Stormwater Report

for

Adin Estates
Franklin, MA

Date: July 16, 2025
Revised: 10/10/2025
Revised: 10/28/2025

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10/29/2025

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ENGINEERING & LAND SURVEYING

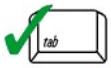
F-4719

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

Massachusetts Department of Environmental Protection
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Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

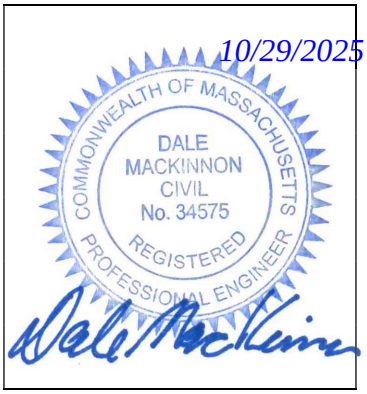
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

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

☐ Reduced Impervious Area (Redevelopment Only)

☒ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

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

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

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☐ Other (describe): _____

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

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NARRATIVE

This report was prepared on behalf of the applicant, Calarese Properties. The land to be subdivided and developed encompasses an area of 202,782 +/- sf. (4.655 +/-Ac.) owned and to be developed by the applicant. The property is bordered by residential lots to the west, north, east, and southeast, and a blueberry farm to the south. The site is located within the Single Family III zoning district and has site access from Union Street. No wetland resource areas or buffers are present on site, and the site is not located within the Franklin water resource district or mapped FEMA flood zone. The site is presently developed as a blueberry farm.

PROJECT DESCRIPTION

The Applicant is proposing to construct a five lot residential subdivision, approximately 560 feet in length, connecting to Union Street opposite Delta Drive. A new 26 foot wide road is proposed to be constructed, along with associated sidewalk, utilities, street trees, and other associated infrastructure, Drainage infrastructure associated with the new development will also be constructed. The topography consists of slopes ranging from 0% to 25% grade, with most of the existing parcel cleared for the cultivation of blueberries.

DESCRIPTION OF EXISTING DRAINAGE

The pre-developed site drains principally from southwest to northeast, with portions of the site draining to the southwest. The pre-development drainage area is modeled as five hydrologic areas. These hydrologic areas are shown on the Pre-Development Watershed Plan attached to this report and are denoted as EX-1 through EX-5.

EX-1 contains approximately 144,271 square feet of contributing area, consisting primarily of woods, grass, blueberry fields (modeled as woods/grass comb.) existing pavement/roofs, and offsite flow from an abutting residential lot. This watershed is located in the eastern portion of the property. Runoff from this hydrologic area flows northeast overland, crossing the abutting residential lots (AP-1), eventually flowing onto Union Street, AP-2.

EX-2 contains approximately 21,803 square feet of contributing area, consisting of woods, grass, existing pavement, and offsite flow from an abutting residential lot . Runoff from this hydrologic area flows overland from south to northeast, where it discharges directly to Union Street, AP-2.

EX-3 contains approximately 104,941 square feet of contributing area, consisting of woods, grass, runoff from offsite residential lots, and blueberry fields (modeled as woods/grass comb.). Runoff from this hydrologic area flows overland to an existing depression located in the center of the watershed, near the western lot line (EP-1), where it infiltrates into the soil. Any excess runoff would discharge to the south (AP-3), though no discharge is anticipated up to and through the 100-year storm.

EX-4 contains approximately 14,262 square feet of contributing area, consisting of woods, grass, and blueberry fields (modeled as woods/grass comb.). Runoff from this hydrologic area flows overland to the southwestern corner of the lot, flowing offsite via an existing gulley/swale to the abutting property, AP-4.

EX-5 contains approximately 1,912 square feet of contributing area, consisting primarily of woods. Runoff from this small hydrologic area flows overland to the south to the abutting property, AP-4.

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DESCRIPTION OF PROPOSED DRAINAGE FACILITIES

The proposed drainage system to manage stormwater from the roadway construction and associated development consists of Deep Sump Hooded Catch Basins, a Sediment Forebay, and an Infiltration Basin. Stormwater from the proposed homes, driveways, lots, sidewalks and roadways is collected and conveyed by a conventional catch basin and drain manhole system to the sediment forebay prior to discharge to infiltration basin #1 for treatment, detention, and infiltration. The existing depression along the western lot line is proposed to be reshaped into a swale to convey surface runoff to a proposed catch basin, which connects to the primary infiltration basin via pipe.

In the Post-Development condition, six hydrologic areas were considered. These watershed areas consider the pavement, lawns, sidewalks, roofs, offsite flows, and drainage facilities proposed to be constructed. These hydrologic areas are shown on the Post-Development Watershed Plan attached to this report and are denoted as PR-1 through PR-6.

PR-1 contains approximately 174,371 square feet of contributing area and includes all land which drains directly to Infiltration Basin #1. Runoff is captured by catch basins, conveyed to the northeast, and discharged to the sediment forebay and infiltration basin for treatment, detention, and infiltration. The outlet control structure will connect via pipe to the existing drainage infrastructure in Union Street, avoiding point discharges to the northern abutters which may adversely affect their land. The basin's emergency overflow is directed to a proposed swale, which would discharge directly to Union Street, again to avoid impacts to the northern residential abutters. No surface overflow will occur up to or during the 100-year storm event.

PR-2 contains approximately 21,998 square feet of contributing area and includes all land which drains directly Union Street. Runoff from on-site paved areas within this watershed are captured by proposed catch basins, treated by a hydrodynamic separator manhole, and discharged via pipe to the existing Union Street drainage system. Calculations are provided within this report to demonstrate all applicable stormwater standards and regulations have been met.

PR-3 contains approximately 80,730 square feet of contributing area and includes all land which drains to the proposed western swale and drainage inlet CB-7, consisting of woods, grass, roofs, and runoff from offsite residential lots. Runoff from this watershed is conveyed by pipe to Infiltration Basin #1, mixing with runoff from PR-1, for treatment, detention, and infiltration.

PR-4 contains approximately 8,560 square feet of contributing area and includes all land which drains directly to the northern abutter, consisting entirely of woods and grass. Runoff flows overland to the north, crossing the northern abutter's property (AP-1) and eventually discharging to Union Street, AP-2.

PR-5 contains approximately 2,501 square feet of contributing area and includes all land which drains directly to the southwestern lot corner, consisting of woods and grass cover. Runoff flows overland to the south, eventually discharging to the abutting blueberry farm at the southwestern lot corner, AP-3.

PR-6 contains approximately 1,913 square feet of contributing area, consists of grass and woods cover, and includes all land which drains directly to the southern abutting blueberry farm. Runoff flows overland to the south, discharging to AP-4.

This report documents design compliance with the applicable sections of the Massachusetts Stormwater Management Standards 1-10.

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Stormwater Design Parameter:

The stormwater management system was designed to control the post-development rate of peak rainfall runoff from the site by keeping it below the post-development peak rate of rainfall runoff as stated as the objective in the Massachusetts Stormwater Handbook. The calculations were performed using the HydroCAD hydraulic program, developed by applied Microcomputer System. The HydroCAD software is based upon the Soil Conservation Service, "Technical Release 55 – Urban Hydrology for Small Watersheds" and is generally accepted industry methodology.

The analysis was performed for the 2-year, 10-year, 25-year, and 100-year 24-hour storm events.

The following data was required for input:

- Watershed Area: Areas of each watershed were calculated and expressed in square feet for these calculations.
- SCS Curve Number (Cn): Based on the cover type and hydrologic soil group, a weighted curve number (CN) was determined for each of the existing watersheds utilizing Table 2-2a- *Runoff Curve Numbers For Urban Areas* and *Worksheet 2, Runoff Curve Number and Runoff* from the Soil Conservation Service Technical Release 55 – Urban Hydrology for Small Watersheds.
- Time of Concentration, Tc (Minutes): The time of concentration for each watershed was determined by finding the time necessary for runoff to travel from the hydraulically most distant point in the watershed to the point of analysis. This was calculated by using a minimum time of 6 minutes for runoff to reach the most distant catch basin.
- SCS 24-Hour Storm Type: For the greater New England region, a Type III storm rainfall distribution is recommended for drainage calculations and was used for this project.
- Rainfall Precipitation: Rainfall precipitations used the Atlas-14 Volume 10, Version 3 rainfall estimates for the site, obtained from the NOAA Precipitation Frequency Data Server (PFDS) for the 2, 10, 25, and 100 year storm events and are as follows:

2-year storm event:	3.36 inches
10-year storm event:	5.22 inches
25-year storm event:	6.37 inches
100-year storm event:	8.16 inches

An on-site conventional storm drainage collection system is designed based on the "Rational Method" using Manning's equation to carry a minimum 25-year storm event and underground culverts to carry a minimum 50-year storm event through the site (See Pipe Sizing Attachments). The proposed drainage pipes will be Reinforced Concrete Pipe (RCP), unless otherwise noted on the plans.

Standard 1: No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

All runoff from impervious areas will sheet flow across the pavement areas, accumulate into hooded catch basins, connect with drain pipe to a sediment forebay and discharge to the infiltration basin. Approximately 75' of new road could not be routed to the proposed infiltration basin and treated by a proposed Contech water quality unit prior to discharging to the existing drainage infrastructure within Union Street. No new untreated stormwater discharges are proposed.

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Standard 2: Stormwater management systems shall be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates.

To meet Standard 2, the post-development peak discharge rate must be equal to or less than pre-development rates to prevent storm damage and downstream and offsite flooding from the 2-year and the 10-year 24-hour storm events.

Peak discharge rates volumes were calculated and evaluated at four analysis points. The point of evaluation is shown on the accompanying watershed plans.

In summary of the attached drainage analysis (HydroCAD), the peak discharge rates at the point of evaluation in cubic feet per second (cfs) are as follows;

	Storm Events	Site Runoff Flow Rates and Volumes					
		Pre-Dev		Proposed		Change	
		(cfs)	[af]	(cfs)	[af]	(cfs)	[af]
Analysis Point 1 (AP-1)	2-year	0.00	0.000	0.00	0.000	-0.00	-0.000
	10-year	0.06	0.048	0.00	0.001	-0.06	-0.047
	25-year	0.26	0.121	0.00	0.002	-0.26	-0.119
	100-year	1.72	0.286	0.03	0.006	-1.69	-0.280

	Storm Events	Site Runoff Flow Rates and Volumes					
		Pre-Dev		Proposed		Change	
		(cfs)	[af]	(cfs)	[af]	(cfs)	[af]
Analysis Point 2 (AP-2)	2-year	0.09	0.014	0.02	0.009	-0.07	-0.005
	10-year	0.65	0.096	0.46	0.038	-0.19	-0.058
	25-year	1.10	0.197	0.85	0.065	-0.25	-0.132
	100-year	2.59	0.412	1.59	0.322	-1.00	-0.09

	Storm Events	Site Runoff Flow Rates and Volumes					
		Pre-Dev		Proposed		Change	
		(cfs)	[af]	(cfs)	[af]	(cfs)	[af]
Analysis Point 3 (AP-3)	2-year	0.00	0.000	0.00	0.000	0.00	0.000
	10-year	0.00	0.001	0.00	0.000	0.00	-0.001
	25-year	0.01	0.005	0.00	0.000	-0.01	-0.005
	100-year	0.05	0.017	0.05	0.004	0.00	-0.013

	Storm Events	Site Runoff Flow Rates and Volumes					
		Pre-Dev		Proposed		Change	
		(cfs)	[af]	(cfs)	[af]	(cfs)	[af]
Analysis Point 4 (AP-4)	2-year	0.00	0.000	0.00	0.000	0.00	0.000
	10-year	0.00	0.000	0.00	0.000	0.00	0.000
	25-year	0.00	0.000	0.00	0.000	0.00	0.000
	100-year	0.00	0.002	0.00	0.002	0.00	0.000

Standard 3: Loss of annual recharge to ground water shall be eliminated or minimized through the use of environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post- development site shall approximate the annual recharge from pre-development conditions based on soil type. This standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

Soil Evaluation

Soil evaluation is broken down into two stages. Stage 1 identifies the underlying soils just beneath the surface that contribute to how much runoff is generated as stormwater falls and moves across the surface. Stage 2 evaluates the soils in direct contact with the proposed infiltration BMPs. The attachments section includes the NRCS Soil Survey used for Stage 1 while the site plan set includes the on-site soil textural analysis in the specific locations that infiltration is proposed. The information from the NRCS Soil Survey is included on the Pre and Post Development Watershed Plans.

Recharge Volume

Soils underlying the site are defined as map unit 300B Montauk fine sandy loam, 3 to 8 percent slopes, and map unit 422C Canton fine sandy loam, 8 to 15 percent slopes. We have estimated the soil as a mix of hydrologic group "B" for the westerly portion of the site and "C" for the easterly portion of the site of the site based on Web Soil Survey USDA/NRCS Soil Map. Test Pits throughout the site depicted the underlying soil C layer material to be a mix of loamy sand and sandy loam, with an area of Sand present near the entrance to the site. The infiltration design is based on a Type A Soil "1982 Rawls Rates" of 2.41 in/hr for the proposed roadway Infiltration Basin. See Soil Data in Attachment Section.

Table 2: Basin #1 Required Recharge Volume Calculation

	Recharge	**Impervious**	**Volume**
Hydrologic Group	(in/sqft)	(sqft)	(cf)
A - *sand*	0.60	43,402	2,170
B - *loam*	0.35	0	0
C - *silty loam*	0.25	0	0
D - *clay*	0.10	None	0
Required Recharge Volume Total			**2,170 cf**

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Stormwater Basin Sizing

There are three ways of determining the recharge volume provided by a storm water basin (Static, Simple Dynamic, and Dynamic Field). The Static Method, used here, includes the volume of water that can be stored beneath the lowest outlet of the basin. This, the most conservative method of determining the recharge volume, doesn't account for any infiltration that takes place while the basin is filling with water and is less dependent on maintenance of the basin since the only way for the water below the lowest invert can leave the basin is though infiltration. The following table summarizes the recharge volume provided by the infiltration basin. Detailed volume calculations for the basin are included in the attachments.

Table 3: Basin Recharge Volumes

	Recharge Volume
Basin 1 @ 328.36	32,960 cf
Total	32,960 cf

72-hour Drawdown

When using the conservative Static Method to determine infiltration volume provided, the Rawls Rate is used to represent the infiltration rate in place of a hydraulic conductivity rate. The specific rate chosen is based on the textural analysis of the in-site soil performed by a competent soil professional.

A Massachusetts Certified Soil Evaluator performed an evaluation of the soil at the proposed infiltration BMP. The soil textural analysis for the infiltration BMP is listed below with the associated Rawls Rate used in the HydroCAD calculations. Where textural analysis varied within any single BMP, the most restrictive textural evaluation and Rawls Rate were used. Soil logs of the in-situ soil evaluation are included within the Site Plan set.

Table 4: Rawls Rate

	Most Restrictive Soil Texture	**Rawls Rate (in/hour)**
Infiltration Basin 1	Sand/Loamy Sand	2.41 in/hr

Drawdown time for the infiltration basin is modelled using the static method:

$$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ Area)}$$

Time $_{drawdown}$ = 32,960 / (0.20 ft/hr x 3,156 sq. ft.)
Time $_{drawdown}$ = 52.2 hours

The following table summarizes the drawdown time for the basin to show it will drawdown within the 72-hour maximum.

Table 5: Basin Drawdown

	Time for Drawdown
Infiltration Basin 1	52.2 hours

Standard 4: Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This standard is met when:

- ***a) Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;***
- ***b) Structural stormwater best management practices are sized to capture the required water quality volume as determined in accordance with the Massachusetts Stormwater Handbook; and***
- ***c) Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.***

The Water Quality Volume requiring 80% TSS removal, is calculated as follows:

The required water quality volume is based on 1.0" as the soil recharge rate is 2.41 in/hr, meeting the threshold rate of 2.4 in/hr or greater. The water quality volume equals 1.0 inches of runoff times the increased impervious area of the post-development site.

Basin #1 Required Water Quality Volume:

Existing Site Impervious Area = 4,225 sf
Proposed Site Impervious Area = 43,402 sf
Total Site Impervious Area Increase = 39,177 sf
Impervious area to be treated = **43,402 sf**

Total volume to be treated:
1.0" x 1'/12" x 43,402 sf = **3,616.8 cf Water Quality Volume Required**

Provided Water Quality Volume:

Infiltration Basin 1 Treatment volume:

Contributing Impervious Area = 51,368 sf (includes offsite impervious from abutting lots)

Basin 1 req'd WQV = 3,616.8 cf

(Storage below lowest invert @ 328.36) = 32,960 cf

Forebay Sizing

All the stormwater from the impervious pavement is collected and discharged to the proposed sediment forebay which is sized to treat 0.1" of runoff from the 64,861sf impervious area contributing to the basin. Detailed calculations for the sediment forebay are included in Appendix 5 / Stage-Area-Storage Calculations.

Forebay #1
0.1"/12" per foot x 64,861 sf = 540.5 cf of storage required

Table 6: Sediment Forebay Sizing

	Impervious Area being Discharged	Required Volume	Provided Volume
Forebay 1 @ Inv.=325.0	64,861 cf	540.5 c.f.	583 c.f.

See TSS Removal Calculations in Attachment Section.

WQU-1 Required Water Quality Volume:
Proposed Site Impervious Area Captured = 2,657 sf
Impervious area to be treated = **2,657 sf**

Total volume to be treated:
1.0" x 1'/12" x 2,657 sf = **221.42 cf Water Quality Volume Required**

Water Quality Unit Sizing

Stormwater from impervious areas is collected by CB-and CB-10 and discharged to WQU-1, a Contech Continuous Deflection Hydrodynamic Separator. Water Quality Flow Rates were calculated in accordance with procedures outlined within the Massachusetts Stormwater Management Handbook. Detailed calculations from the manufacturer for the Contech unit is included in Appendix 5.

Water Quality Flow Rate = (qu)(A)(WQV)

WQU-1:

Qu = 774 csm/in
A = 0.06099633 acres = 0.00009530676 sq.mi.
WQV = 1"

WQU-1 required WQFR = 0.07377 cfs
CDS2015-4-C maximum rated treatment capacity = 1.4 cfs

MS4 Bylaw Compliance:

Based on the Town of Franklin MS4 stormwater bylaw as specified in § 153-16 (B)(1)(a), new developments require the on-site stormwater management systems to be designed to retain the volume of runoff equivalent to, or greater than, one (1.0) inch multiplied by the total post-construction impervious surface area, and/or remove 90% of the average annual load of Total Suspended Solids (TSS) generated from the total post construction impervious area on site and 60% of the average annual load of Total Phosphorous (TP) generated from the post construction impervious surface area on site.

The total impervious area contributing runoff to infiltration basin 1, including roofs and offsite impervious areas, is 64,861 square feet. The equivalent 1" of runoff from these surfaces is 5,405.1

cubic feet. The total storage provided below the lowest inverts out are as follows. See Appendix 5 – Stage -Area-Storage calculations.

Basin 1 @ Elev. 328.2 = 31,331 cf
Total Storage Volume Required = 5,405 cf
Total Storage Volume Provided = 31,331 cf

Standard 4: requires the development and implementation of suitable practices for source control and pollution prevention. These measures must be identified in a long-term pollution prevention plan.

The long-term pollution prevention plan is incorporated into the Operation and Maintenance Plan required by Standard 9.

Standard 5: For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.

The proposed project is not a use with higher potential pollutant loads.

Standard 6: Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook.

The subject property does not discharge stormwater within the Franklin Water Resource District or Zone II of a public water supply well. Due to the presence of soils with rapid recharge rates in the area of the infiltration basin, the Water Quality Volume is calculated using the required 1.0" rule, and 44% TSS removal is achieved prior to discharge to the infiltration basin. See Standard 4 for computations. The design utilizes stormwater BMPs designated as suitable for critical areas within the Massachusetts Stormwater Handbook. No metal roofs are proposed.

Standard 7: A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable:

This project is not a redevelopment project and meets all applicable stormwater standards.

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Standard 8: 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) shall be developed and implemented.

During land disturbance and construction activities, project proponents must implement controls that prevent erosion, control sediment movement, and stabilize exposed soils to prevent pollutants from moving offsite or entering wetlands or waters. Land disturbance activities include demolition, construction, clearing, excavation, grading, filling, and reconstruction.

Construction Period Pollution Prevention Plan and Erosion and Sedimentation Control.
EPA NPDES – Storm Water Pollution Prevention Plan (SWPPP)

A. Names of Persons or Entities Responsible for Plan Compliance

Calarese Properties
c/o Roger Calarese
154 Brookview Road
Franklin, MA 02038
Tel: 508-528-3700

B. Construction Period Pollution Prevention Measures
   1. Inventory materials to be present on-site during construction.
   2. Train employees and subcontractors in prevention and clean up procedures.
   3. All materials stored on site will be stored in their appropriate containers and if possible, under a roof or covered.
   4. Follow manufacturer's recommendation for disposal of used containers.
   5. Store only enough product on site to do the job.
   6. On site equipment, fueling and maintenance measures:
      a. Inspect on-site vehicles and equipment daily for leaks.
      b. Conduct all vehicle and equipment maintenance and refueling in front of building, away from storm drains.
      c. Perform major repairs and maintenance off site.
      d. Use drip pans, drip cloths or absorbent pads when replacing spent fuels.
      e. Collect spent fuels and remove from site, per Local and State regulations.
      f. Maintain a clean construction entrance where truck traffic is frequent to reduce soil compaction constant sweeping is required and limit tracking of sediment into streets, sweeping street when silt is observed on street.
   7. Stockpile materials and maintain Erosion Control around the materials where it can easily be accessed. Maintain easy access to clean up materials to include brooms, mops, rags gloves, goggles, sand, sawdust, plastic and metal trash containers.
   8. Clean up spills.
      a. Never hose down "dirty" pavement or impermeable surfaces where fluids have spilled. Use dry clean up methods (sawdust, cat litter and/or rags and absorbent pads).
      b. Sweep up dry materials immediately. Never wash them away or bury them.
      c. Clean up spills on dirt areas by digging up and properly disposing of contaminated soil in a certified container and notify a certified hauler for removal.
      d. Report significant spills to the Fire Department.

9. It is the responsibility of the site superintendent or employees designated by the Applicant to inspect erosion control and repair as needed, also to inspect all on site vehicles for leaks and check all containers on site that may contain hazardous materials daily.

C. Erosion and Sedimentation Control Plan.
See Erosion Control Plan prepared by Guerriere & Halnon, Inc. Dated 07/16/2025 and revised through 10/10/2025.

D. Site Development Plans.
See Site Plan prepared by Guerriere & Halnon, Inc. Dated 07/16/2025 and revised through 10/10/2025.

E. Construction Plans
See Site Plan prepared by Guerriere & Halnon, Inc. Dated 07/16/2025 and revised through 10/10/2025.

a. Prior to any work on the site including tree/brush clearing, the approved limit of clearing as well as the location of the proposed erosion control devices (such as silt fence/mulch sock, etc.) must be staked on the ground under the direction of a Massachusetts registered Professional Land Surveyor.
b. Install mulch sock or equivalent erosion control barrier at locations identified on site plans. Any substitutions must be approved by the design engineer and Town of Franklin.
c. Strip off top and subsoil for road construction, do not clear lot areas. Stockpile material to be reused away from abutting properties, remove excess material from the site. Install and maintain erosion control barrier around stockpile. Avoid compacting soils within the footprint of the proposed stormwater basin. If possible, strip the soils within these areas just prior to construction of these systems.
d. Rough grade site, maintaining temporary low areas/sediment traps away from the main basin area. Avoid turbid discharges to abutting properties.
e. Construct drainage outfalls and stormwater basin. Stabilize side slopes with loam, seed and mulch.
f. Install underground utilities; protect all open drainage structures with erosion/siltation control devices.
g. Install binder course of bituminous asphalt.
h. Install wearing course of asphalt, and striping (where required).
i. Maintain all erosion control devices until site is stabilized and the road has been accepted by the town.
j. The Contractor shall be responsible to schedule any required inspections of his/her work.

F. Construction Waste Management Plan

a. Dumpster for trash and bulk waste collection shall be provided separately for construction.
b. Recycle materials whenever possible (paper, plaster cardboard, metal cans). Separate containers for material are recommended.
c. Segregate and provide containers for disposal options for waste.
d. Do not bury waste and debris on site.
e. Certified haulers will be hired to remove the dumpster container waste as needed. Recycling products will also be removed off site weekly.

f. The sewer system is only for disposal of human waste, and substances permitted for disposal in the site sewer permit with the Town B.O.H.

G. Operation and Maintenance of Erosion and Sedimentation Controls

The operation and maintenance of sedimentation control shall be the responsibility of the contractor. The inspection and maintenance of the stormwater component shall be performed as noted below. The contractor shall have erosion control in place at all times. The contractor, based on future weather reports, shall prepare and inspect all erosion control devices; cleaning, repairing and upgrading is a priority so that the devices perform as per design. Inspect the site during rain events. Do not stay away from the site. At a minimum there should be inspection to assure the devices are not clogged or plugged, or that devices have not been destroyed or damaged during the rain event. After a storm event inspection is required to clean and repair any damage components. Immediate repair is required.

