number: 222.01003.002	Drilling Company: TDS	Total Depth: 4 Feet, 3 Inches
Project: Lincoln Eliot Expansion	Drilling Method: Hollow-stem auger	Datum: NAVD
Site Location: 150 Jackson Road	Drilling Equipment: Track-Mounted Rig	Start/Finish Date: 2/24/22
Newton, Massachusetts	Boring Diameter: 8 inches	Logged by: QSH
Client: Arrowstreet	Surface Elevation (ft): +/-44	Reviewed by: JPJ
Water Levels:	During Drilling: NE	End of Boring: Date:

DESCRIPTION Based on USCS and Modified Burmister Soil Classification System	Soil Profile	SAMPLE*	SAMPLE NUMBER	PENETRATION / RECOVERY	BLOWS (PER 6")	SPT-N VALUE	PID/FID (PPM)	DEPTH (FT.)	WELL CONSTRUCTION
S1 (0-2') 2" Crushed ASPHALT, over 3" brown fine to medium SAND, some gravel, over 7"gray fine SAND and fine to medium GRAVEL.	ASPHALT SAND SAND & GRAVEL		S1	24/12	16-26-38-36	64		1	
S2 (2-4') 2" Very dense dark brown fine SAND, trace pieces of asphalt, over 4" gray/tan fine to course SAND and fine to medium GRAVEL.	SAND SAND & GRAVEL		S2	8/6	58- >50/2"	>50		2 3	
Spoon refusal at 4', auger refusal at 4' 3".								4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	

Notes:

Well Legend:

FS	NF	B	BG	C	
Filter Sand	Native Fill	Bentonite	Bentonite grout	Concrete	PVC Screen

NA=not applicable; NM=not measured; NE=not encountered
*Sample designated with black fill submitted for laboratory analysis.