H. Inspection and Maintenance Schedules

1. Inspection must be conducted at least once every 7 days and within 24 hours of the end of a storm event 0.5 inches or greater.
2. Inspection frequency can be reduced to once a month if:
   a. The site is temporarily stabilized.
   b. Runoff is unlikely due to winter conditions when site is covered with snow or ice.
3. Inspections must be conducted by qualified personnel, "qualified personnel" means a person knowledgeable in the principles and practice of erosion and sediment controls and who possess the skills to assess the conditions and take measures to maintain and ensure proper operation, also to conclude if the erosion control methods selected are effective.
4. For each inspection, the inspection report must include: (See attached inspection and maintenance log)
   a. The inspection date.
   b. Names, titles of personnel making the inspection.
   c. Weather information for the period since the last inspection.
   d. Weather information at the time of the inspection.
   e. Locations of discharges of sediment from the site, if any.
   f. Locations of BMP's that need to be maintained.
   g. Locations where additional BMP's may be required.
   h. Corrective action required or any changes to the SWPPP that may be necessary.
5. The owner, or their representative, such as the contractor, shall inspect the following in-place work.

Inspection Schedule:

Erosion Control	Weekly
Catch Basins	Weekly
Temporary Sedimentation Traps/Basins	Weekly
Street Sweeping	Weekly

Please Note: Special inspections shall also be made after a significant rainfall event.

Maintenance Schedule	
Erosion Control Devices Failure	Immediately
Catch Basins	Sump 1/4 full of sediment
Temporary Sedimentation Trap/Basin	As needed
Street Sweeping	14 days minimum and prior to any significant rain event.

Please Note: Special maintenance shall also be made after a significant rainfall event.

I. Inspection and Maintenance Log Form. (Log Form Follows)

Standard 9: A Long –Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that storm water management systems function as designed.

The following shall serve as the (O&M) Plan required by Standard 9, as well as the Long-Term Pollution Prevention Plan required by Standard 4.

A. Names of Persons or Entities Responsible for Plan Compliance;

Calarese Properties
c/o Roger Calarese
154 Brookview Road
Franklin, MA 02038
Tel: 508-528-3700

*The above entity is responsible for plan compliance until Roadway Acceptance by the Town of Franklin, at which time the Town of Franklin assumes responsibility.

B. Stormwater Management System Owner

Calarese Properties
c/o Roger Calarese
154 Brookview Road
Franklin, MA 02038
Tel: 508-528-3700

*The above entity is responsible for plan compliance until Roadway Acceptance by the Town of Franklin, at which time the Town of Franklin assumes responsibility.

C. Good housekeeping practices

1. Maintain site, landscaping and vegetation.
2. Sweep and pick up litter on pavements and grounds.
3. Deliveries shall be monitored by owners or representative to ensure that if any spillage occurs, it shall be contained and cleaned up immediately.
4. Maintain pavement and curbing in good repair.

D. Requirements for routine inspections and maintenance of stormwater BMPs

1. Plans: The stormwater Operation and Maintenance Plan shall consist of all Plans, documents and all local state and federal approvals as required for the subject property.
2. Record Keeping:

a. Maintain a log of all operation and maintenance activities for at least three years following construction, including inspections, repairs, replacement and disposal (for disposal, the log shall indicate the type of material and the disposal location).
b. Make this log available to the Town of Franklin upon request; and
c. Allow the Town of Franklin to inspect each BMP to determine whether the responsible party is implementing the Operation and Maintenance Plan.

3. Descriptions and Designs: The Best Management Practices (BMP) incorporated into the design include the following.
   a. Street Sweeping – Stipulated within the Construction Period Pollution Prevention Plan, the Long-Term Pollution Prevention Plan, and the Operation and Maintenance Plan. As the amount of TSS removal is discretionary, no credit was taken within the calculations for this BMP.
   b. Deep sump catch basins with hoods installed to promote TSS Removal of solids and control floatable pollutants. This BMP has a design rate of 25% TSS Removal.
   c. Infiltration basin and sediment forebay provided to promote the required 80% TSS Removal. Refer to TSS Removal Worksheet in Standard 4 for treatment train.
   d. Safety Fencing: Provide 6-FT high chain link fence with lockable gates around detention basin for public safety.
   e. Spill Containment Kit to contain and clean-up spills that could occur on site.

4. BMP Maintenance: After construction it is the responsibility of the owner to perform maintenance. The cleaning of the components of the stormwater management system shall generally be as follows:
   a. Roadway: The owner shall keep the roadway swept with a mechanical sweeper or hand swept semi-annually at a minimum.
   b. Catch Basins: Shall be cleaned by excavating, pumping or vacuuming four times per year and at the end of foliage and snow removal seasons. The sediment shall be disposed of off-site by the Owner. Inspect quarterly, remove silt when ¼ full.
   c. Sediment Forebay: Inspect monthly. Clean forebay 4 times per year.
   d. Infiltration Basins: Preventative maintenance shall be performed at least twice per year. Inspection shall be performed after every major storm for the first three months and twice a year thereafter and when there are discharges through the high outlet orifice. Mowing of the buffer area, and bottom of basin; removal of trash and debris; removal of grass clippings and organic matter to be performed at least twice per year. Pretreatment devices shall be inspected every other month and a least twice a year and after every major storm event.

5. Access Provisions: All of the components of the storm water system shall be accessible by the Owner

E. Spill prevention and response plans

1. Inventory materials to be present on-site during construction.
2. Train employees and subcontractors in prevention and clean up procedures.
3. All materials stored on site will be stored in their appropriate containers under a roof.
4. Follow manufacturers recommendation for disposal of used containers.
5. Store only enough product on site to do the job.
6. On site equipment, fueling and maintenance measures:
   a. Inspect on-site vehicles and equipment daily for leaks.

b. Conduct all vehicle and equipment maintenance and refueling in one location, away from storm drains.
c. Perform major repairs and maintenance off site.
d. Use drip pans, drip cloths or absorbent pads when replacing spent fuels.
e. Collect spent fuels and remove from site.

7. Clean up spills.
   a. Spill Containment Kit to contain and clean-up spills that could occur on site
   b. Never hose down "dirty" pavement or impermeable surfaces where fluids have spilled. Use dry clean up methods (sawdust, cat litter and/or rags and absorbent pads).
   c. Sweep up dry materials immediately. Never wash them away or bury them.
   d. Clean up spills on dirt areas by digging up and properly disposing of contaminated soil.
   e. Report significant spills to the Fire Department, Conservation Commission and Board of Health.

F. Provisions for maintenance of lawns, gardens, and other landscaped areas

Use only organic fertilizer. Dispose of clippings outside of the 100-foot buffer zone to the adjacent wetland.

G. Requirements for storage and use of herbicides, and pesticides

The application of herbicides or pesticides will be done by professional certified contractors.

H. Provisions for operation and management of septic system

Site to be serviced by private on-site sewer.

I. Requirements for handling of pet waste

Pet waste should never be dumped or washed into the local storm drain system. Waste shall be picked up immediately and placed in bags and properly disposed of in the garbage to be collected and taken to a landfill.

J. Provisions for washing of vehicles

Washing of vehicles shall be done in an area away from sensitive areas and drainage inlets, so as to eliminate wash water from being directly discharged to the local storm drain system. Vehicles should be washed in areas where wash water can be held prior to discharging to the sanitary sewer system or in areas where infiltration precludes runoff to storm drains. Avoid using detergents whenever possible.

K. Provisions for solid waste management

1. Waste Management Plan
   a. Recycle materials whenever possible (paper, plaster cardboard, metal cans). Separate containers for material are recommended.
   b. Do not bury waste and debris on site.
   c. Certified haulers will be hired to remove the dumpster container waste as needed. Recycling products will also be removed off site weekly.

L. Snow disposal and plowing plans relative to Wetland Resource Areas

Snow storage is adequate around the site for large storm events. Storage of snow shall not be placed directly near areas adjacent to the proposed infiltration basin.

M. Winter Road Salt and/or Sand Use and Storage restrictions

No sand, salt, or chemicals for de-icing will be stored outside.

N. Street sweeping schedules

Sweeping, the act of cleaning pavement can be done by mechanical sweepers, vacuum sweeper or hand sweeper. The quantity of sand is a direct correlation with the treatment of ice and snow and the types of chemicals and spreaders that are being used on site to manage snow. If a liquid de-icer such as calcium chloride is used as a pretreatment to new events the amount of sand is minimized. Sweeping for this site should be done semi-annually at a minimum. Collecting the particulate before it enters the catch basins is cheaper and more environmentally friendly than in a catch basin mixing with oils and greases in the surface water runoff in catch basins.

O. Provisions for prevention of illicit discharges to the stormwater management system

The discharge into the stormwater system is not being violated, see attachment for illicit discharges compliance.

P. Training the staff or personnel involved with implementing Long-Term Pollution Prevention Plan

The owner shall develop policies and procedures for containing the illicit spilling of oils, soda, beer, paper and litter. These wastes provide a degrading of the water quality. The placement of signs and trash barrels with lids around the site would contribute to a clean water quality site condition.

Q. List of Emergency contacts for implementing Long-Term Pollution Prevention Plan:

Calrese Properties
c/o Roger Calarese
154 Brookview Road
Franklin, MA 02038
Tel: 508-528-3700

This shall be the contact until such time as the project is sold.

R. Estimated BMP Maintenance Costs

The following prices are estimates of the costs associated with maintenance of the proposed site BMPs. Costs provided are only estimates and may not reflect actual costs to perform the work. Actual costs may vary depending on company/personnel performing the work. Actual costs may increase over time.

BMP	Estimated Maintenance Cost
Pavement sweeping	$ 400 per year
Catch basin cleaning	$ 200 per catch basin per cleaning
Infiltration Basin	$ 200 per cleaning
Spill Containment Kit	$ 750 purchase price

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Standard 10: All illicit discharges to the stormwater management system are prohibited.

Standard 10 prohibits illicit discharges to stormwater management systems. The stormwater management system is the system for conveying, treating, and infiltrating stormwater on site, including stormwater best management practices and any pipes intended to transport stormwater to the ground water, a surface water, or municipal separate storm sewer system. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated ground water, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents.

Illicit Discharge Compliance Statement

It is the intent of the Applicant, Calarese Properties c/o Roger Calarese, 154 Brookview Road, Franklin, MA 02038, to prevent illicit discharges to the stormwater management system, including wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease. There will be no connection to the storm water system to inadvertently direct other types of liquids, chemicals or solids into the storm drainage system. The Owner will also promote a clean Green Environment by mitigating spills onto pavements; oils, soda, chemicals, pet waste, debris and litter.

Respectfully Acknowledged,

Roger Calarese

OPERATION AND MAINTENANCE PLAN

Operation and Maintenance Plan

for

Adin Estates
Franklin, MA

Date: July 16, 2025
October 10, 2025
October 28, 2025

Prepared By:
Guerriere & Halnon, Inc.
55 West Central Street
Franklin, MA. 02038

Prepared for:
Calarese Properties
154 Brookview Road
Franklin, MA 02038

Guerriere & Halnon, Inc.
ENGINEERING & LAND SURVEYING

F-4719

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Standard 9: A Long –Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that storm water management systems function as designed.

The following shall serve as the (O&M) Plan required by Standard 9, as well as the Long-Term Pollution Prevention Plan required by Standard 4.

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154 Brookview Road
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Tel: 508-528-3700

*The above entity is responsible for plan compliance until Roadway Acceptance by the Town of Franklin, at which time the Town of Franklin assumes responsibility.

B. Stormwater Management System Owner

Calarese Properties
c/o Roger Calarese
154 Brookview Road
Franklin, MA 02038
Tel: 508-528-3700

*The above entity is responsible for plan compliance until Roadway Acceptance by the Town of Franklin, at which time the Town of Franklin assumes responsibility.

C. Good housekeeping practices

1. Maintain site, landscaping and vegetation.
2. Sweep and pick up litter on pavements and grounds.
3. Deliveries shall be monitored by owners or representative to ensure that if any spillage occurs, it shall be contained and cleaned up immediately.
4. Maintain pavement and curbing in good repair.

D. Requirements for routine inspections and maintenance of stormwater BMPs

1. Plans: The stormwater Operation and Maintenance Plan shall consist of all Plans, documents and all local state and federal approvals as required for the subject property.
2. Record Keeping:
   a. Maintain a log of all operation and maintenance activities for at least three years following construction, including inspections, repairs, replacement and disposal (for disposal, the log shall indicate the type of material and the disposal location).
   b. Make this log available to the Town of Franklin upon request; and
   c. Allow the Town of Franklin to inspect each BMP to determine whether the responsible party is implementing the Operation and Maintenance Plan.
3. Descriptions and Designs: The Best Management Practices (BMP) incorporated into the design include the following.
   a. Street Sweeping – Stipulated within the Construction Period Pollution Prevention Plan, the Long-Term Pollution Prevention Plan, and the Operation and

Maintenance Plan. As the amount of TSS removal is discretionary, no credit was taken within the calculations for this BMP.

b. Deep sump catch basins with hoods installed to promote TSS Removal of solids and control floatable pollutants. This BMP has a design rate of 25% TSS Removal.
c. Infiltration basin and sediment forebay provided to promote the required 80% TSS Removal. Refer to TSS Removal Worksheet in Standard 4 for treatment train.
d. Safety Fencing: Provide 6-FT high chain link fence with lockable gates around detention basin for public safety.
e. Spill Containment Kit to contain and clean-up spills that could occur on site.

4. BMP Maintenance: After construction it is the responsibility of the owner to perform maintenance. The cleaning of the components of the stormwater management system shall generally be as follows:
   a. Roadway: The owner shall keep the roadway swept with a mechanical sweeper or hand swept semi-annually at a minimum.
   b. Catch Basins: Shall be cleaned by excavating, pumping or vacuuming four times per year and at the end of foliage and snow removal seasons. The sediment shall be disposed of off-site by the Owner. Inspect quarterly, remove silt when ¼ full.
   c. Sediment Forebay: Inspect monthly. Clean forebay 4 times per year.
   d. Infiltration Basins: Preventative maintenance shall be performed at least twice per year. Inspection shall be performed after every major storm for the first three months and twice a year thereafter and when there are discharges through the high outlet orifice. Mowing of the buffer area, and bottom of basin; removal of trash and debris; removal of grass clippings and organic matter to be performed at least twice per year. Pretreatment devices shall be inspected every other month and a least twice a year and after every major storm event.

5. Access Provisions: All of the components of the storm water system shall be accessible by the Owner

E. Spill prevention and response plans

1. Inventory materials to be present on-site during construction.
2. Train employees and subcontractors in prevention and clean up procedures.
3. All materials stored on site will be stored in their appropriate containers under a roof.
4. Follow manufacturers recommendation for disposal of used containers.
5. Store only enough product on site to do the job.
6. On site equipment, fueling and maintenance measures:
   a. Inspect on-site vehicles and equipment daily for leaks.
   b. Conduct all vehicle and equipment maintenance and refueling in one location, away from storm drains.
   c. Perform major repairs and maintenance off site.
   d. Use drip pans, drip cloths or absorbent pads when replacing spent fuels.
   e. Collect spent fuels and remove from site.
7. Clean up spills.
   a. Spill Containment Kit to contain and clean-up spills that could occur on site
   b. Never hose down “dirty” pavement or impermeable surfaces where fluids have spilled. Use dry clean up methods (sawdust, cat litter and/or rags and absorbent pads).
   c. Sweep up dry materials immediately. Never wash them away or bury them.

d. Clean up spills on dirt areas by digging up and properly disposing of contaminated soil.
e. Report significant spills to the Fire Department, Conservation Commission and Board of Health.

F. Provisions for maintenance of lawns, gardens, and other landscaped areas

Use only organic fertilizer. Dispose of clippings outside of the 100-foot buffer zone to the adjacent wetland.

G. Requirements for storage and use of herbicides, and pesticides

The application of herbicides or pesticides will be done by professional certified contractors.

H. Provisions for operation and management of septic system

Site to be serviced by private on-site sewer.

I. Requirements for handling of pet waste

Pet waste should never be dumped or washed into the local storm drain system. Waste shall be picked up immediately and placed in bags and properly disposed of in the garbage to be collected and taken to a landfill.

J. Provisions for washing of vehicles

Washing of vehicles shall be done in an area away from sensitive areas and drainage inlets, so as to eliminate wash water from being directly discharged to the local storm drain system. Vehicles should be washed in areas where wash water can be held prior to discharging to the sanitary sewer system or in areas where infiltration precludes runoff to storm drains. Avoid using detergents whenever possible.

K. Provisions for solid waste management

1. Waste Management Plan
   a. Recycle materials whenever possible (paper, plaster cardboard, metal cans). Separate containers for material are recommended.
   b. Do not bury waste and debris on site.
   c. Certified haulers will be hired to remove the dumpster container waste as needed. Recycling products will also be removed off site weekly.

L. Snow disposal and plowing plans relative to Wetland Resource Areas

Snow storage is adequate around the site for large storm events. Storage of snow shall not be placed directly near areas adjacent to the proposed infiltration basin.

M. Winter Road Salt and/or Sand Use and Storage restrictions

No sand, salt, or chemicals for de-icing will be stored outside.

N. Street sweeping schedules

Sweeping, the act of cleaning pavement can be done by mechanical sweepers, vacuum sweeper or hand sweeper. The quantity of sand is a direct correlation with the treatment of ice and snow and the types of chemicals and spreaders that are being used on site to manage snow. If a liquid de-icer such as calcium chloride is used as a pretreatment to new events the amount of sand is minimized. Sweeping for this site should be done semi-annually at a minimum. Collecting the

particulate before it enters the catch basins is cheaper and more environmentally friendly than in a catch basin mixing with oils and greases in the surface water runoff in catch basins.

O. Provisions for prevention of illicit discharges to the stormwater management system

The discharge into the stormwater system is not being violated, see attachment for illicit discharges compliance.

P. Training the staff or personnel involved with implementing Long-Term Pollution Prevention Plan

The owner shall develop policies and procedures for containing the illicit spilling of oils, soda, beer, paper and litter. These wastes provide a degrading of the water quality. The placement of signs and trash barrels with lids around the site would contribute to a clean water quality site condition.

Q. List of Emergency contacts for implementing Long-Term Pollution Prevention Plan:

Calrese Properties
c/o Roger Calarese
154 Brookview Road
Franklin, MA 02038
Tel: 508-528-3700

This shall be the contact until such time as the project is sold.

R. Estimated BMP Maintenance Costs

The following prices are estimates of the costs associated with maintenance of the proposed site BMPs. Costs provided are only estimates and may not reflect actual costs to perform the work. Actual costs may vary depending on company/personnel performing the work. Actual costs may increase over time.

BMP	Estimated Maintenance Cost
Pavement sweeping	$ 400 per year
Catch basin cleaning	$ 200 per catch basin per cleaning
Infiltration Basin	$ 200 per cleaning
Spill Containment Kit	$ 750 purchase price

Stormwater Report
Adin Estates
Franklin, MA 02038

Standard 10: All illicit discharges to the stormwater management system are prohibited.

Standard 10 prohibits illicit discharges to stormwater management systems. The stormwater management system is the system for conveying, treating, and infiltrating stormwater on site, including stormwater best management practices and any pipes intended to transport stormwater to the ground water, a surface water, or municipal separate storm sewer system. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated ground water, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents.

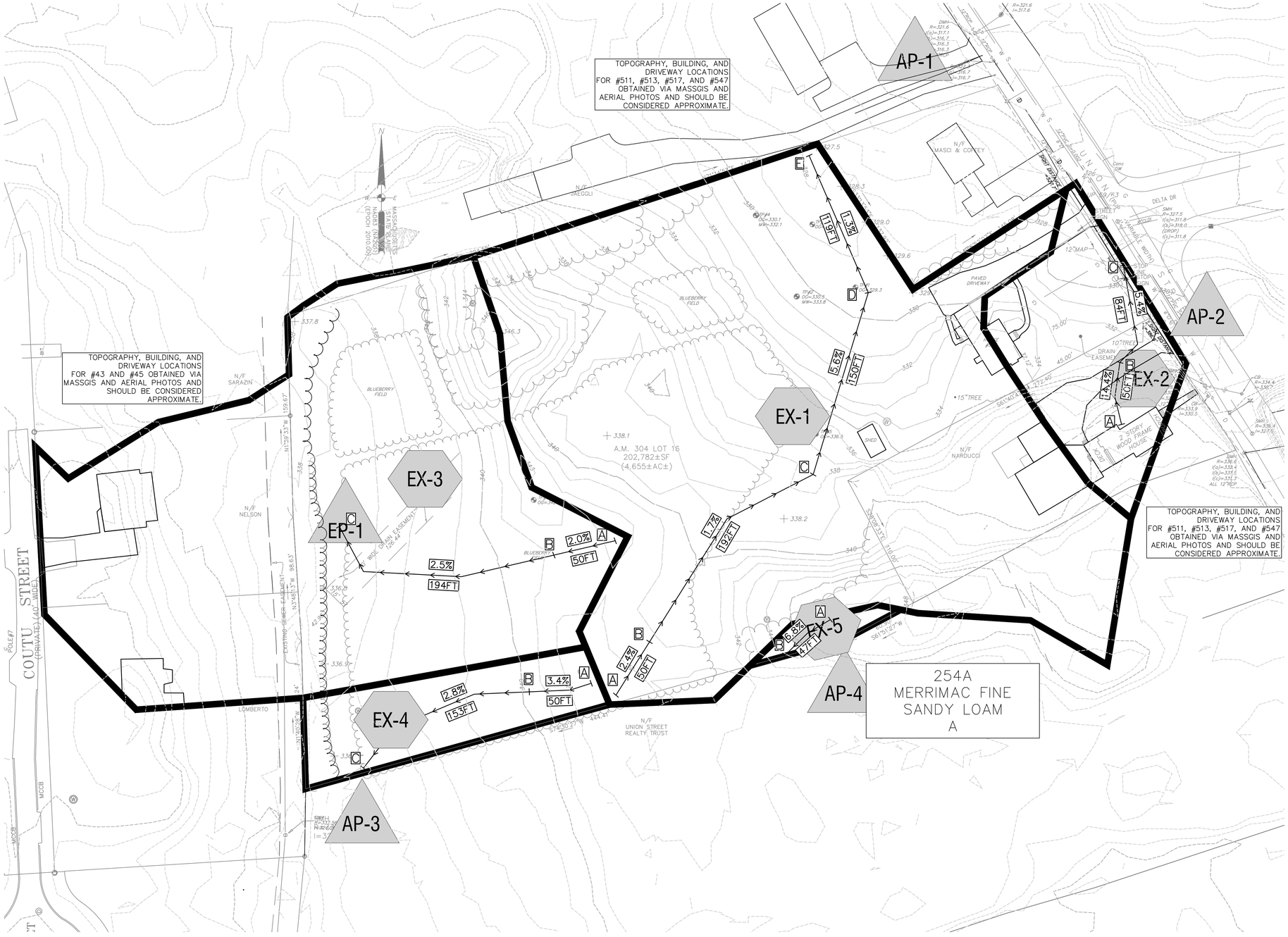
Illicit Discharge Compliance Statement

It is the intent of the Applicant, Calarese Properties c/o Roger Calarese, 154 Brookview Road, Franklin, MA 02038, to prevent illicit discharges to the stormwater management system, including wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease. There will be no connection to the storm water system to inadvertently direct other types of liquids, chemicals or solids into the storm drainage system. The Owner will also promote a clean Green Environment by mitigating spills onto pavements; oils, soda, chemicals, pet waste, debris and litter.

Respectfully Acknowledged,

Roger Calarese

WATERSHED PLANS



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F4683

LEGAL NOTES

UTILITIES ARE PLOTTED AS A COMPILATION OF RECORD DOCUMENTS, MARKINGS AND OTHER OBSERVED EVIDENCE TO DEVELOP A VIEW OF THE UNDERGROUND UTILITIES AND SHOULD BE CONSIDERED APPROXIMATE. LOOKING EXCAVATION, THE EXACT LOCATION OF UNDERGROUND FEATURES CANNOT BE ACCURATELY, COMPLETELY AND RELIABLY DEPICTED. ADDITIONAL UTILITIES, NOT EVIDENCED BY RECORD DOCUMENTS OR OBSERVED PHYSICAL EVIDENCE, MAY EXIST. CONTRACTORS (IN ACCORDANCE WITH MASS.G.L. CHAPTER 82 SECTION 40 AS AMENDED) MUST CONTACT ALL UTILITY COMPANIES BEFORE EXCAVATING AND DRILLING AND CALL DIGSAFE AT 1(888)DIG-SAFE{7233}.

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OWNER

CALARESE PROPERTIES
154 BROOKVIEW ROAD
FRANKLIN, MA 02038

DEED BOOK 0000 PAGE 0
PLAN No. 862 OF 1956 PLAN Bk. 3485
A.M. 304 LOT 16

APPLICANT

CALARESE PROPERTIES
154 BROOKVIEW ROAD
FRANKLIN, MA 02038

ADIN ESTATES
DEFINITIVE SUBDIVISION PLAN OF LAND FRANKLIN MASSACHUSETTS

PRE-DEVELOPMENT WATERSHED PLAN

OCTOBER 28, 2025

DATE	REVISION DESCRIPTION

GRAPHIC SCALE: 1"=40'

0 10 20 30 40 50 75 100 FEET
0 5 10 15 20 30 METERS

Guerriere & Halnon, Inc.
ENGINEERING & LAND SURVEYING
55 WEST CENTRAL ST. PH. (508) 528-3221
FRANKLIN, MA 02038 FX. (508) 528-7921
www.gandhengineering.com

SHEET 1 OF 1

JOB NO. F4719

F4719

TOPOGRAPHY, BUILDING, AND DRIVEWAY LOCATIONS FOR #511, #513, #517, AND #547 OBTAINED VIA MASSGIS AND AERIAL PHOTOS AND SHOULD BE CONSIDERED APPROXIMATE.

TOPOGRAPHY, BUILDING, AND DRIVEWAY LOCATIONS FOR #43 AND #45 OBTAINED VIA MASSGIS AND AERIAL PHOTOS AND SHOULD BE CONSIDERED APPROXIMATE.

TOPOGRAPHY, BUILDING, AND DRIVEWAY LOCATIONS FOR #511, #513, #517, AND #547 OBTAINED VIA MASSGIS AND AERIAL PHOTOS AND SHOULD BE CONSIDERED APPROXIMATE.

AP-1

AP-2

AP-3

AP-4

PR-1

PR-2

PR-3

PR-4

PR-5

PR-6

UNION STREET

DELTA DR

COUTU STREET (PRIVATE) (40' WIDE)

COUTU STREET EXTENSION (PRIVATE)

HUBERT STREET (PRIVATE) (40' WIDE UNIMPROVED)

PROPOSED SWALE MIN. SLOPE=0.75 (SEE DETAIL)

PROPOSED SWALE MIN. SLOPE=1.33% (SEE DETAIL)

9.5%
38FT
1.8%
50FT
A
C
3.0%
151FT

EXISTING SEWER EASEMENT

DRAINAGE EASEMENT AREA=31,599±SF

LOT 5 AREA=28,194±SF (0.647±AC)

LOT 4 AREA=28,008±SF (0.643±AC)

LOT 3 AREA=20,909±SF (0.480±AC)

N/F MASCI & CORTEY

N/F DAEGLI

N/F SARAZIN

N/F NARDUCCI

N/F UNION STREET REALTY TRUST

LOMBERTO

BENCHMARK TOP OF STAKE ELEVATION=336.16 (NAVD88)

BENCHMARK TOP OF CONCRETE BOUND/IRON ELEVATION=329.07 (NAVD88)

254A
MERRIMAC FINE
SANDY LOAM
A

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154 BROOKVIEW ROAD
FRANKLIN, MA 02038

ADIN ESTATES
DEFINITIVE SUBDIVISION PLAN OF LAND
FRANKLIN
MASSACHUSETTS

POST-DEVELOPMENT WATERSHED PLAN

OCTOBER 28, 2025

DATE	REVISION DESCRIPTION

GRAPHIC SCALE: 1"=40'

0 10 20 30 40 50 75 100 FEET
0 5 10 15 20 30 METERS

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SHEET 1 OF 1

JOB NO. F4719

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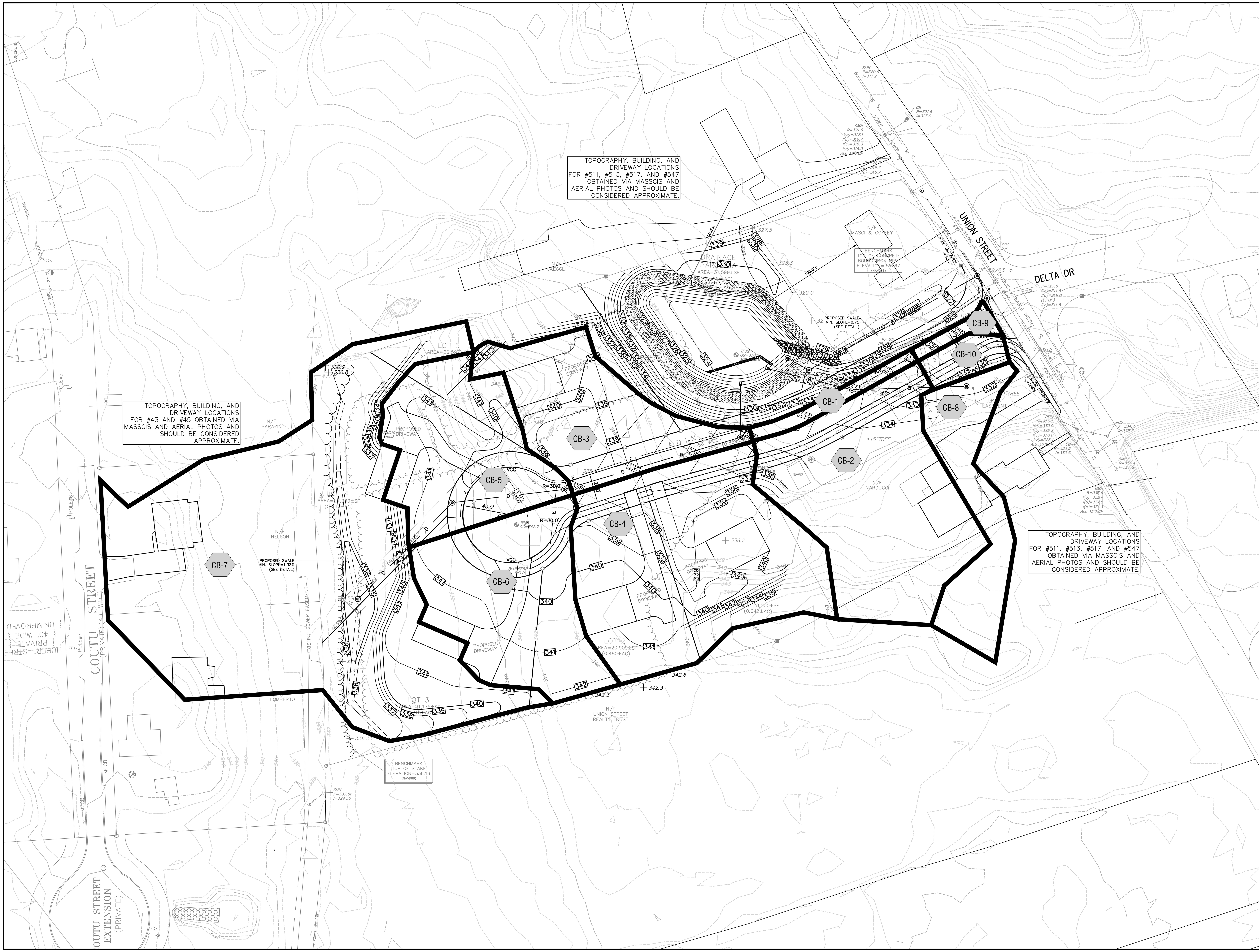
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CB-1
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CB-3
CB-4
CB-5
CB-6
CB-7
CB-8
CB-9
CB-10
DRAINAGE PARCEL
AREA=31,599±SF
LOT 5
LOT 3
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PROPOSED DRIVEWAY
PROPOSED SWALE MIN. SLOPE=0.75 (SEE DETAIL)
PROPOSED SWALE MIN. SLOPE=1.33% (SEE DETAIL)
N/F JAEGGLI
N/F MASCI & COFFEY
N/F SARAZIN
N/F NELSON
N/F NARDUCCI
N/F UNION STREET REALTY TRUST
LOMBERTO
BENCHMARK TOP OF STAKE ELEVATION=336.16
EXISTING SEWER EASEMENT
R=30.0'
45.0'
VGC
342.3
342.6

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A.M. 304 LOT 16

APPLICANT

CALARESE PROPERTIES
154 BROOKVIEW ROAD
FRANKLIN, MA 02038

ADIN ESTATES DEFINITIVE SUBDIVISION PLAN OF LAND FRANKLIN MASSACHUSETTS

CATCH BASIN SUBCATCHMENT WATERSHED PLAN

OCTOBER 28, 2025

DATE	REVISION DESCRIPTION

GRAPHIC SCALE: 1"=40'

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SHEET 1 OF 1

JOB NO. F4719

F4719

PRE-DEVELOPMENT HYDROCAD CALCULATIONS

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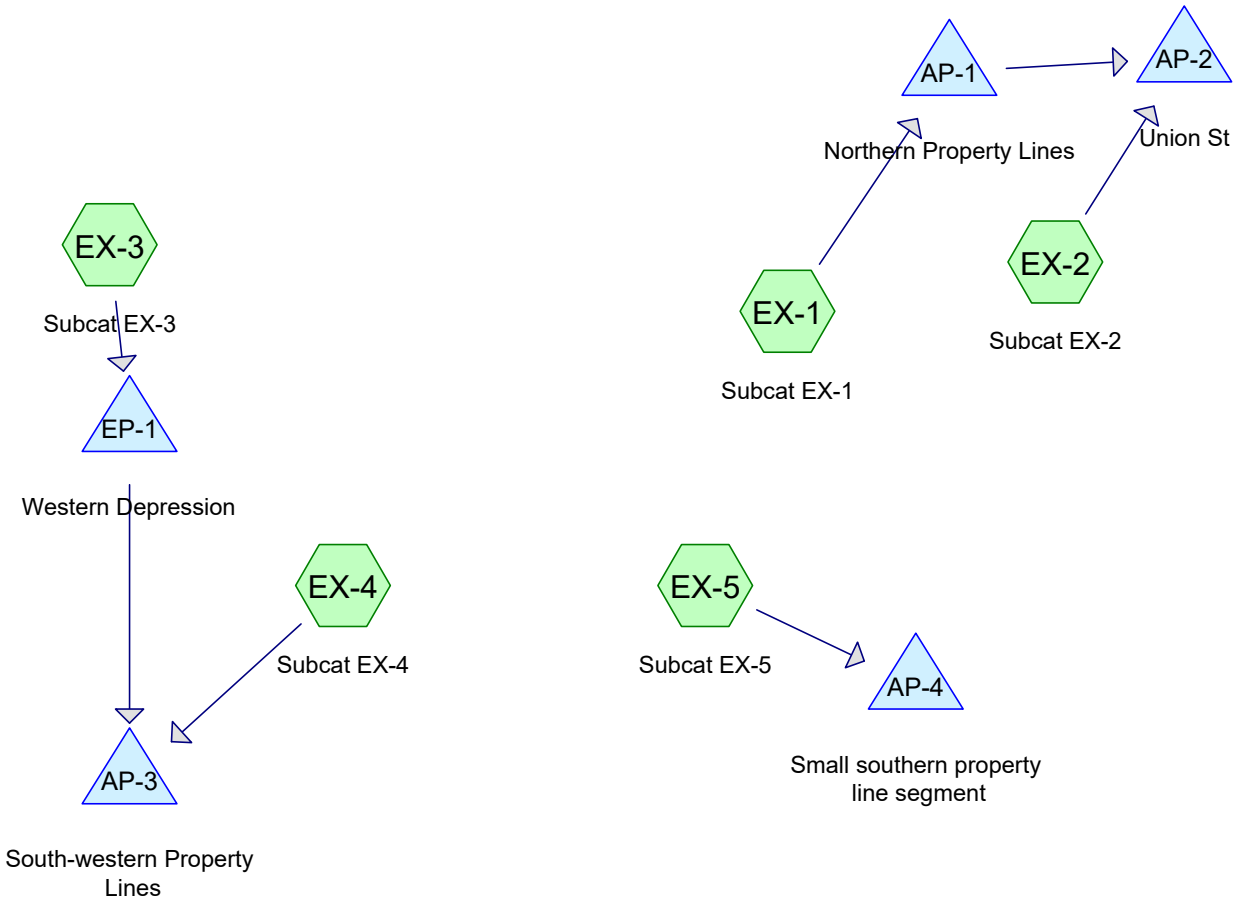


Subcat Reach Pond Link

Routing Diagram for F4719 543 Union St (PRE)
Prepared by Guerriere & Halnon Inc, Printed 10/29/2025

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NOAA10 24-hr	D	Default	24.00	1	3.36	2
2	10-Year	NOAA10 24-hr	D	Default	24.00	1	5.22	2
3	25-Year	NOAA10 24-hr	D	Default	24.00	1	6.37	2
4	100-Year	NOAA10 24-hr	D	Default	24.00	1	8.16	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.181	54	1/2 acre lots, 25% imp, HSG A (EX-1, EX-2)
1.833	39	>75% Grass cover, Good, HSG A (EX-1, EX-2, EX-3)
0.181	98	Paved parking, HSG A (EX-1, EX-2, EX-3)
0.168	98	Roofs, HSG A (EX-1, EX-2, EX-3)
1.452	30	Woods, Good, HSG A (EX-1, EX-3, EX-4, EX-5)
2.778	32	Woods/grass comb., Good, HSG A (EX-1, EX-2, EX-3, EX-4, EX-5)
6.593	**38**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
6.593	HSG A	EX-1, EX-2, EX-3, EX-4, EX-5
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
6.593		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.181	0.000	0.000	0.000	0.000	0.181	1/2 acre lots, 25% imp	EX-1, EX-2
1.833	0.000	0.000	0.000	0.000	1.833	>75% Grass cover, Good	EX-1, EX-2, EX-3
0.181	0.000	0.000	0.000	0.000	0.181	Paved parking	EX-1, EX-2, EX-3
0.168	0.000	0.000	0.000	0.000	0.168	Roofs	EX-1, EX-2, EX-3
1.452	0.000	0.000	0.000	0.000	1.452	Woods, Good	EX-1, EX-3, EX-4, EX-5
2.778	0.000	0.000	0.000	0.000	2.778	Woods/grass comb., Good	EX-1, EX-2, EX-3, EX-4, EX-5
6.593	**0.000**	**0.000**	**0.000**	**0.000**	**6.593**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: Subcat EX-1 Runoff Area=3.312 ac 4.09% Impervious Runoff Depth=0.00"
Flow Length=511' Tc=14.9 min CN=37 Runoff=0.00 cfs 0.000 af

Subcatchment EX-2: Subcat EX-2 Runoff Area=21,803 sf 28.49% Impervious Runoff Depth=0.33"
Flow Length=134' Tc=6.0 min CN=56 Runoff=0.09 cfs 0.014 af

Subcatchment EX-3: Subcat EX-3 Runoff Area=104,941 sf 4.86% Impervious Runoff Depth=0.00"
Flow Length=244' Tc=10.9 min CN=36 Runoff=0.00 cfs 0.000 af

Subcatchment EX-4: Subcat EX-4 Runoff Area=14,262 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=239' Tc=10.7 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment EX-5: Subcat EX-5 Runoff Area=1,912 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=203' Tc=8.7 min CN=30 Runoff=0.00 cfs 0.000 af

Pond AP-1: Northern Property Lines Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Pond AP-2: Union St Inflow=0.09 cfs 0.014 af
Primary=0.09 cfs 0.014 af

Pond AP-3: South-western Property Lines Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Pond AP-4: Small southern property line segment Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Pond EP-1: Western Depression Peak Elev=336.20' Storage=0 cf Inflow=0.00 cfs 0.000 af
Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

Total Runoff Area = 6.593 ac Runoff Volume = 0.014 af Average Runoff Depth = 0.03"
94.01% Pervious = 6.198 ac 5.99% Impervious = 0.395 ac

Summary for Subcatchment EX-1: Subcat EX-1

[45] Hint: Runoff=Zero

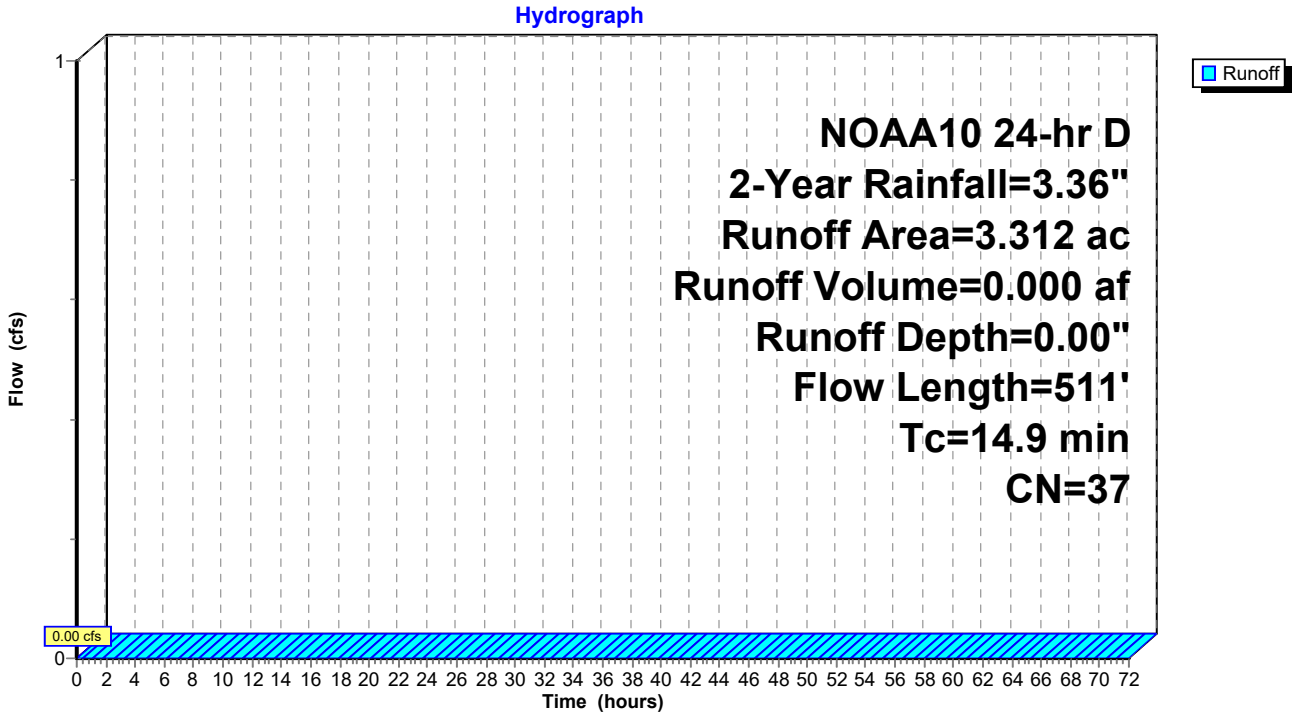
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Pond AP-1 : Northern Property Lines

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.36"

Area (ac)	CN	Description
0.000	32	Woods/grass comb., Good, HSG A
0.000	32	Woods/grass comb., Good, HSG A
1.290	32	Woods/grass comb., Good, HSG A
0.001	32	Woods/grass comb., Good, HSG A
0.000	32	Woods/grass comb., Good, HSG A
0.000	32	Woods/grass comb., Good, HSG A
0.039	32	Woods/grass comb., Good, HSG A
0.273	30	Woods, Good, HSG A
0.488	30	Woods, Good, HSG A
0.138	39	>75% Grass cover, Good, HSG A
0.818	39	>75% Grass cover, Good, HSG A
0.174	54	1/2 acre lots, 25% imp, HSG A
0.052	98	Paved parking, HSG A
0.014	98	Roofs, HSG A
0.007	98	Roofs, HSG A
0.019	98	Roofs, HSG A
3.312	37	Weighted Average
3.177		95.91% Pervious Area
0.135		4.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0240	0.11		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
3.5	192	0.0170	0.91		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
1.5	150	0.0560	1.66		**Shallow Concentrated Flow, C-->D** Short Grass Pasture Kv= 7.0 fps
2.5	119	0.0130	0.80		**Shallow Concentrated Flow, D-->E** Short Grass Pasture Kv= 7.0 fps
14.9	511	Total			

Subcatchment EX-1: Subcat EX-1



Summary for Subcatchment EX-2: Subcat EX-2

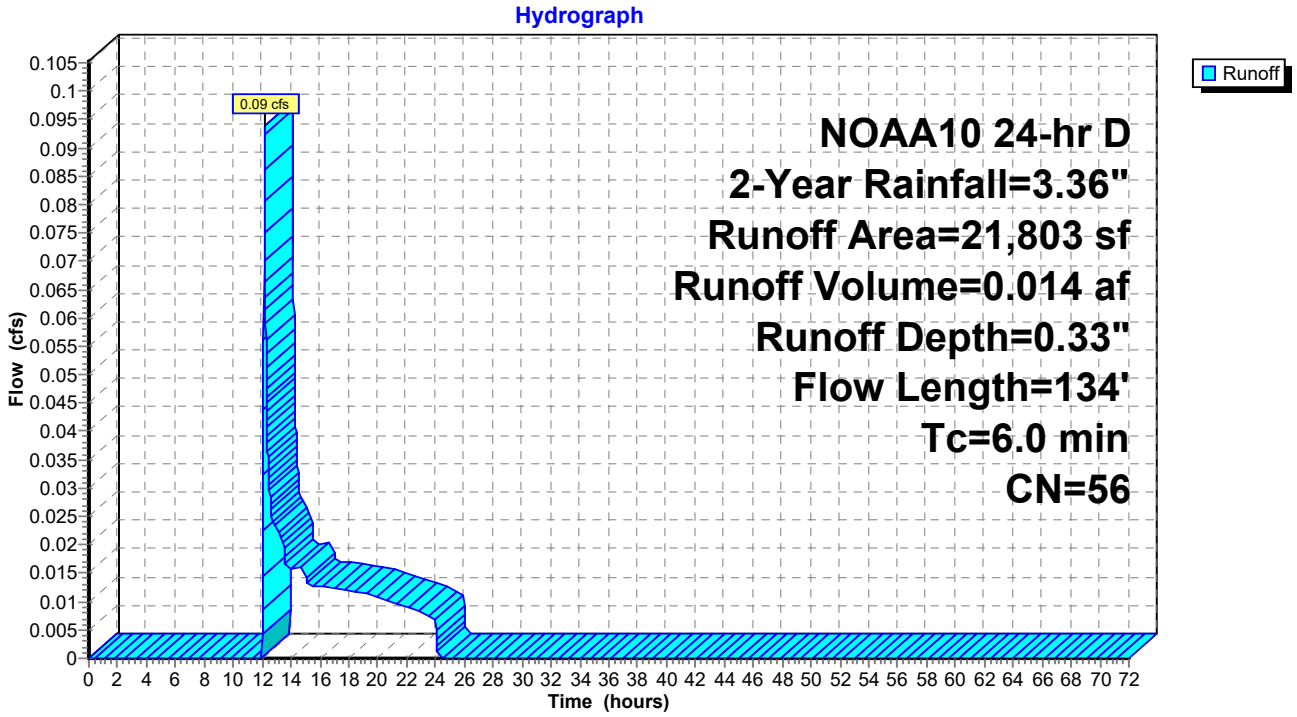
Runoff = 0.09 cfs @ 12.16 hrs, Volume= 0.014 af, Depth= 0.33"
Routed to Pond AP-2 : Union St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.36"

Area (sf)	CN	Description
64	32	Woods/grass comb., Good, HSG A
481	32	Woods/grass comb., Good, HSG A
0	32	Woods/grass comb., Good, HSG A
2,851	39	>75% Grass cover, Good, HSG A
332	54	1/2 acre lots, 25% imp, HSG A
2,384	98	Paved parking, HSG A
680	98	Paved parking, HSG A
104	98	Paved parking, HSG A
39	98	Roofs, HSG A
1,584	98	Roofs, HSG A
513	98	Roofs, HSG A
577	98	Paved parking, HSG A
248	98	Paved parking, HSG A
943	39	>75% Grass cover, Good, HSG A
299	39	>75% Grass cover, Good, HSG A
7,676	39	>75% Grass cover, Good, HSG A
1,019	39	>75% Grass cover, Good, HSG A
2,009	39	>75% Grass cover, Good, HSG A
21,803	56	Weighted Average
15,592		71.51% Pervious Area
6,211		28.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.1440	0.23		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
0.3	84	0.5400	5.14		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
2.1					**Direct Entry, ADDED TO GET TO 6MIN**
6.0	134	Total			

Subcatchment EX-2: Subcat EX-2



Summary for Subcatchment EX-3: Subcat EX-3

[45] Hint: Runoff=Zero

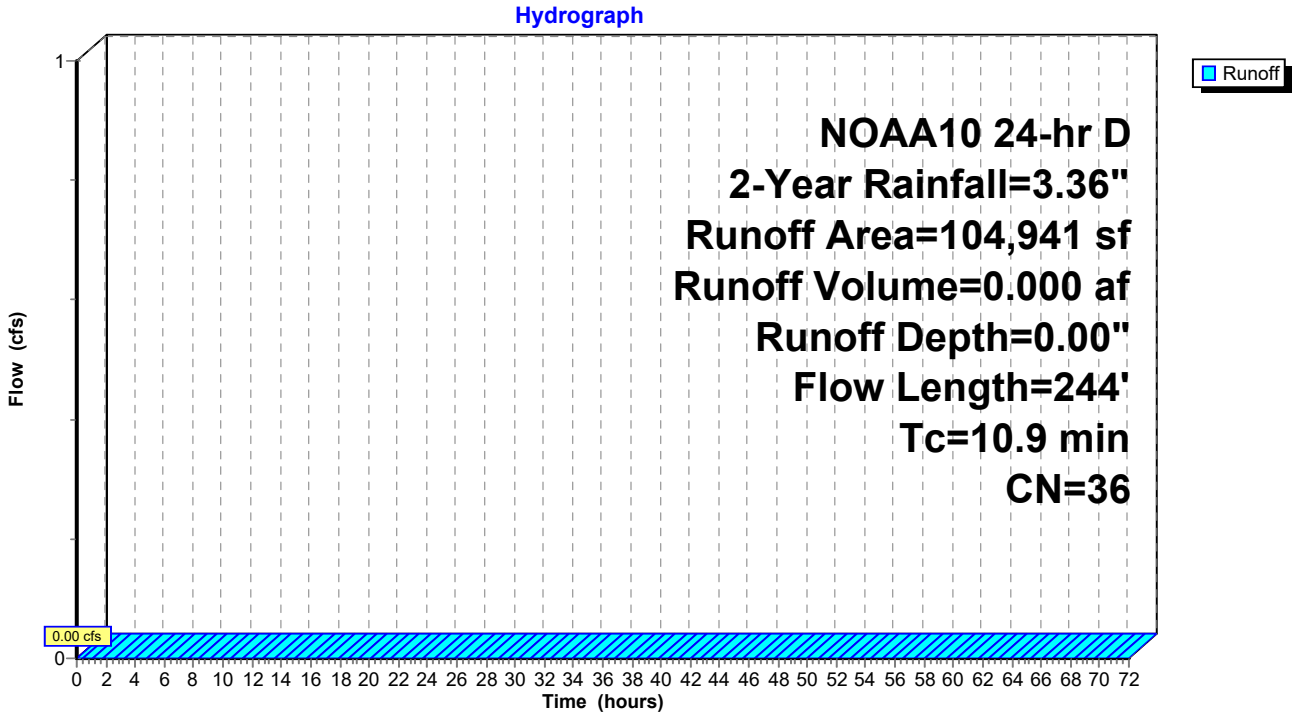
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Pond EP-1 : Western Depression

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.36"

Area (sf)	CN	Description
179	32	Woods/grass comb., Good, HSG A
458	32	Woods/grass comb., Good, HSG A
48,794	32	Woods/grass comb., Good, HSG A
16,635	30	Woods, Good, HSG A
5,110	30	Woods, Good, HSG A
20,101	39	>75% Grass cover, Good, HSG A
3,312	39	>75% Grass cover, Good, HSG A
1,654	98	Paved parking, HSG A
1,923	98	Roofs, HSG A
1,519	98	Roofs, HSG A
5,257	30	Woods, Good, HSG A
104,941	36	Weighted Average
99,845		95.14% Pervious Area
5,096		4.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	50	0.0200	0.10		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
2.9	194	0.0250	1.11		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
10.9	244	Total			

Subcatchment EX-3: Subcat EX-3



Summary for Subcatchment EX-4: Subcat EX-4

[45] Hint: Runoff=Zero

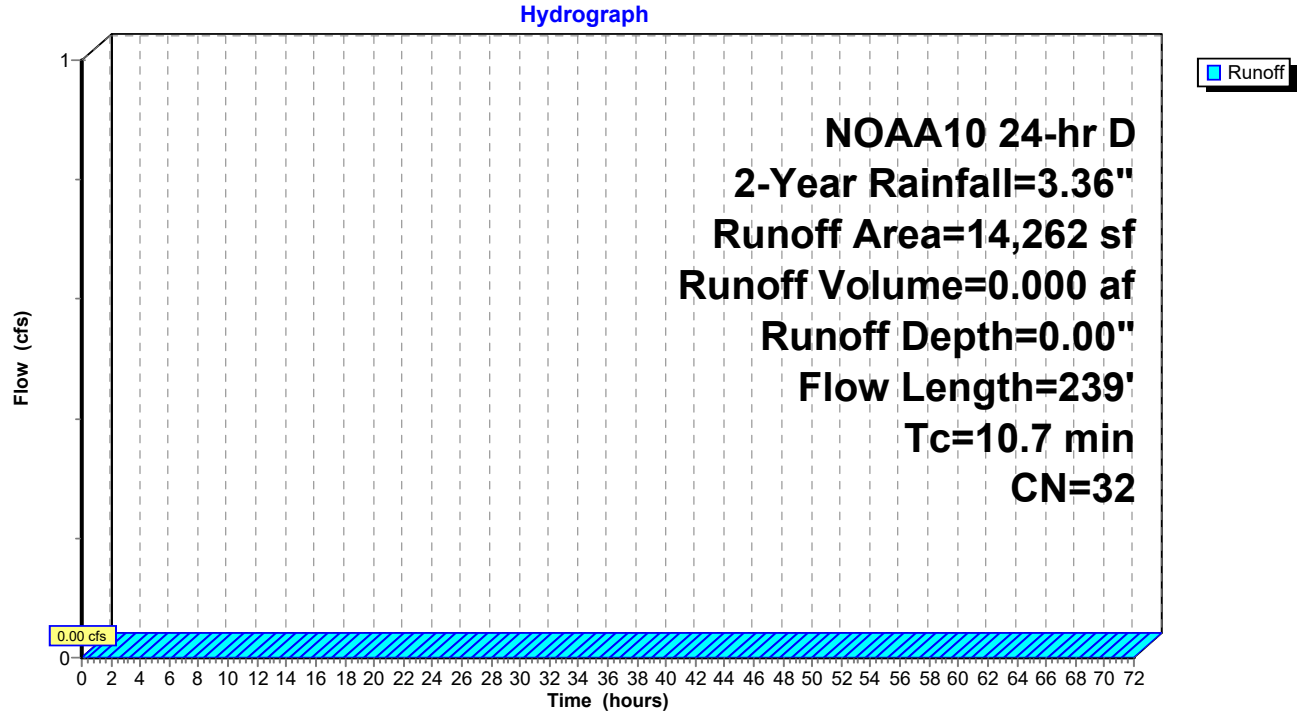
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Pond AP-3 : South-western Property Lines

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.36"

Area (sf)	CN	Description
1,208	30	Woods, Good, HSG A
13,054	32	Woods/grass comb., Good, HSG A
14,262	32	Weighted Average
14,262		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0180	0.10		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
0.3	38	0.0950	2.16		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
2.1	151	0.0300	1.21		**Shallow Concentrated Flow, C-->D** Short Grass Pasture Kv= 7.0 fps
10.7	239	Total			

Subcatchment EX-4: Subcat EX-4



Summary for Subcatchment EX-5: Subcat EX-5

[45] Hint: Runoff=Zero

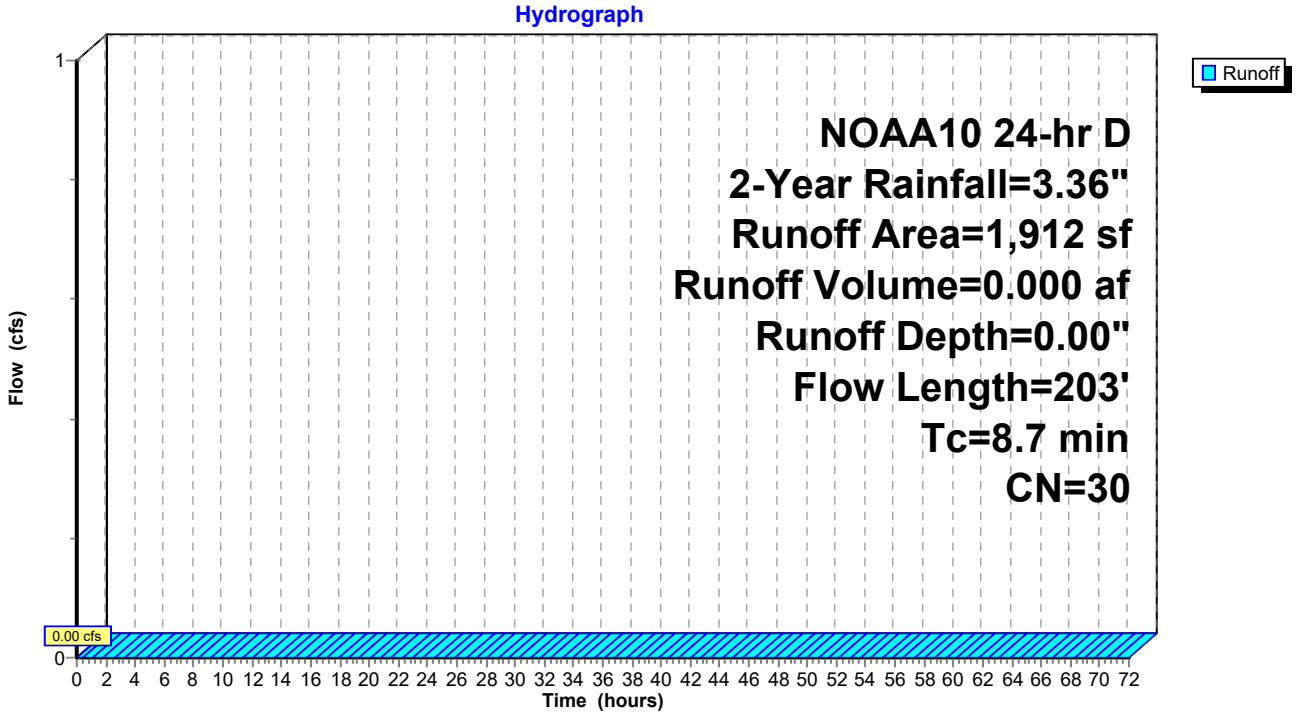
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Pond AP-4 : Small southern property line segment

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.36"

Area (sf)	CN	Description
1,900	30	Woods, Good, HSG A
11	32	Woods/grass comb., Good, HSG A
1,912	30	Weighted Average
1,912		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	50	0.0340	0.13		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
2.2	153	0.0280	1.17		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
8.7	203	Total			

Subcatchment EX-5: Subcat EX-5



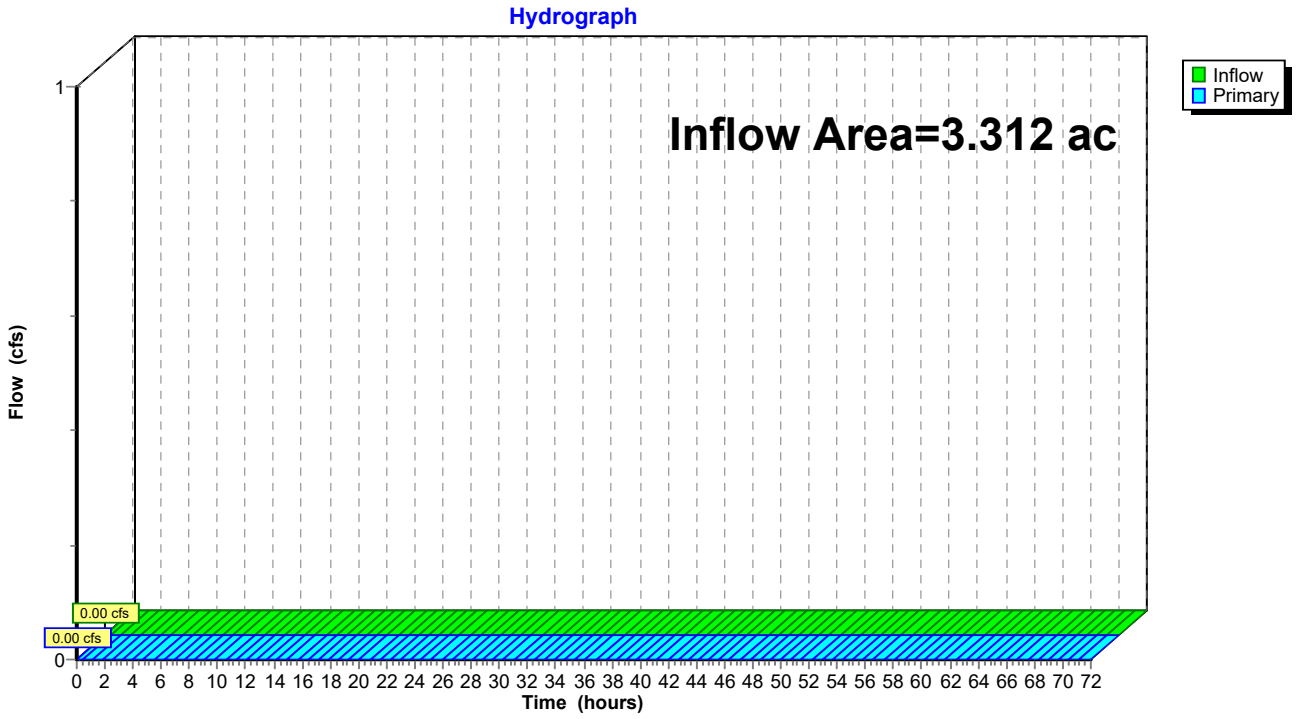
Summary for Pond AP-1: Northern Property Lines

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.312 ac, 4.09% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Routed to Pond AP-2 : Union St

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-1: Northern Property Lines



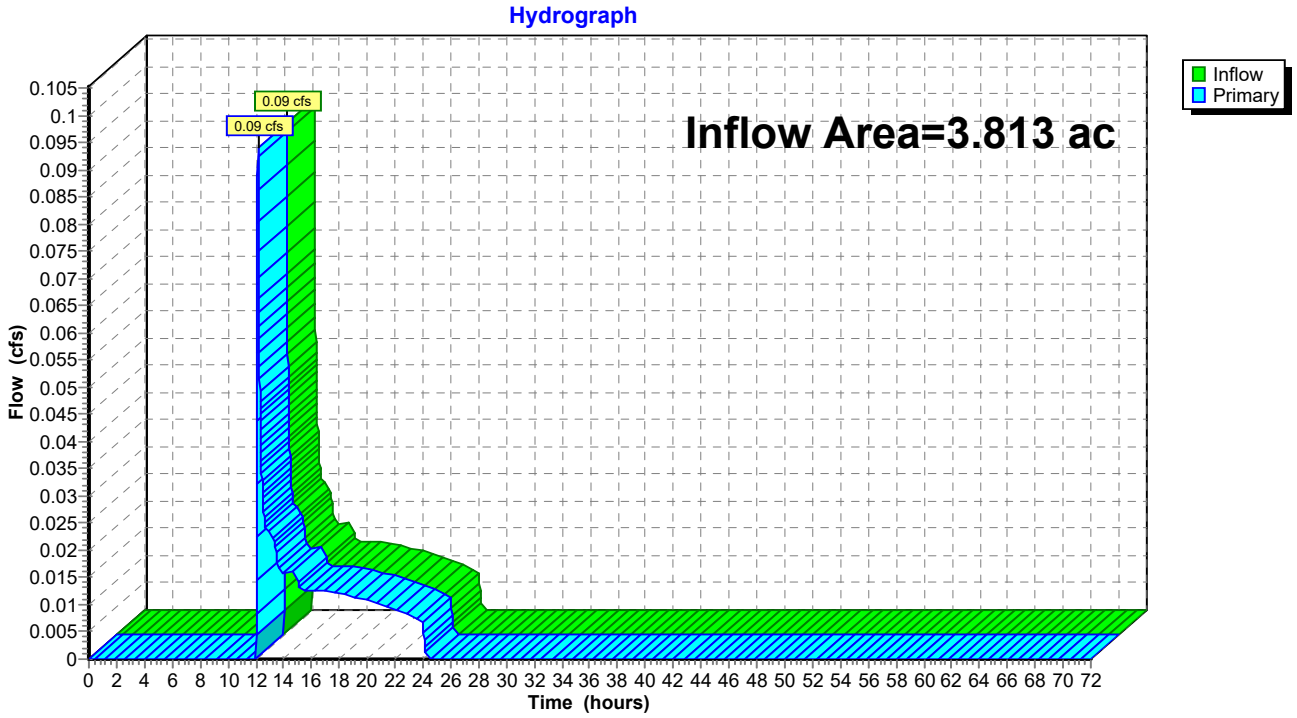
Summary for Pond AP-2: Union St

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.813 ac, 7.29% Impervious, Inflow Depth = 0.04" for 2-Year event
Inflow = 0.09 cfs @ 12.16 hrs, Volume= 0.014 af
Primary = 0.09 cfs @ 12.16 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-2: Union St



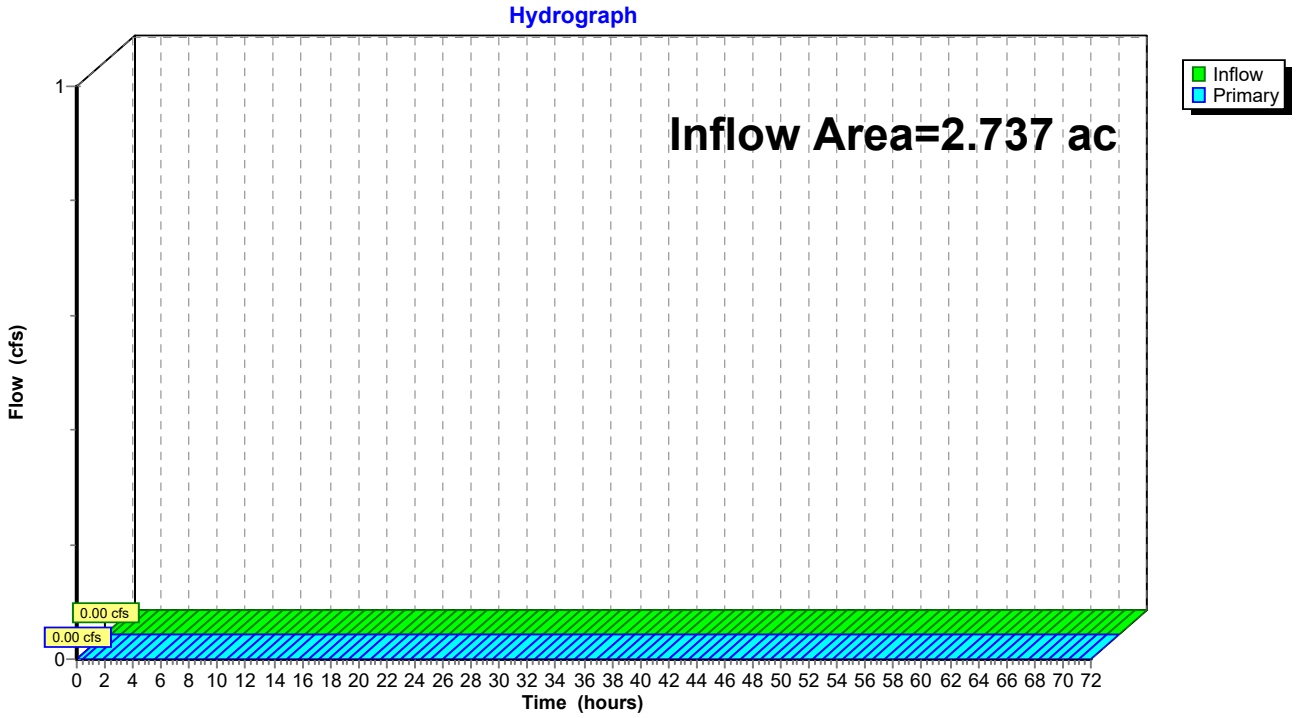
Summary for Pond AP-3: South-western Property Lines

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.737 ac, 4.28% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-3: South-western Property Lines



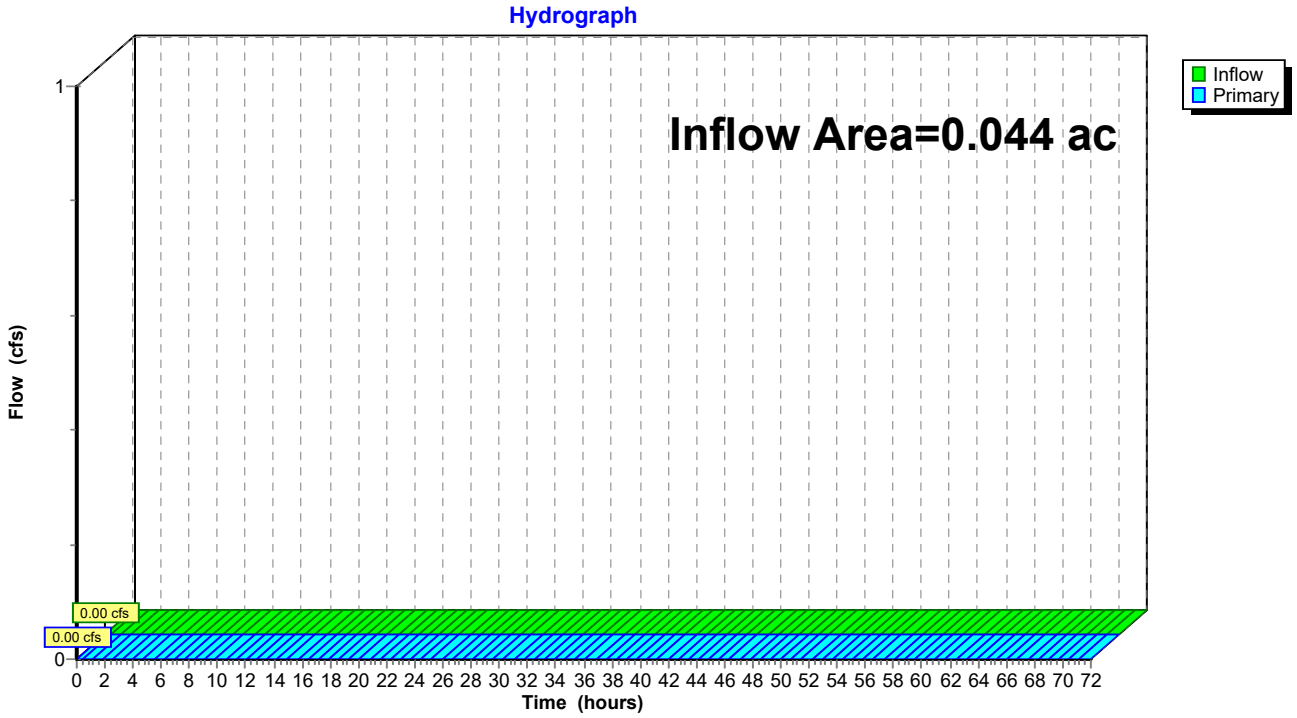
Summary for Pond AP-4: Small southern property line segment

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.044 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-4: Small southern property line segment



Summary for Pond EP-1: Western Depression

[92] Warning: Device #1 is above defined storage

Inflow Area = 2.409 ac, 4.86% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond AP-3 : South-western Property Lines

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 336.20' @ 0.00 hrs Surf.Area= 269 sf Storage= 0 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	336.20'	4,959 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

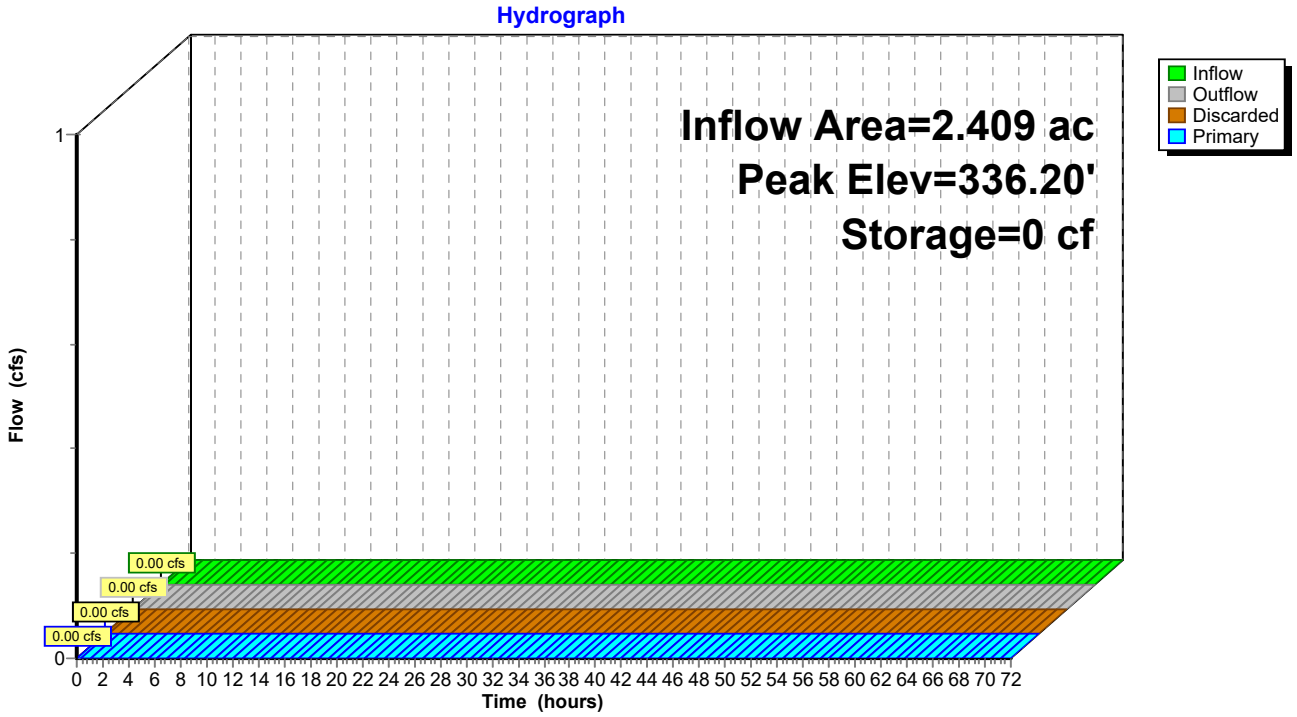
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
336.20	269	0	0
337.00	12,128	4,959	4,959

Device	Routing	Invert	Outlet Devices
#1	Primary	337.00'	**27.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	336.20'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=336.20' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=336.20' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond EP-1: Western Depression



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: Subcat EX-1 Runoff Area=3.312 ac 4.09% Impervious Runoff Depth=0.17"
Flow Length=511' Tc=14.9 min CN=37 Runoff=0.06 cfs 0.048 af

Subcatchment EX-2: Subcat EX-2 Runoff Area=21,803 sf 28.49% Impervious Runoff Depth=1.16"
Flow Length=134' Tc=6.0 min CN=56 Runoff=0.65 cfs 0.048 af

Subcatchment EX-3: Subcat EX-3 Runoff Area=104,941 sf 4.86% Impervious Runoff Depth=0.14"
Flow Length=244' Tc=10.9 min CN=36 Runoff=0.04 cfs 0.029 af

Subcatchment EX-4: Subcat EX-4 Runoff Area=14,262 sf 0.00% Impervious Runoff Depth=0.04"
Flow Length=239' Tc=10.7 min CN=32 Runoff=0.00 cfs 0.001 af

Subcatchment EX-5: Subcat EX-5 Runoff Area=1,912 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=203' Tc=8.7 min CN=30 Runoff=0.00 cfs 0.000 af

Pond AP-1: Northern Property Lines Inflow=0.06 cfs 0.048 af
Primary=0.06 cfs 0.048 af

Pond AP-2: Union St Inflow=0.65 cfs 0.096 af
Primary=0.65 cfs 0.096 af

Pond AP-3: South-western Property Lines Inflow=0.00 cfs 0.001 af
Primary=0.00 cfs 0.001 af

Pond AP-4: Small southern property line segment Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Pond EP-1: Western Depression Peak Elev=336.23' Storage=12 cf Inflow=0.04 cfs 0.029 af
Discarded=0.04 cfs 0.029 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.029 af

Total Runoff Area = 6.593 ac Runoff Volume = 0.126 af Average Runoff Depth = 0.23"
94.01% Pervious = 6.198 ac 5.99% Impervious = 0.395 ac

Summary for Subcatchment EX-1: Subcat EX-1

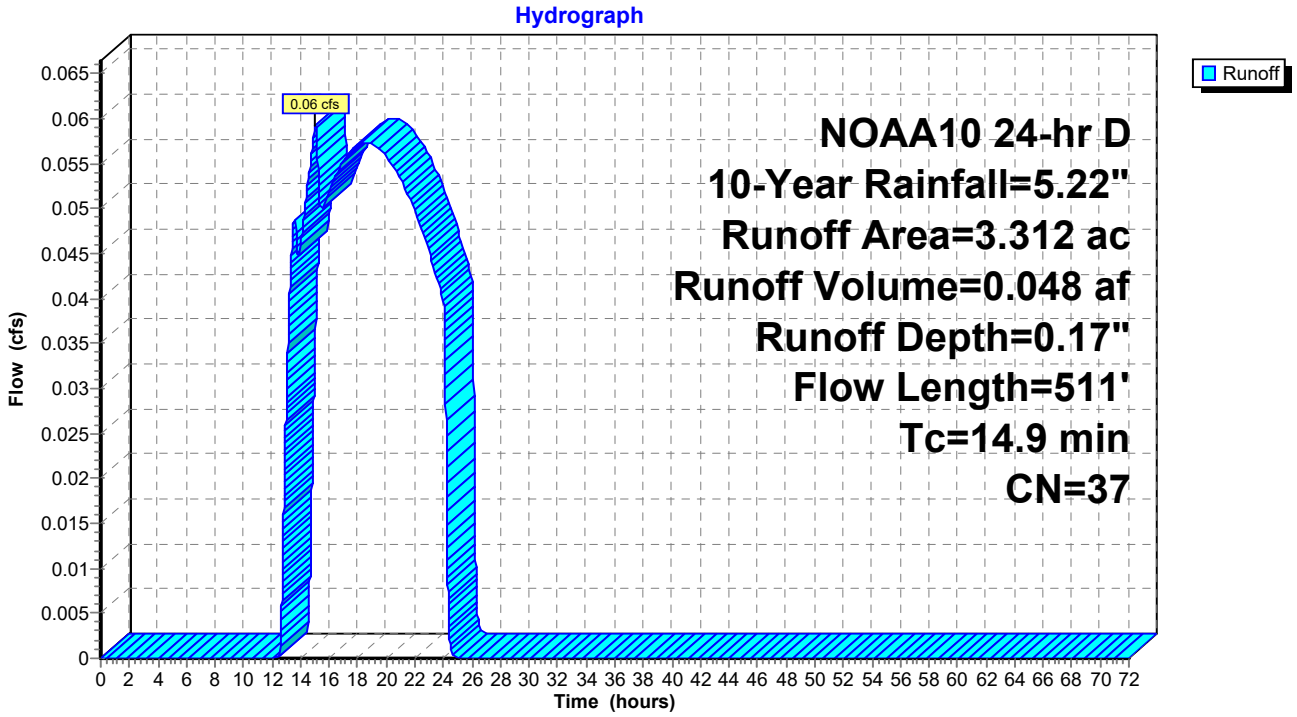
Runoff = 0.06 cfs @ 15.05 hrs, Volume= 0.048 af, Depth= 0.17"
Routed to Pond AP-1 : Northern Property Lines

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.22"

Area (ac)	CN	Description
0.000	32	Woods/grass comb., Good, HSG A
0.000	32	Woods/grass comb., Good, HSG A
1.290	32	Woods/grass comb., Good, HSG A
0.001	32	Woods/grass comb., Good, HSG A
0.000	32	Woods/grass comb., Good, HSG A
0.000	32	Woods/grass comb., Good, HSG A
0.039	32	Woods/grass comb., Good, HSG A
0.273	30	Woods, Good, HSG A
0.488	30	Woods, Good, HSG A
0.138	39	>75% Grass cover, Good, HSG A
0.818	39	>75% Grass cover, Good, HSG A
0.174	54	1/2 acre lots, 25% imp, HSG A
0.052	98	Paved parking, HSG A
0.014	98	Roofs, HSG A
0.007	98	Roofs, HSG A
0.019	98	Roofs, HSG A
3.312	37	Weighted Average
3.177		95.91% Pervious Area
0.135		4.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0240	0.11		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
3.5	192	0.0170	0.91		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
1.5	150	0.0560	1.66		**Shallow Concentrated Flow, C-->D** Short Grass Pasture Kv= 7.0 fps
2.5	119	0.0130	0.80		**Shallow Concentrated Flow, D-->E** Short Grass Pasture Kv= 7.0 fps
14.9	511	Total			

Subcatchment EX-1: Subcat EX-1



Summary for Subcatchment EX-2: Subcat EX-2

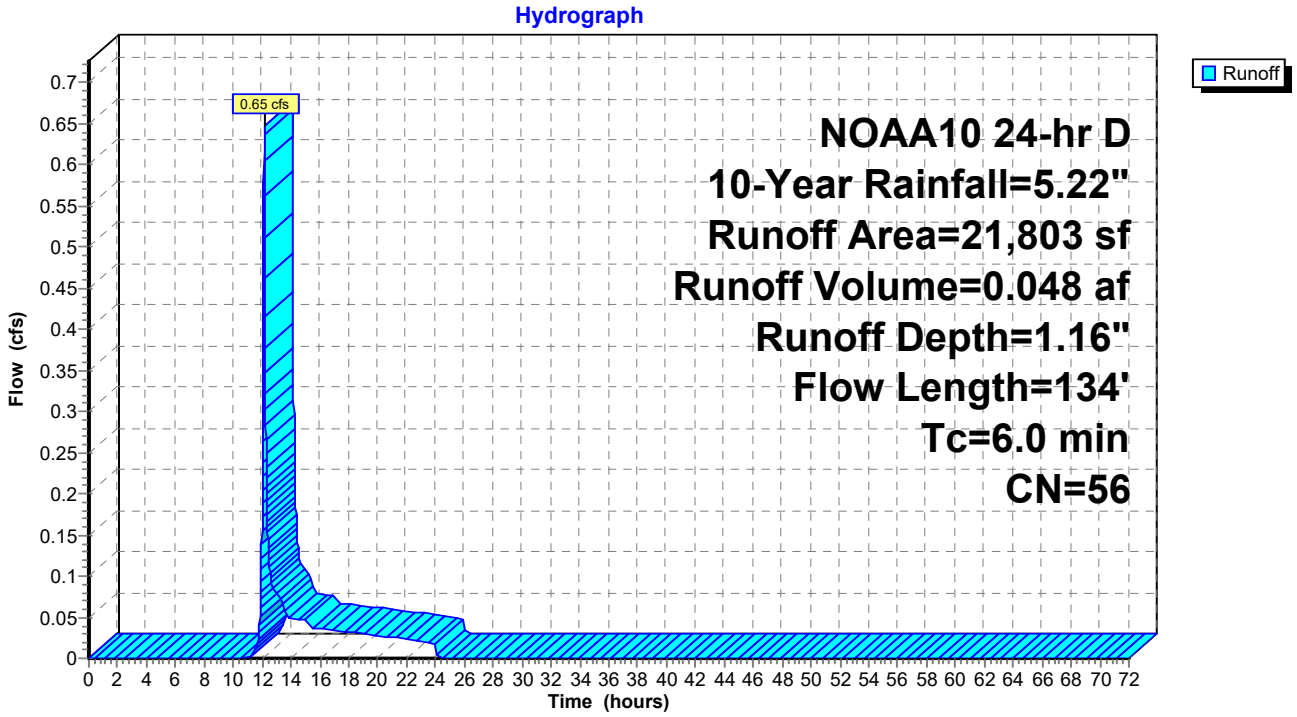
Runoff = 0.65 cfs @ 12.14 hrs, Volume= 0.048 af, Depth= 1.16"
Routed to Pond AP-2 : Union St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.22"

Area (sf)	CN	Description
64	32	Woods/grass comb., Good, HSG A
481	32	Woods/grass comb., Good, HSG A
0	32	Woods/grass comb., Good, HSG A
2,851	39	>75% Grass cover, Good, HSG A
332	54	1/2 acre lots, 25% imp, HSG A
2,384	98	Paved parking, HSG A
680	98	Paved parking, HSG A
104	98	Paved parking, HSG A
39	98	Roofs, HSG A
1,584	98	Roofs, HSG A
513	98	Roofs, HSG A
577	98	Paved parking, HSG A
248	98	Paved parking, HSG A
943	39	>75% Grass cover, Good, HSG A
299	39	>75% Grass cover, Good, HSG A
7,676	39	>75% Grass cover, Good, HSG A
1,019	39	>75% Grass cover, Good, HSG A
2,009	39	>75% Grass cover, Good, HSG A
21,803	56	Weighted Average
15,592		71.51% Pervious Area
6,211		28.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.1440	0.23		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
0.3	84	0.5400	5.14		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
2.1					**Direct Entry, ADDED TO GET TO 6MIN**
6.0	134	Total			

Subcatchment EX-2: Subcat EX-2



Summary for Subcatchment EX-3: Subcat EX-3

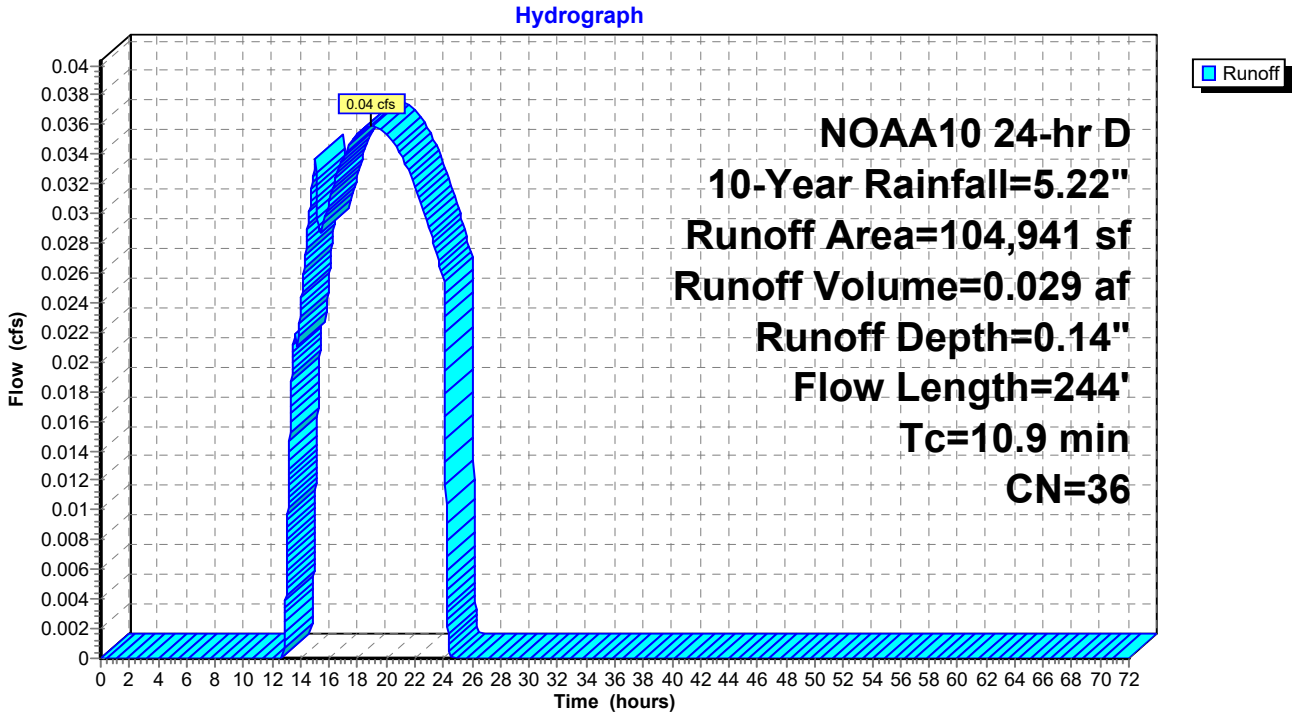
Runoff = 0.04 cfs @ 18.98 hrs, Volume= 0.029 af, Depth= 0.14"
Routed to Pond EP-1 : Western Depression

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.22"

Area (sf)	CN	Description
179	32	Woods/grass comb., Good, HSG A
458	32	Woods/grass comb., Good, HSG A
48,794	32	Woods/grass comb., Good, HSG A
16,635	30	Woods, Good, HSG A
5,110	30	Woods, Good, HSG A
20,101	39	>75% Grass cover, Good, HSG A
3,312	39	>75% Grass cover, Good, HSG A
1,654	98	Paved parking, HSG A
1,923	98	Roofs, HSG A
1,519	98	Roofs, HSG A
5,257	30	Woods, Good, HSG A
104,941	36	Weighted Average
99,845		95.14% Pervious Area
5,096		4.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	50	0.0200	0.10		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
2.9	194	0.0250	1.11		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
10.9	244	Total			

Subcatchment EX-3: Subcat EX-3



Summary for Subcatchment EX-4: Subcat EX-4

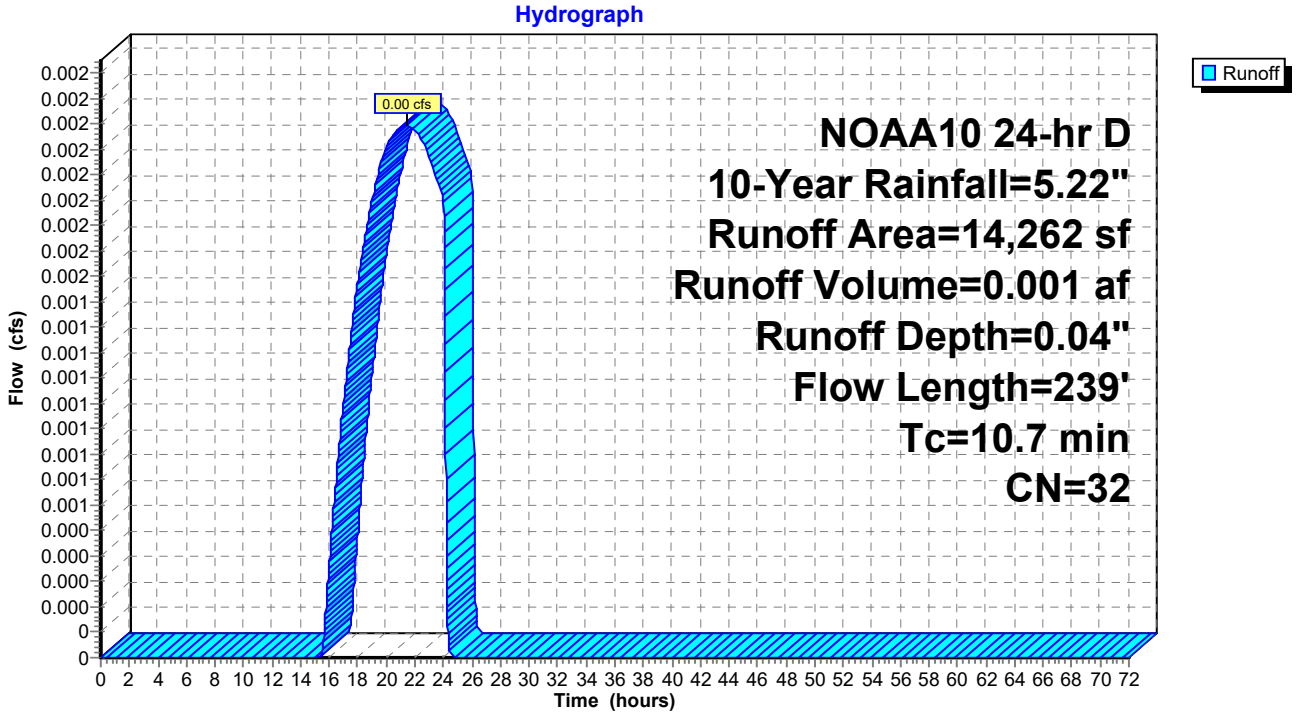
Runoff = 0.00 cfs @ 21.39 hrs, Volume= 0.001 af, Depth= 0.04"
Routed to Pond AP-3 : South-western Property Lines

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.22"

Area (sf)	CN	Description
1,208	30	Woods, Good, HSG A
13,054	32	Woods/grass comb., Good, HSG A
14,262	32	Weighted Average
14,262		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0180	0.10		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
0.3	38	0.0950	2.16		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
2.1	151	0.0300	1.21		**Shallow Concentrated Flow, C-->D** Short Grass Pasture Kv= 7.0 fps
10.7	239	Total			

Subcatchment EX-4: Subcat EX-4



Summary for Subcatchment EX-5: Subcat EX-5

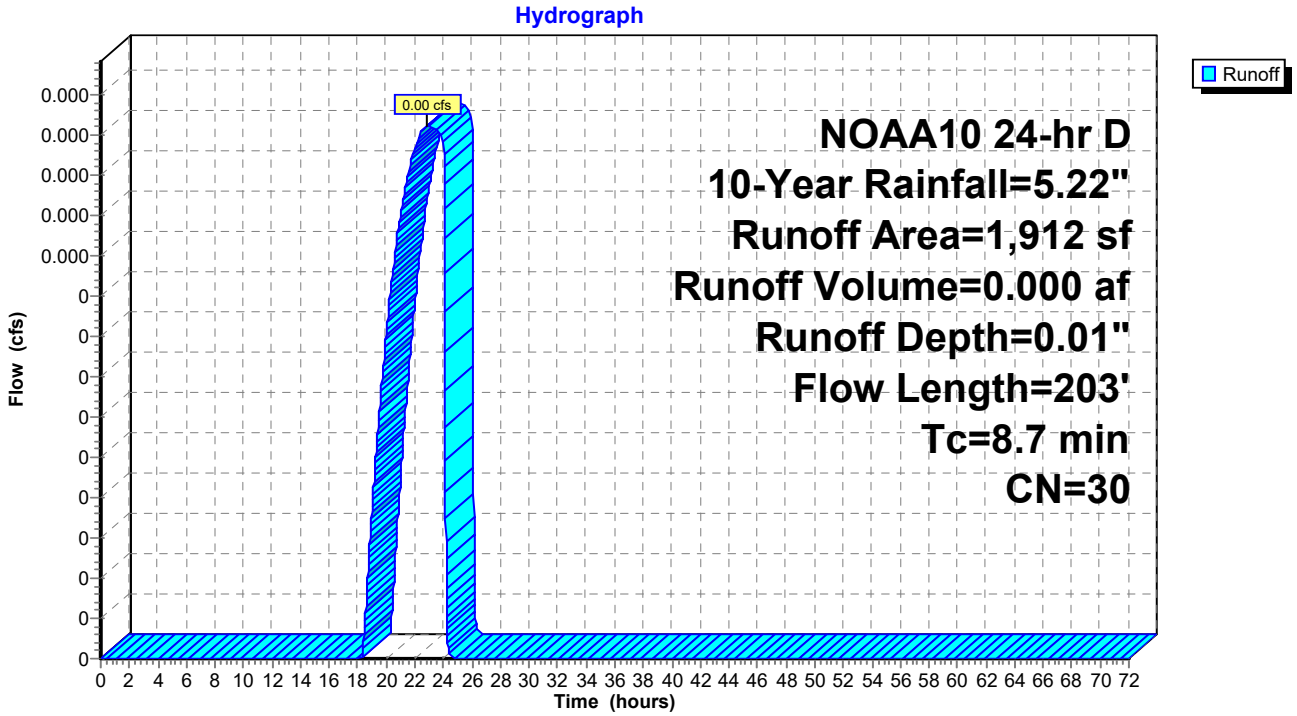
Runoff = 0.00 cfs @ 22.88 hrs, Volume= 0.000 af, Depth= 0.01"
Routed to Pond AP-4 : Small southern property line segment

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.22"

Area (sf)	CN	Description
1,900	30	Woods, Good, HSG A
11	32	Woods/grass comb., Good, HSG A
1,912	30	Weighted Average
1,912		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	50	0.0340	0.13		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
2.2	153	0.0280	1.17		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
8.7	203	Total			

Subcatchment EX-5: Subcat EX-5



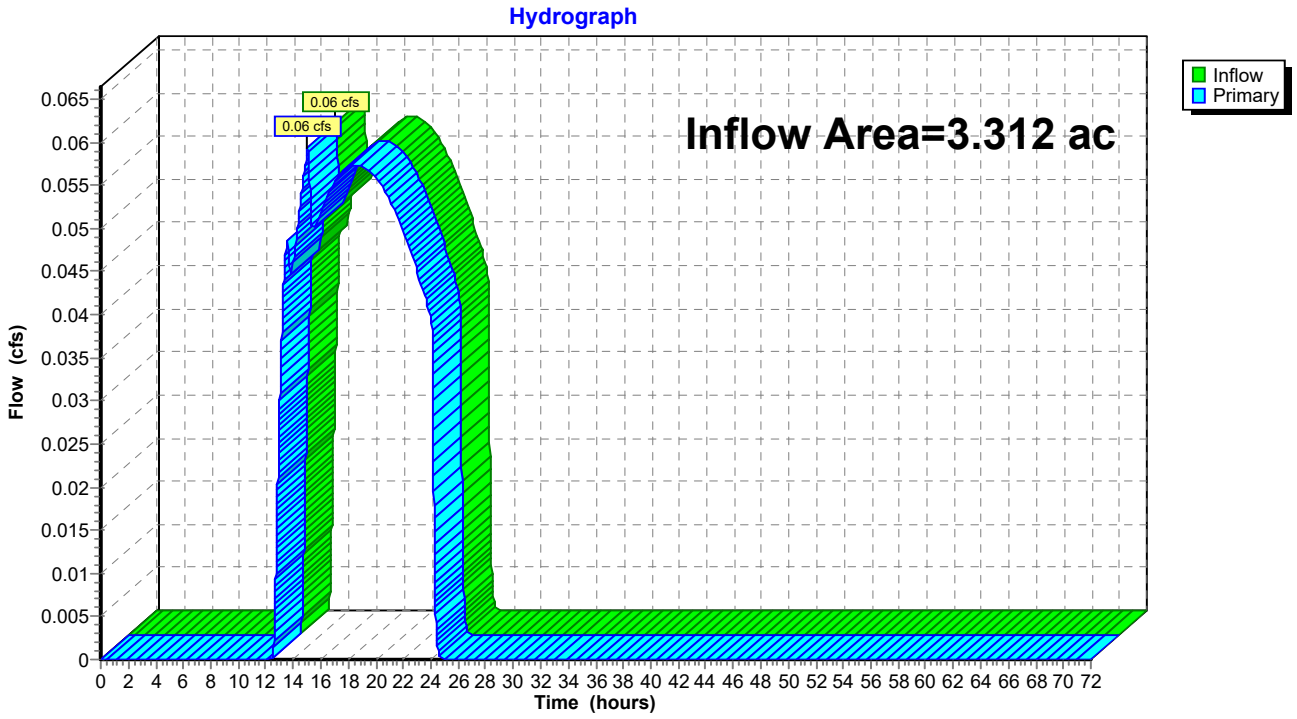
Summary for Pond AP-1: Northern Property Lines

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.312 ac, 4.09% Impervious, Inflow Depth = 0.17" for 10-Year event
Inflow = 0.06 cfs @ 15.05 hrs, Volume= 0.048 af
Primary = 0.06 cfs @ 15.05 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.0 min
Routed to Pond AP-2 : Union St

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-1: Northern Property Lines



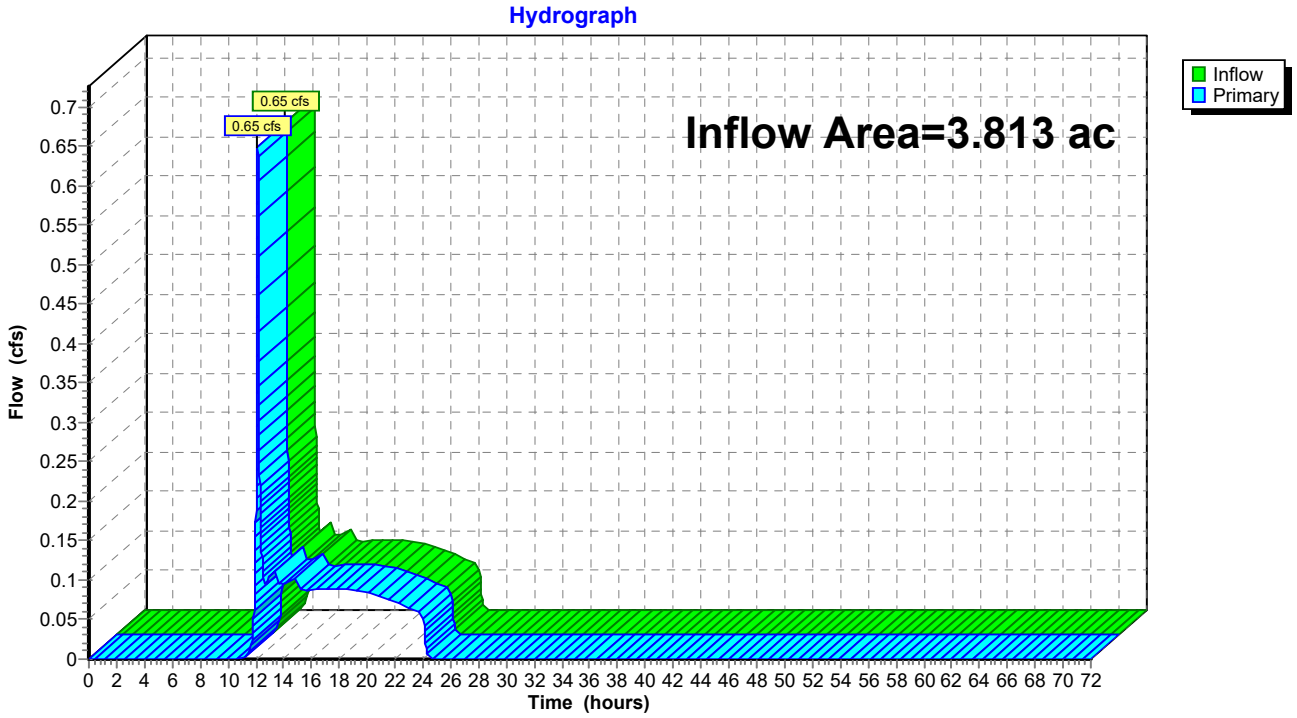
Summary for Pond AP-2: Union St

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.813 ac, 7.29% Impervious, Inflow Depth = 0.30" for 10-Year event
Inflow = 0.65 cfs @ 12.14 hrs, Volume= 0.096 af
Primary = 0.65 cfs @ 12.14 hrs, Volume= 0.096 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-2: Union St



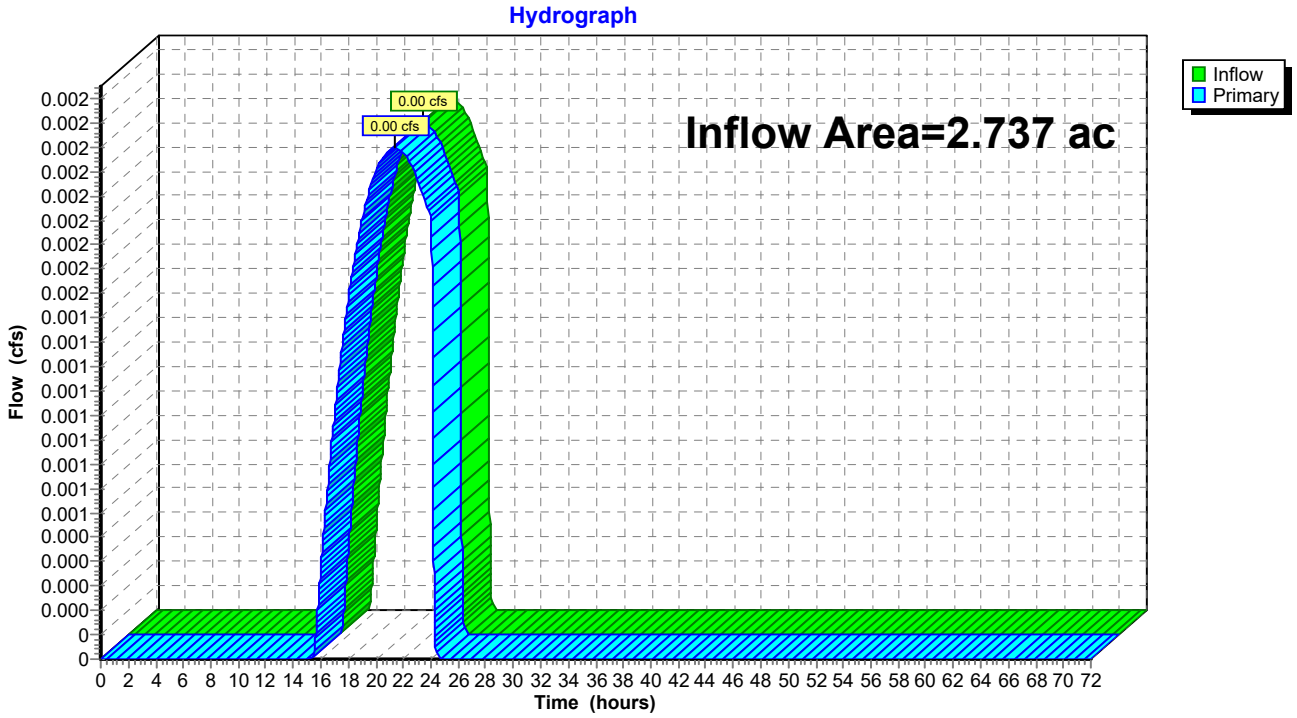
Summary for Pond AP-3: South-western Property Lines

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.737 ac, 4.28% Impervious, Inflow Depth = 0.01" for 10-Year event
Inflow = 0.00 cfs @ 21.39 hrs, Volume= 0.001 af
Primary = 0.00 cfs @ 21.39 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-3: South-western Property Lines



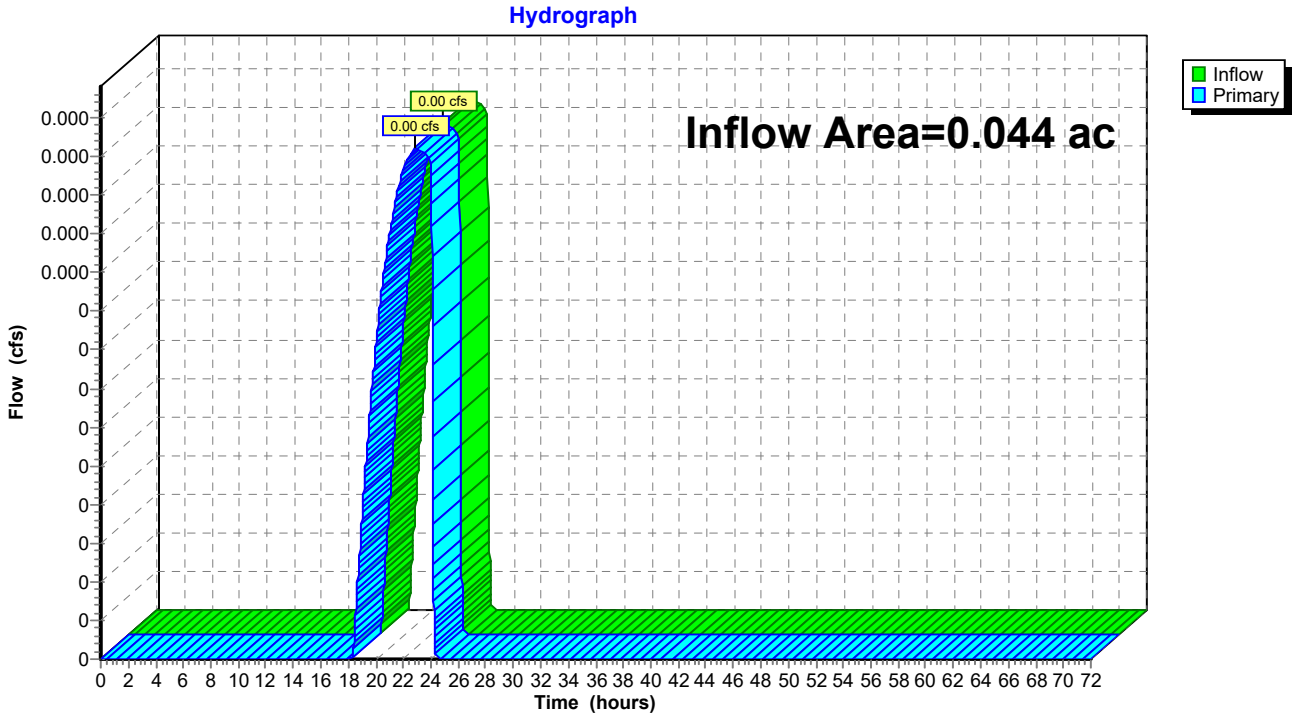
Summary for Pond AP-4: Small southern property line segment

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.044 ac, 0.00% Impervious, Inflow Depth = 0.01" for 10-Year event
Inflow = 0.00 cfs @ 22.88 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 22.88 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-4: Small southern property line segment



Summary for Pond EP-1: Western Depression

[92] Warning: Device #1 is above defined storage

Inflow Area = 2.409 ac, 4.86% Impervious, Inflow Depth = 0.14" for 10-Year event
Inflow = 0.04 cfs @ 18.98 hrs, Volume= 0.029 af
Outflow = 0.04 cfs @ 19.30 hrs, Volume= 0.029 af, Atten= 0%, Lag= 19.3 min
Discarded = 0.04 cfs @ 19.30 hrs, Volume= 0.029 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond AP-3 : South-western Property Lines

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 336.23' @ 19.30 hrs Surf.Area= 643 sf Storage= 12 cf

Plug-Flow detention time= 4.5 min calculated for 0.029 af (100% of inflow)
Center-of-Mass det. time= 4.5 min (1,129.8 - 1,125.3)

Volume	Invert	Avail.Storage	Storage Description
#1	336.20'	4,959 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

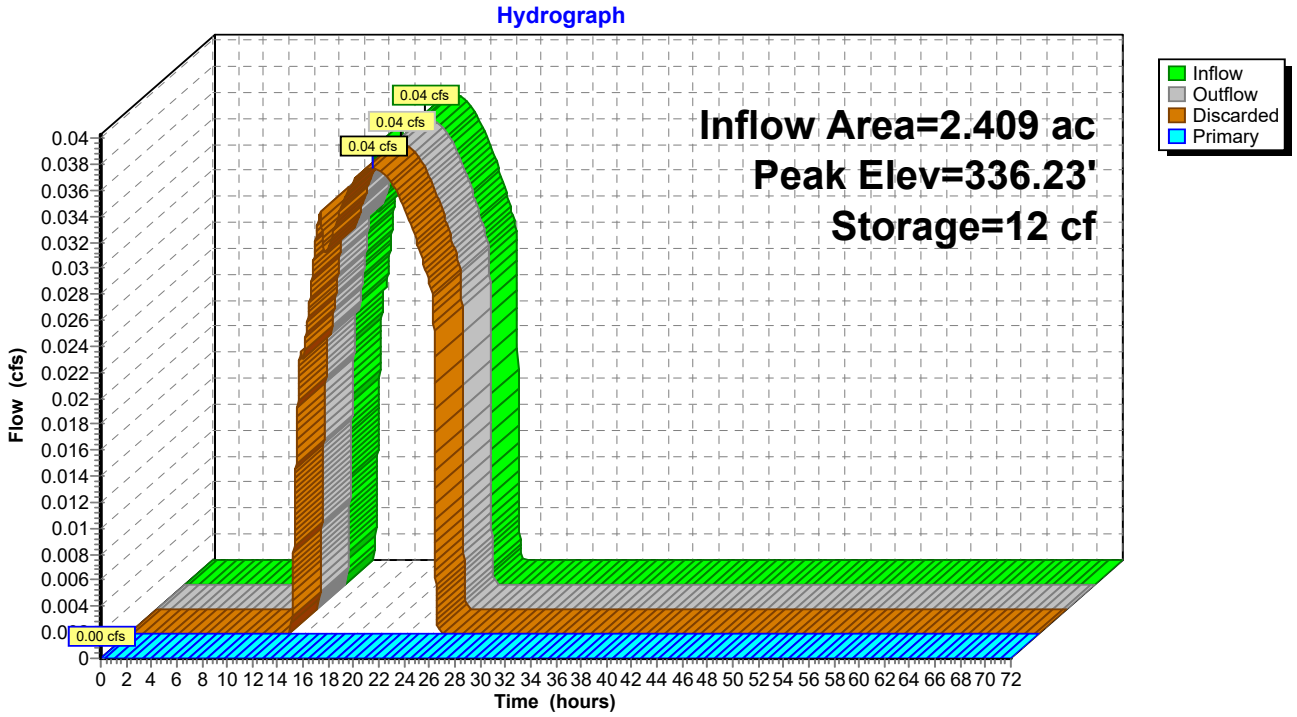
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
336.20	269	0	0
337.00	12,128	4,959	4,959

Device	Routing	Invert	Outlet Devices
#1	Primary	337.00'	**27.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	336.20'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.04 cfs @ 19.30 hrs HW=336.23' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=336.20' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond EP-1: Western Depression



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: Subcat EX-1 Runoff Area=3.312 ac 4.09% Impervious Runoff Depth=0.44"
Flow Length=511' Tc=14.9 min CN=37 Runoff=0.26 cfs 0.121 af

Subcatchment EX-2: Subcat EX-2 Runoff Area=21,803 sf 28.49% Impervious Runoff Depth=1.82"
Flow Length=134' Tc=6.0 min CN=56 Runoff=1.09 cfs 0.076 af

Subcatchment EX-3: Subcat EX-3 Runoff Area=104,941 sf 4.86% Impervious Runoff Depth=0.38"
Flow Length=244' Tc=10.9 min CN=36 Runoff=0.13 cfs 0.077 af

Subcatchment EX-4: Subcat EX-4 Runoff Area=14,262 sf 0.00% Impervious Runoff Depth=0.19"
Flow Length=239' Tc=10.7 min CN=32 Runoff=0.01 cfs 0.005 af

Subcatchment EX-5: Subcat EX-5 Runoff Area=1,912 sf 0.00% Impervious Runoff Depth=0.12"
Flow Length=203' Tc=8.7 min CN=30 Runoff=0.00 cfs 0.000 af

Pond AP-1: Northern Property Lines Inflow=0.26 cfs 0.121 af
Primary=0.26 cfs 0.121 af

Pond AP-2: Union St Inflow=1.10 cfs 0.197 af
Primary=1.10 cfs 0.197 af

Pond AP-3: South-western Property Lines Inflow=0.01 cfs 0.005 af
Primary=0.01 cfs 0.005 af

Pond AP-4: Small southern property line segment Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Pond EP-1: Western Depression Peak Elev=336.31' Storage=122 cf Inflow=0.13 cfs 0.077 af
Discarded=0.11 cfs 0.077 af Primary=0.00 cfs 0.000 af Outflow=0.11 cfs 0.077 af

Total Runoff Area = 6.593 ac Runoff Volume = 0.280 af Average Runoff Depth = 0.51"
94.01% Pervious = 6.198 ac 5.99% Impervious = 0.395 ac

Summary for Subcatchment EX-1: Subcat EX-1

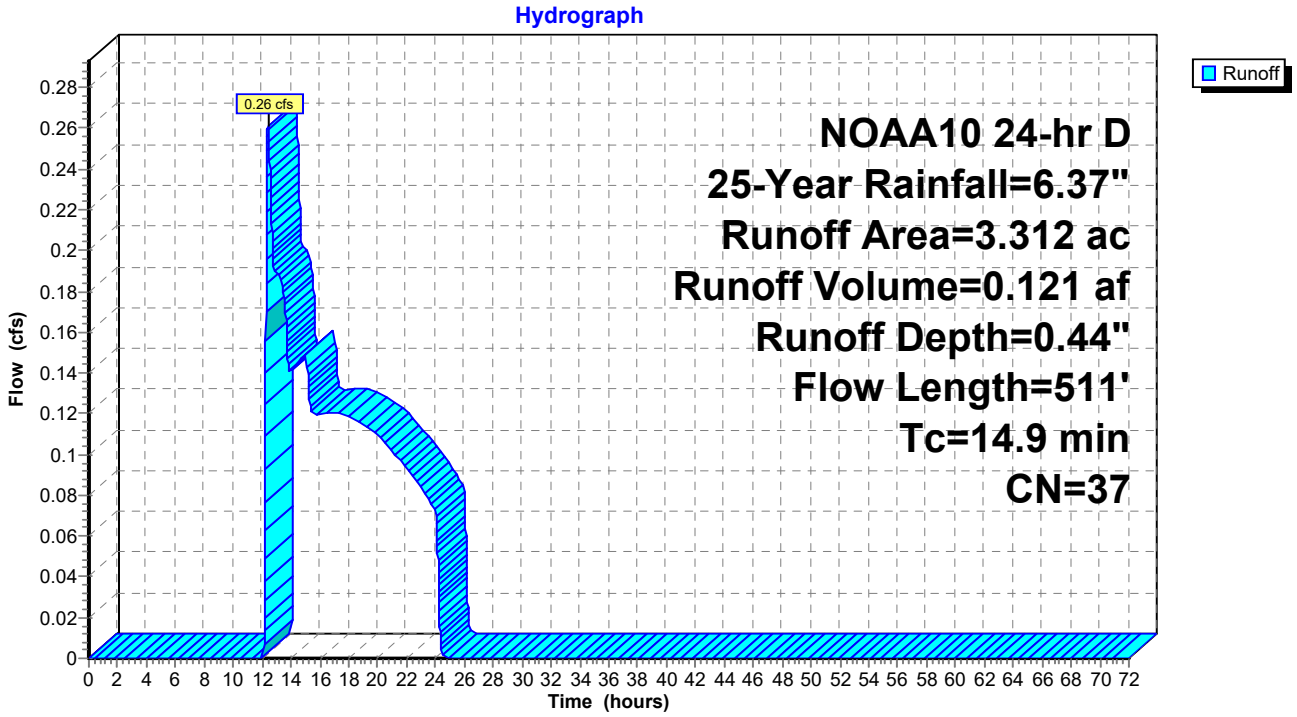
Runoff = 0.26 cfs @ 12.40 hrs, Volume= 0.121 af, Depth= 0.44"
Routed to Pond AP-1 : Northern Property Lines

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.37"

Area (ac)	CN	Description
0.000	32	Woods/grass comb., Good, HSG A
0.000	32	Woods/grass comb., Good, HSG A
1.290	32	Woods/grass comb., Good, HSG A
0.001	32	Woods/grass comb., Good, HSG A
0.000	32	Woods/grass comb., Good, HSG A
0.000	32	Woods/grass comb., Good, HSG A
0.039	32	Woods/grass comb., Good, HSG A
0.273	30	Woods, Good, HSG A
0.488	30	Woods, Good, HSG A
0.138	39	>75% Grass cover, Good, HSG A
0.818	39	>75% Grass cover, Good, HSG A
0.174	54	1/2 acre lots, 25% imp, HSG A
0.052	98	Paved parking, HSG A
0.014	98	Roofs, HSG A
0.007	98	Roofs, HSG A
0.019	98	Roofs, HSG A
3.312	37	Weighted Average
3.177		95.91% Pervious Area
0.135		4.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0240	0.11		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
3.5	192	0.0170	0.91		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
1.5	150	0.0560	1.66		**Shallow Concentrated Flow, C-->D** Short Grass Pasture Kv= 7.0 fps
2.5	119	0.0130	0.80		**Shallow Concentrated Flow, D-->E** Short Grass Pasture Kv= 7.0 fps
14.9	511	Total			

Subcatchment EX-1: Subcat EX-1



Summary for Subcatchment EX-2: Subcat EX-2

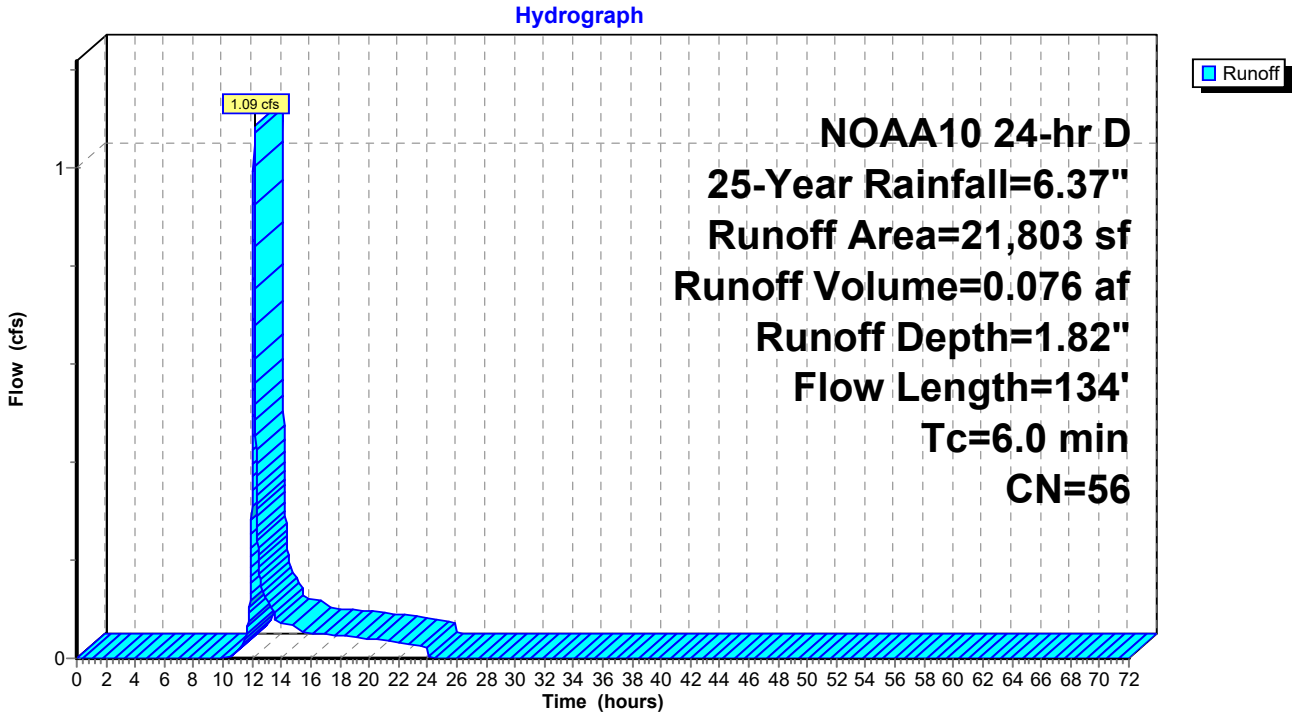
Runoff = 1.09 cfs @ 12.14 hrs, Volume= 0.076 af, Depth= 1.82"
Routed to Pond AP-2 : Union St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.37"

Area (sf)	CN	Description
64	32	Woods/grass comb., Good, HSG A
481	32	Woods/grass comb., Good, HSG A
0	32	Woods/grass comb., Good, HSG A
2,851	39	>75% Grass cover, Good, HSG A
332	54	1/2 acre lots, 25% imp, HSG A
2,384	98	Paved parking, HSG A
680	98	Paved parking, HSG A
104	98	Paved parking, HSG A
39	98	Roofs, HSG A
1,584	98	Roofs, HSG A
513	98	Roofs, HSG A
577	98	Paved parking, HSG A
248	98	Paved parking, HSG A
943	39	>75% Grass cover, Good, HSG A
299	39	>75% Grass cover, Good, HSG A
7,676	39	>75% Grass cover, Good, HSG A
1,019	39	>75% Grass cover, Good, HSG A
2,009	39	>75% Grass cover, Good, HSG A
21,803	56	Weighted Average
15,592		71.51% Pervious Area
6,211		28.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.1440	0.23		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
0.3	84	0.5400	5.14		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
2.1					**Direct Entry, ADDED TO GET TO 6MIN**
6.0	134	Total			

Subcatchment EX-2: Subcat EX-2



Summary for Subcatchment EX-3: Subcat EX-3

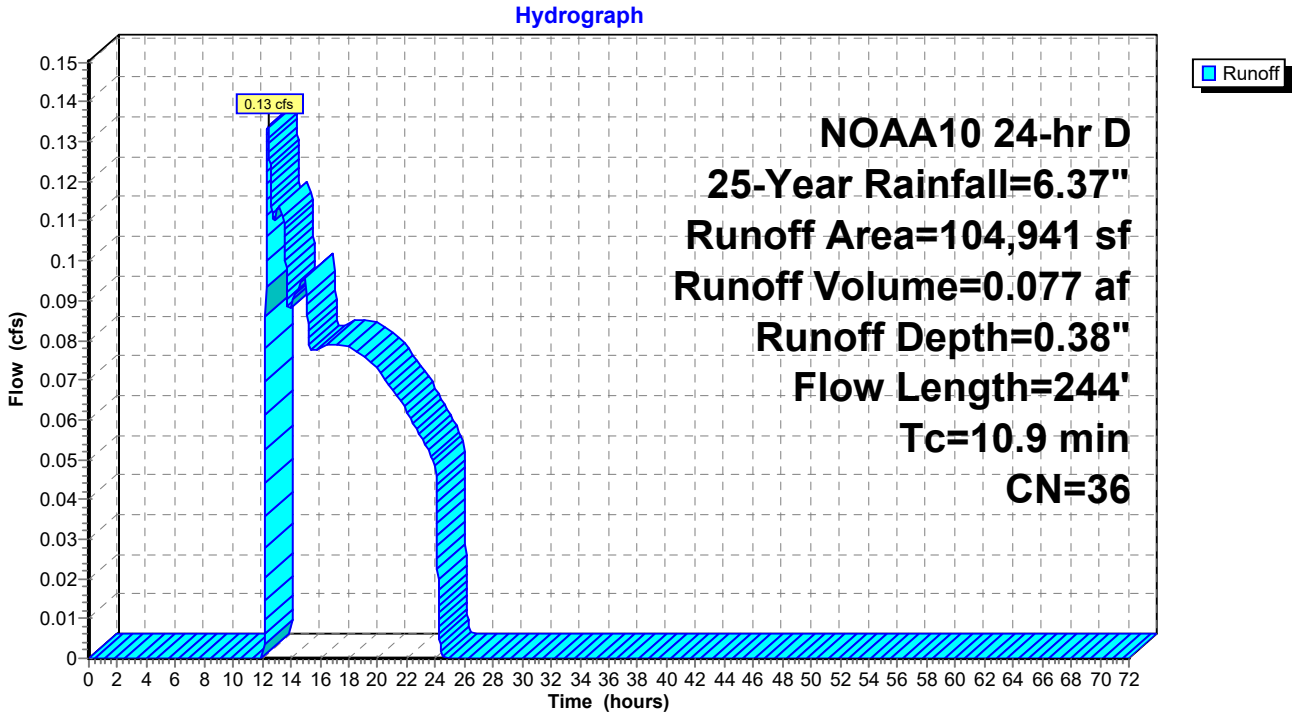
Runoff = 0.13 cfs @ 12.39 hrs, Volume= 0.077 af, Depth= 0.38"
Routed to Pond EP-1 : Western Depression

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.37"

Area (sf)	CN	Description
179	32	Woods/grass comb., Good, HSG A
458	32	Woods/grass comb., Good, HSG A
48,794	32	Woods/grass comb., Good, HSG A
16,635	30	Woods, Good, HSG A
5,110	30	Woods, Good, HSG A
20,101	39	>75% Grass cover, Good, HSG A
3,312	39	>75% Grass cover, Good, HSG A
1,654	98	Paved parking, HSG A
1,923	98	Roofs, HSG A
1,519	98	Roofs, HSG A
5,257	30	Woods, Good, HSG A
104,941	36	Weighted Average
99,845		95.14% Pervious Area
5,096		4.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	50	0.0200	0.10		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
2.9	194	0.0250	1.11		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
10.9	244	Total			

Subcatchment EX-3: Subcat EX-3



Summary for Subcatchment EX-4: Subcat EX-4

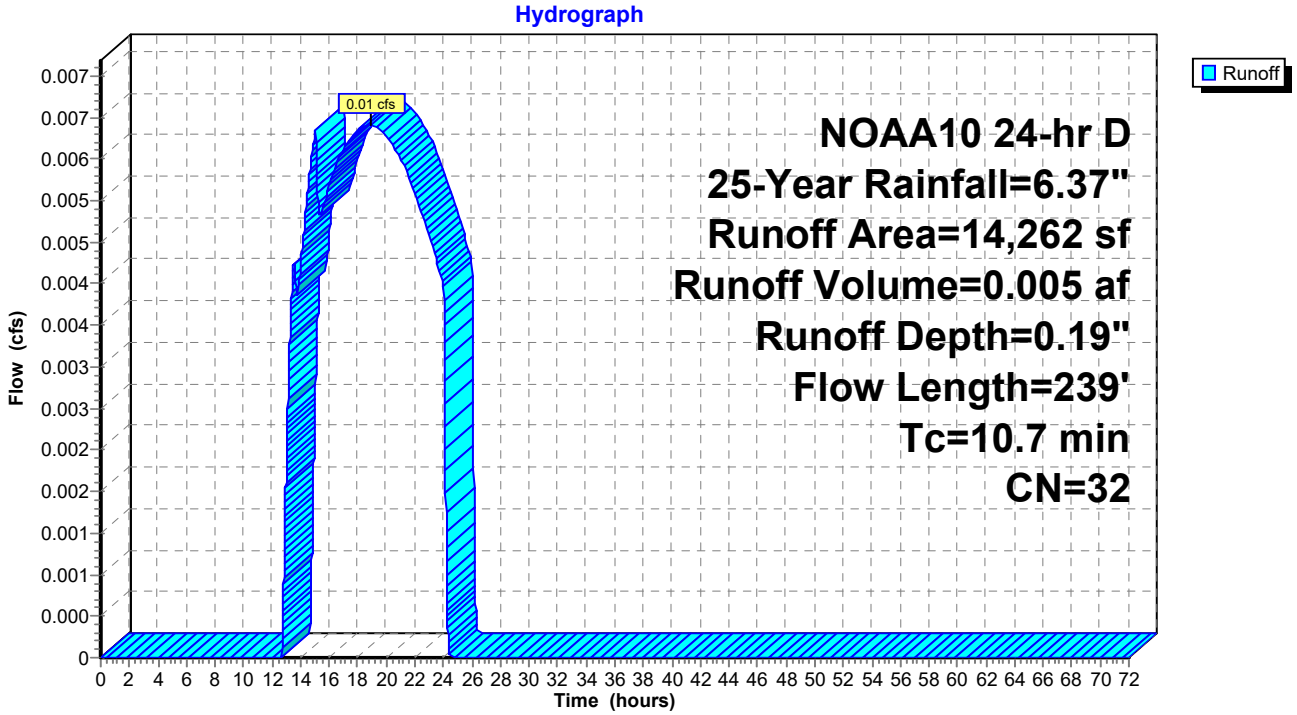
Runoff = 0.01 cfs @ 18.96 hrs, Volume= 0.005 af, Depth= 0.19"
Routed to Pond AP-3 : South-western Property Lines

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.37"

Area (sf)	CN	Description
1,208	30	Woods, Good, HSG A
13,054	32	Woods/grass comb., Good, HSG A
14,262	32	Weighted Average
14,262		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0180	0.10		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
0.3	38	0.0950	2.16		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
2.1	151	0.0300	1.21		**Shallow Concentrated Flow, C-->D** Short Grass Pasture Kv= 7.0 fps
10.7	239	Total			

Subcatchment EX-4: Subcat EX-4



Summary for Subcatchment EX-5: Subcat EX-5

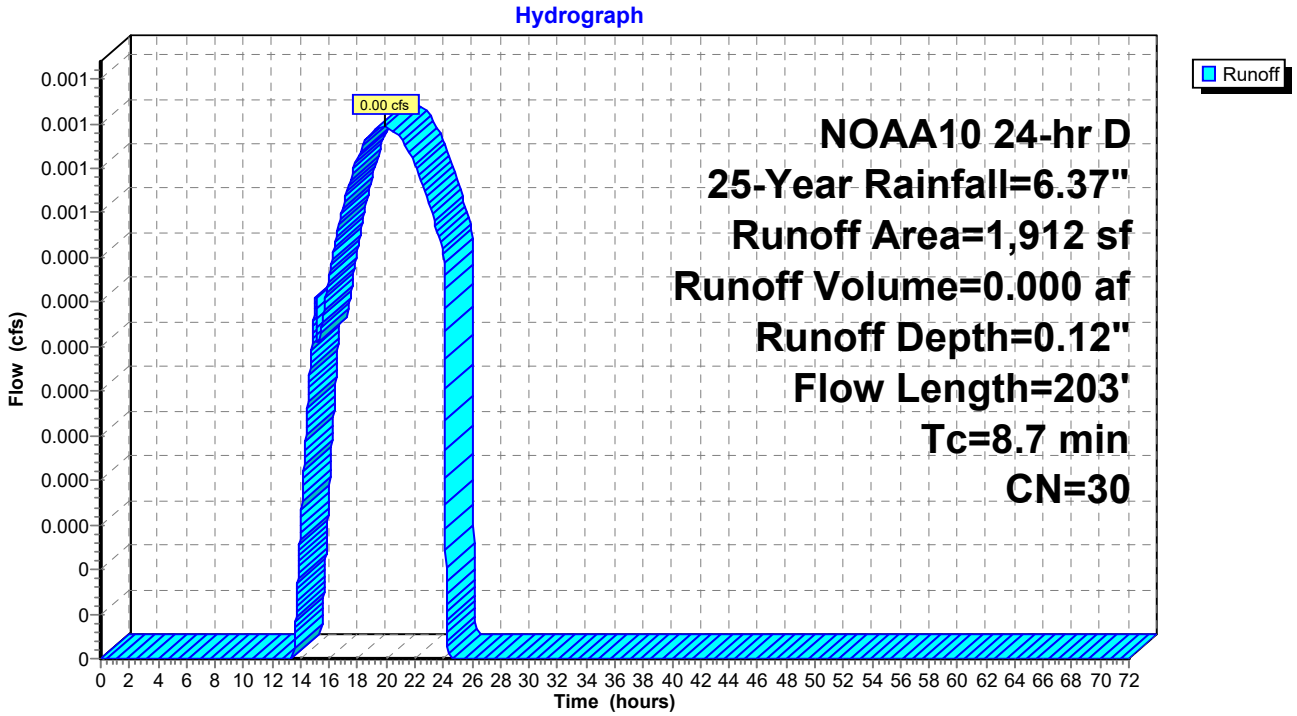
Runoff = 0.00 cfs @ 19.96 hrs, Volume= 0.000 af, Depth= 0.12"
Routed to Pond AP-4 : Small southern property line segment

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.37"

Area (sf)	CN	Description
1,900	30	Woods, Good, HSG A
11	32	Woods/grass comb., Good, HSG A
1,912	30	Weighted Average
1,912		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	50	0.0340	0.13		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
2.2	153	0.0280	1.17		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
8.7	203	Total			

Subcatchment EX-5: Subcat EX-5



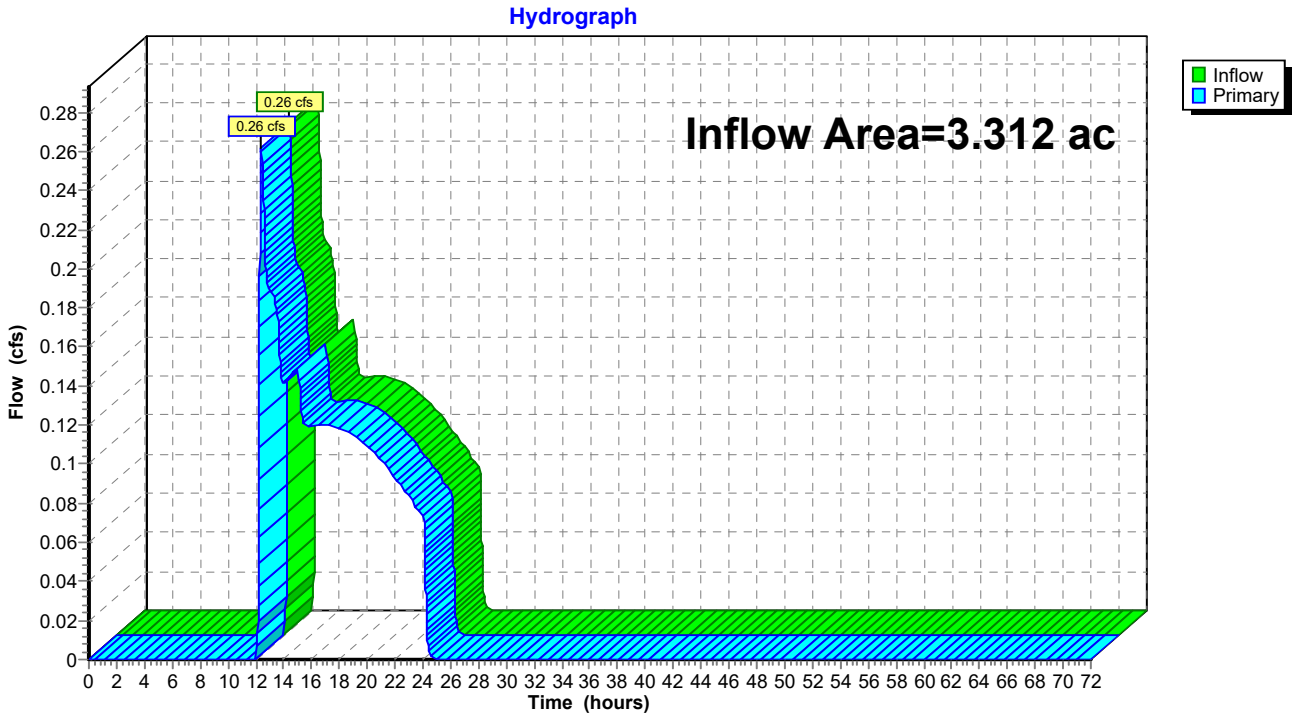
Summary for Pond AP-1: Northern Property Lines

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.312 ac, 4.09% Impervious, Inflow Depth = 0.44" for 25-Year event
Inflow = 0.26 cfs @ 12.40 hrs, Volume= 0.121 af
Primary = 0.26 cfs @ 12.40 hrs, Volume= 0.121 af, Atten= 0%, Lag= 0.0 min
Routed to Pond AP-2 : Union St

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-1: Northern Property Lines



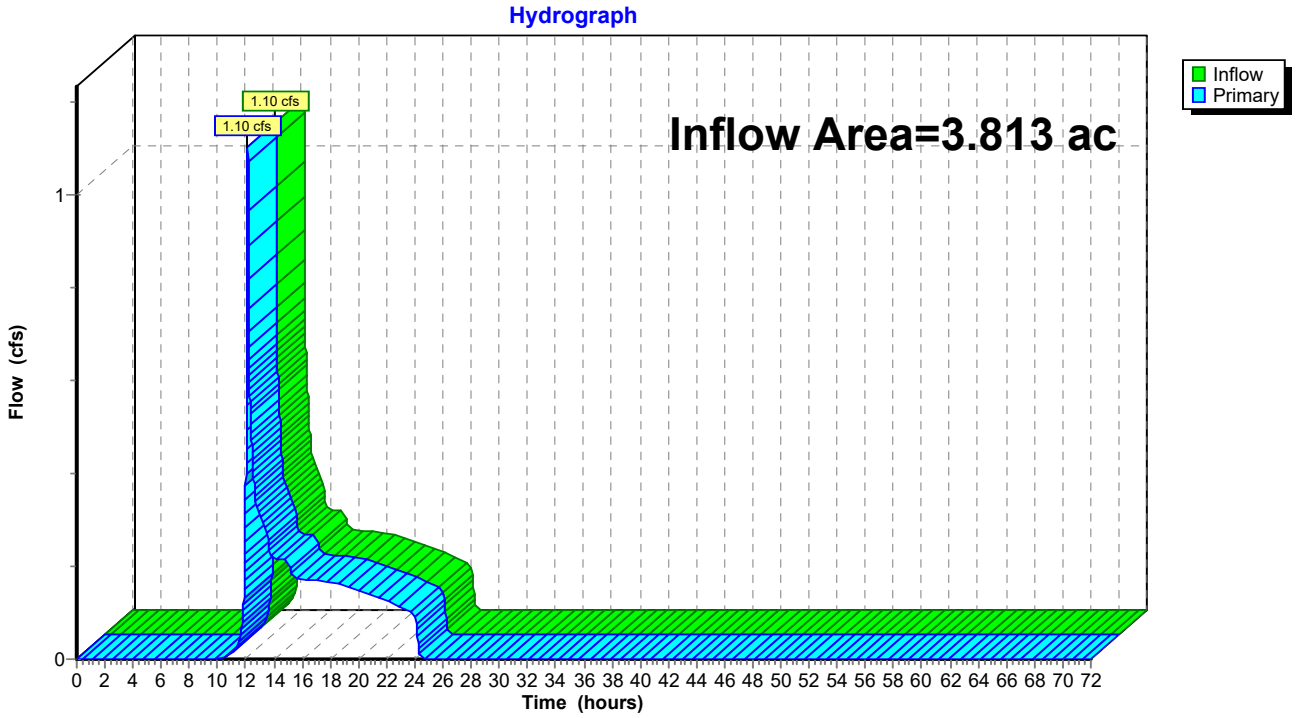
Summary for Pond AP-2: Union St

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.813 ac, 7.29% Impervious, Inflow Depth = 0.62" for 25-Year event
Inflow = 1.10 cfs @ 12.14 hrs, Volume= 0.197 af
Primary = 1.10 cfs @ 12.14 hrs, Volume= 0.197 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-2: Union St



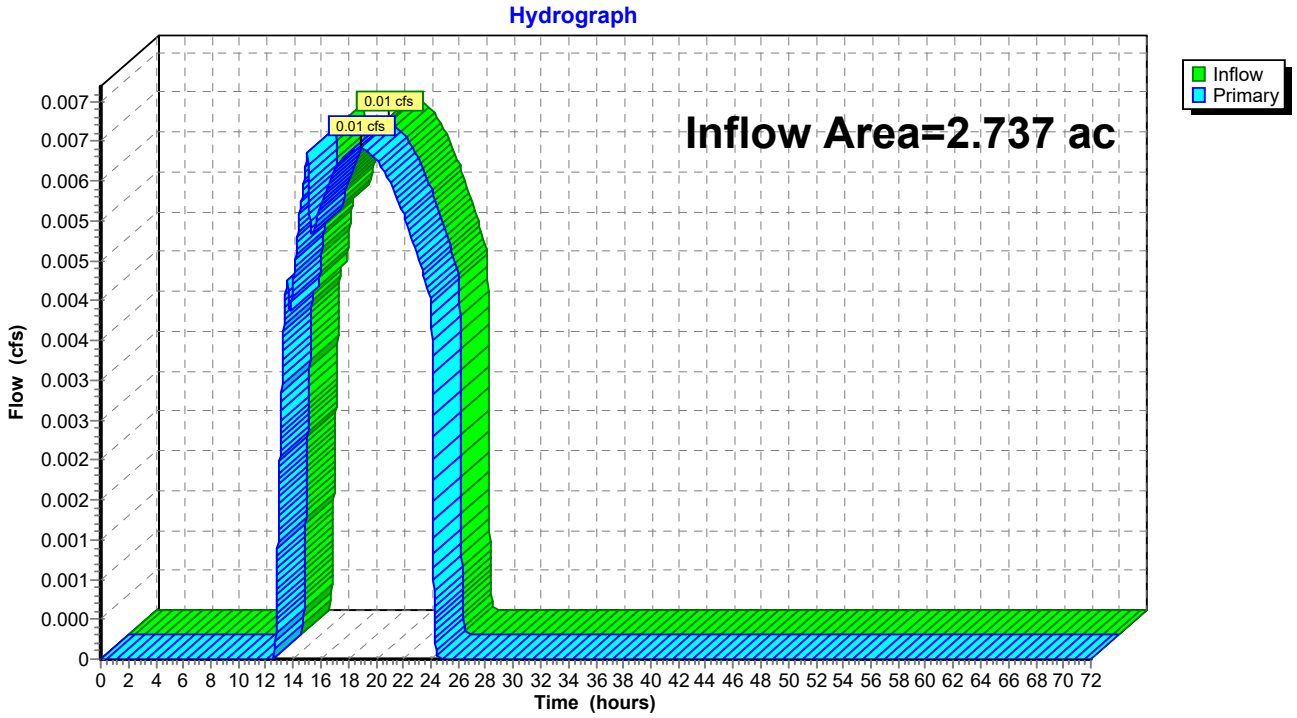
Summary for Pond AP-3: South-western Property Lines

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.737 ac, 4.28% Impervious, Inflow Depth = 0.02" for 25-Year event
Inflow = 0.01 cfs @ 18.96 hrs, Volume= 0.005 af
Primary = 0.01 cfs @ 18.96 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-3: South-western Property Lines



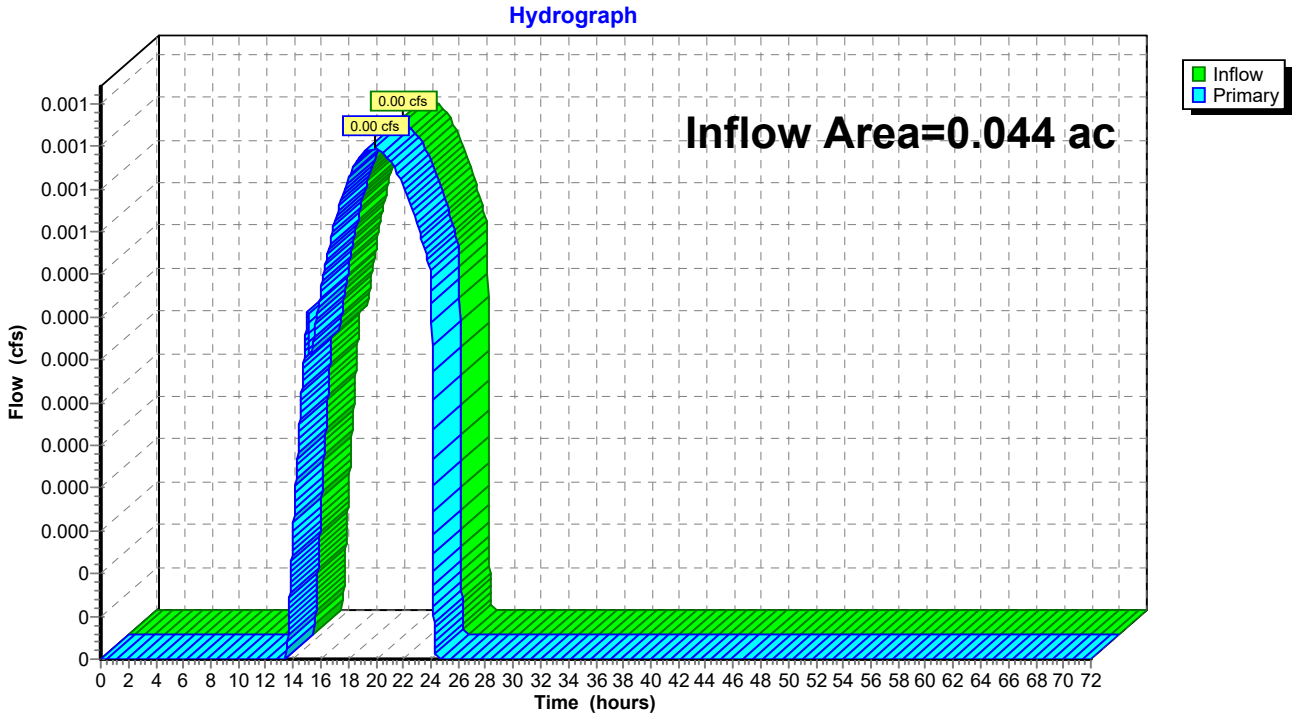
Summary for Pond AP-4: Small southern property line segment

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.044 ac, 0.00% Impervious, Inflow Depth = 0.12" for 25-Year event
Inflow = 0.00 cfs @ 19.96 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 19.96 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-4: Small southern property line segment



Summary for Pond EP-1: Western Depression

[92] Warning: Device #1 is above defined storage

Inflow Area = 2.409 ac, 4.86% Impervious, Inflow Depth = 0.38" for 25-Year event
Inflow = 0.13 cfs @ 12.39 hrs, Volume= 0.077 af
Outflow = 0.11 cfs @ 13.56 hrs, Volume= 0.077 af, Atten= 20%, Lag= 70.0 min
Discarded = 0.11 cfs @ 13.56 hrs, Volume= 0.077 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond AP-3 : South-western Property Lines

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 336.31' @ 13.56 hrs Surf.Area= 1,922 sf Storage= 122 cf

Plug-Flow detention time= 13.9 min calculated for 0.077 af (100% of inflow)
Center-of-Mass det. time= 13.9 min (1,061.7 - 1,047.8)

Volume	Invert	Avail.Storage	Storage Description
#1	336.20'	4,959 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

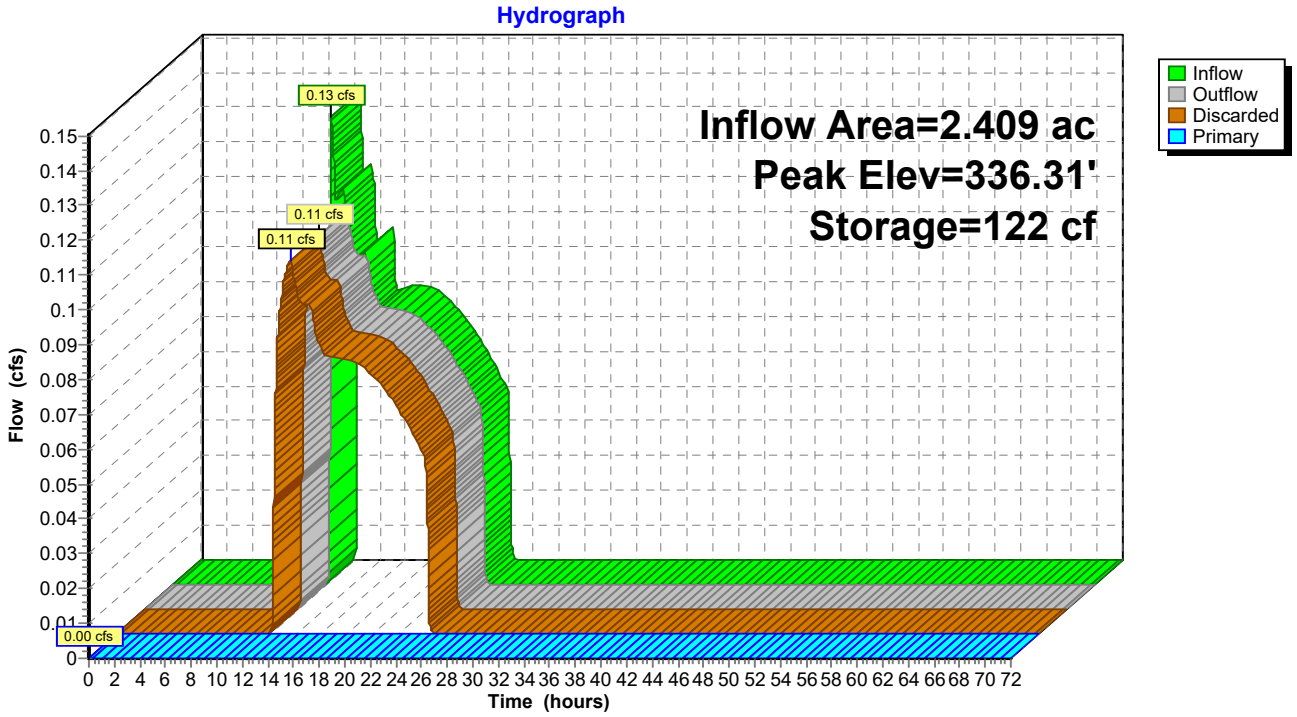
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
336.20	269	0	0
337.00	12,128	4,959	4,959

Device	Routing	Invert	Outlet Devices
#1	Primary	337.00'	**27.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	336.20'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.11 cfs @ 13.56 hrs HW=336.31' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=336.20' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond EP-1: Western Depression



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: Subcat EX-1 Runoff Area=3.312 ac 4.09% Impervious Runoff Depth=1.04"
Flow Length=511' Tc=14.9 min CN=37 Runoff=1.72 cfs 0.286 af

Subcatchment EX-2: Subcat EX-2 Runoff Area=21,803 sf 28.49% Impervious Runoff Depth=3.00"
Flow Length=134' Tc=6.0 min CN=56 Runoff=1.86 cfs 0.125 af

Subcatchment EX-3: Subcat EX-3 Runoff Area=104,941 sf 4.86% Impervious Runoff Depth=0.95"
Flow Length=244' Tc=10.9 min CN=36 Runoff=1.22 cfs 0.190 af

Subcatchment EX-4: Subcat EX-4 Runoff Area=14,262 sf 0.00% Impervious Runoff Depth=0.61"
Flow Length=239' Tc=10.7 min CN=32 Runoff=0.05 cfs 0.017 af

Subcatchment EX-5: Subcat EX-5 Runoff Area=1,912 sf 0.00% Impervious Runoff Depth=0.45"
Flow Length=203' Tc=8.7 min CN=30 Runoff=0.00 cfs 0.002 af

Pond AP-1: Northern Property Lines Inflow=1.72 cfs 0.286 af
Primary=1.72 cfs 0.286 af

Pond AP-2: Union St Inflow=2.59 cfs 0.412 af
Primary=2.59 cfs 0.412 af

Pond AP-3: South-western Property Lines Inflow=0.05 cfs 0.017 af
Primary=0.05 cfs 0.017 af

Pond AP-4: Small southern property line segment Inflow=0.00 cfs 0.002 af
Primary=0.00 cfs 0.002 af

Pond EP-1: Western Depression Peak Elev=336.56' Storage=1,048 cf Inflow=1.22 cfs 0.190 af
Discarded=0.31 cfs 0.190 af Primary=0.00 cfs 0.000 af Outflow=0.31 cfs 0.190 af

Total Runoff Area = 6.593 ac Runoff Volume = 0.620 af Average Runoff Depth = 1.13"
94.01% Pervious = 6.198 ac 5.99% Impervious = 0.395 ac

Summary for Subcatchment EX-1: Subcat EX-1

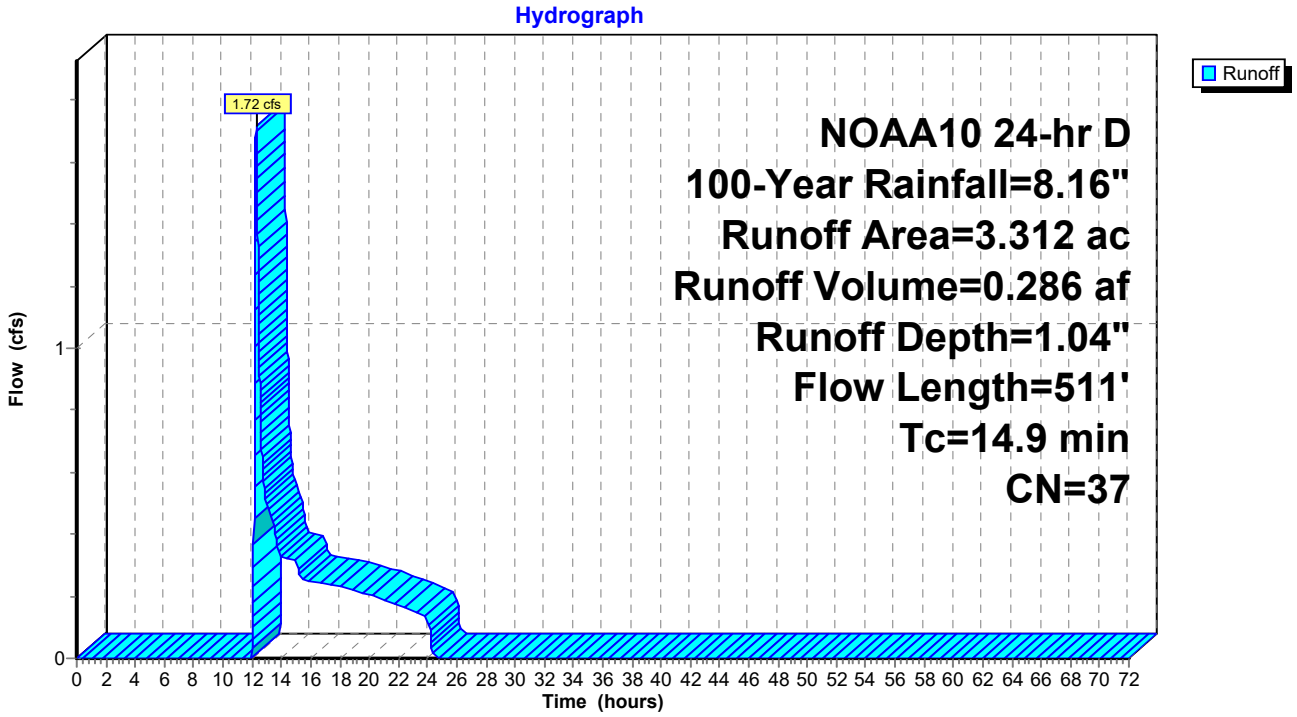
Runoff = 1.72 cfs @ 12.27 hrs, Volume= 0.286 af, Depth= 1.04"
Routed to Pond AP-1 : Northern Property Lines

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.16"

Area (ac)	CN	Description
0.000	32	Woods/grass comb., Good, HSG A
0.000	32	Woods/grass comb., Good, HSG A
1.290	32	Woods/grass comb., Good, HSG A
0.001	32	Woods/grass comb., Good, HSG A
0.000	32	Woods/grass comb., Good, HSG A
0.000	32	Woods/grass comb., Good, HSG A
0.039	32	Woods/grass comb., Good, HSG A
0.273	30	Woods, Good, HSG A
0.488	30	Woods, Good, HSG A
0.138	39	>75% Grass cover, Good, HSG A
0.818	39	>75% Grass cover, Good, HSG A
0.174	54	1/2 acre lots, 25% imp, HSG A
0.052	98	Paved parking, HSG A
0.014	98	Roofs, HSG A
0.007	98	Roofs, HSG A
0.019	98	Roofs, HSG A
3.312	37	Weighted Average
3.177		95.91% Pervious Area
0.135		4.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0240	0.11		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
3.5	192	0.0170	0.91		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
1.5	150	0.0560	1.66		**Shallow Concentrated Flow, C-->D** Short Grass Pasture Kv= 7.0 fps
2.5	119	0.0130	0.80		**Shallow Concentrated Flow, D-->E** Short Grass Pasture Kv= 7.0 fps
14.9	511	Total			

Subcatchment EX-1: Subcat EX-1



Summary for Subcatchment EX-2: Subcat EX-2

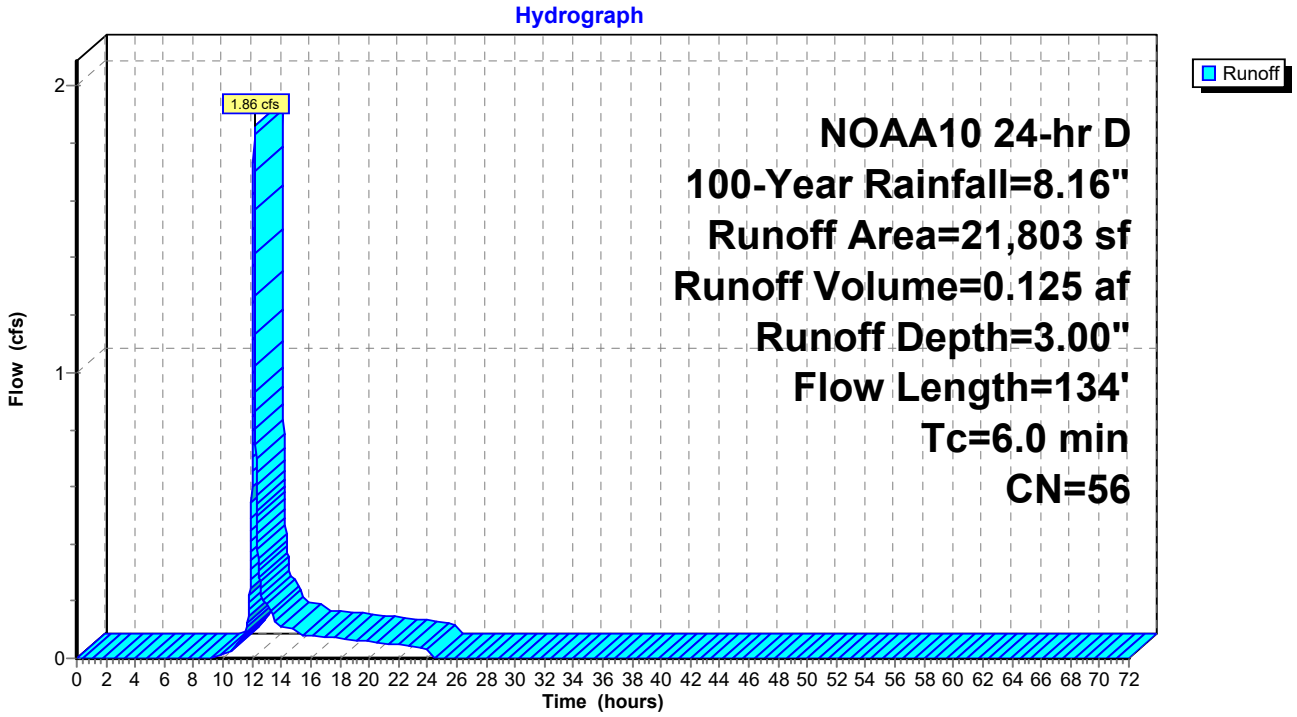
Runoff = 1.86 cfs @ 12.14 hrs, Volume= 0.125 af, Depth= 3.00"
Routed to Pond AP-2 : Union St

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.16"

Area (sf)	CN	Description
64	32	Woods/grass comb., Good, HSG A
481	32	Woods/grass comb., Good, HSG A
0	32	Woods/grass comb., Good, HSG A
2,851	39	>75% Grass cover, Good, HSG A
332	54	1/2 acre lots, 25% imp, HSG A
2,384	98	Paved parking, HSG A
680	98	Paved parking, HSG A
104	98	Paved parking, HSG A
39	98	Roofs, HSG A
1,584	98	Roofs, HSG A
513	98	Roofs, HSG A
577	98	Paved parking, HSG A
248	98	Paved parking, HSG A
943	39	>75% Grass cover, Good, HSG A
299	39	>75% Grass cover, Good, HSG A
7,676	39	>75% Grass cover, Good, HSG A
1,019	39	>75% Grass cover, Good, HSG A
2,009	39	>75% Grass cover, Good, HSG A
21,803	56	Weighted Average
15,592		71.51% Pervious Area
6,211		28.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.1440	0.23		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
0.3	84	0.5400	5.14		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
2.1					**Direct Entry, ADDED TO GET TO 6MIN**
6.0	134	Total			

Subcatchment EX-2: Subcat EX-2



Summary for Subcatchment EX-3: Subcat EX-3

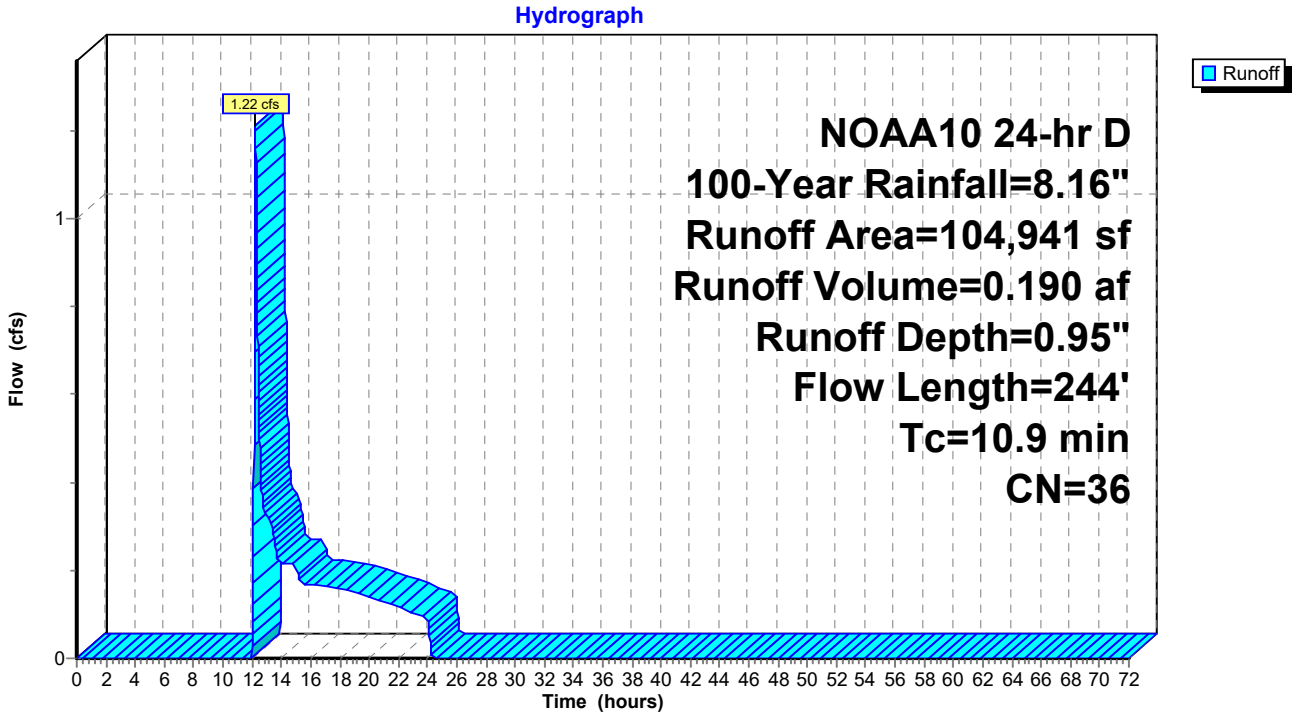
Runoff = 1.22 cfs @ 12.22 hrs, Volume= 0.190 af, Depth= 0.95"
Routed to Pond EP-1 : Western Depression

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.16"

Area (sf)	CN	Description
179	32	Woods/grass comb., Good, HSG A
458	32	Woods/grass comb., Good, HSG A
48,794	32	Woods/grass comb., Good, HSG A
16,635	30	Woods, Good, HSG A
5,110	30	Woods, Good, HSG A
20,101	39	>75% Grass cover, Good, HSG A
3,312	39	>75% Grass cover, Good, HSG A
1,654	98	Paved parking, HSG A
1,923	98	Roofs, HSG A
1,519	98	Roofs, HSG A
5,257	30	Woods, Good, HSG A
104,941	36	Weighted Average
99,845		95.14% Pervious Area
5,096		4.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	50	0.0200	0.10		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
2.9	194	0.0250	1.11		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
10.9	244	Total			

Subcatchment EX-3: Subcat EX-3



Summary for Subcatchment EX-4: Subcat EX-4

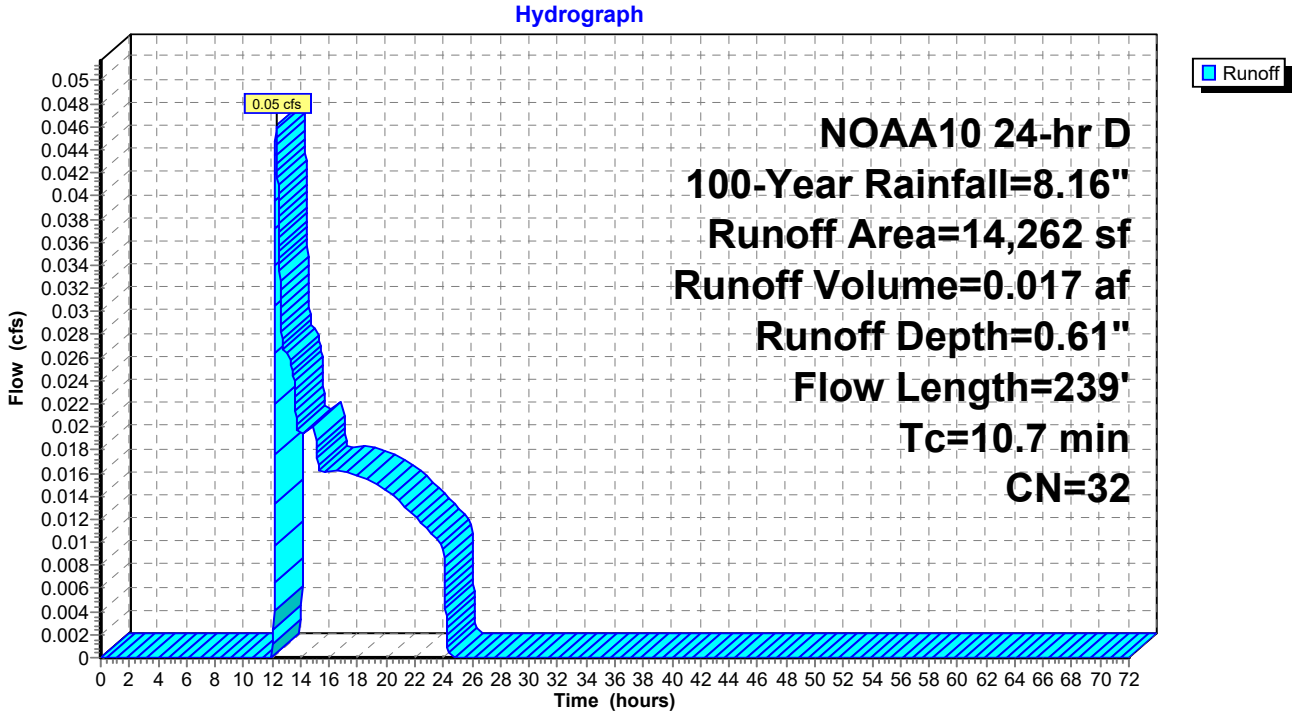
Runoff = 0.05 cfs @ 12.28 hrs, Volume= 0.017 af, Depth= 0.61"
Routed to Pond AP-3 : South-western Property Lines

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.16"

Area (sf)	CN	Description
1,208	30	Woods, Good, HSG A
13,054	32	Woods/grass comb., Good, HSG A
14,262	32	Weighted Average
14,262		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0180	0.10		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
0.3	38	0.0950	2.16		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
2.1	151	0.0300	1.21		**Shallow Concentrated Flow, C-->D** Short Grass Pasture Kv= 7.0 fps
10.7	239	Total			

Subcatchment EX-4: Subcat EX-4



Summary for Subcatchment EX-5: Subcat EX-5

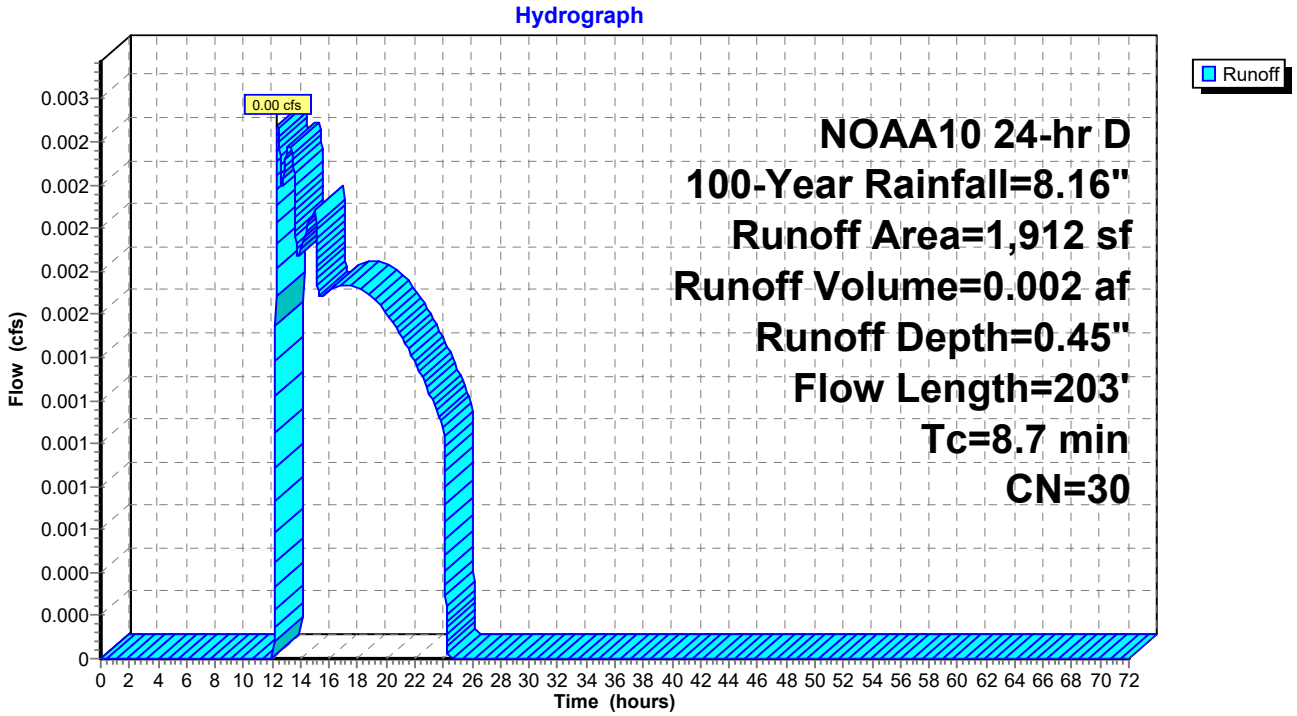
Runoff = 0.00 cfs @ 12.39 hrs, Volume= 0.002 af, Depth= 0.45"
Routed to Pond AP-4 : Small southern property line segment

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.16"

Area (sf)	CN	Description
1,900	30	Woods, Good, HSG A
11	32	Woods/grass comb., Good, HSG A
1,912	30	Weighted Average
1,912		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	50	0.0340	0.13		**Sheet Flow, A-->B** Grass: Dense n= 0.240 P2= 3.36"
2.2	153	0.0280	1.17		**Shallow Concentrated Flow, B-->C** Short Grass Pasture Kv= 7.0 fps
8.7	203	Total			

Subcatchment EX-5: Subcat EX-5



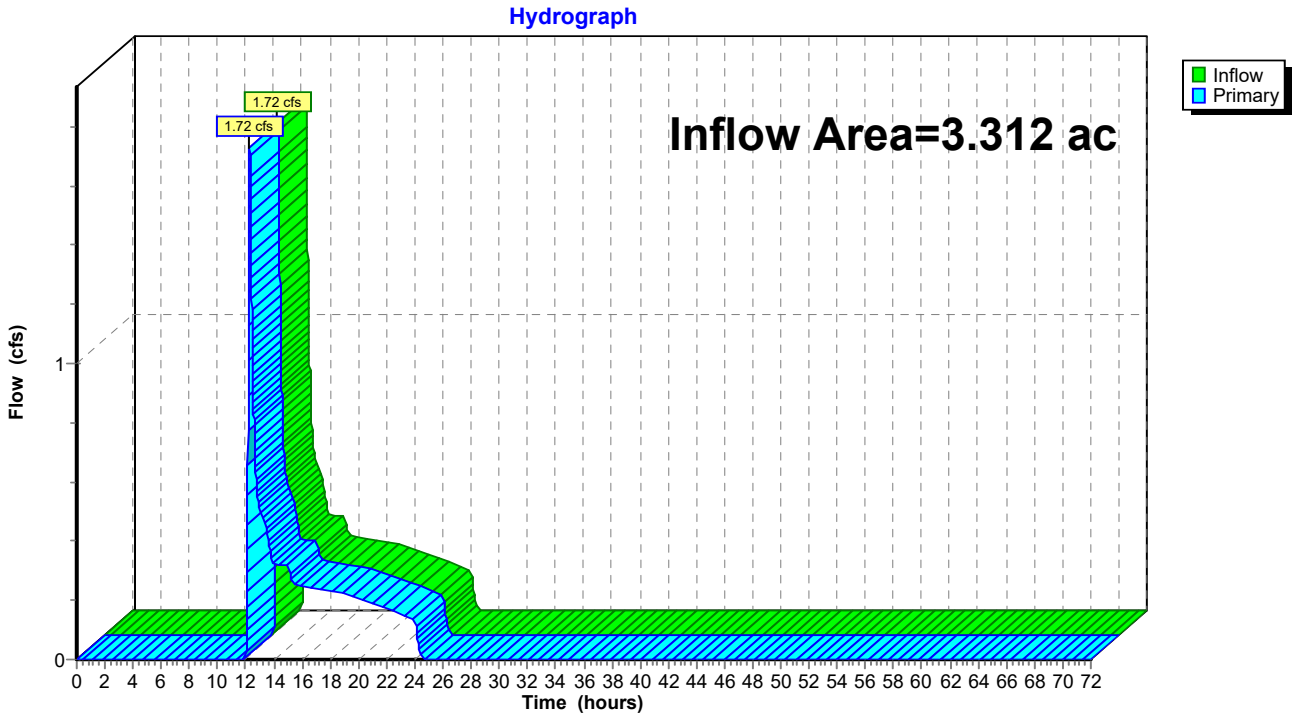
Summary for Pond AP-1: Northern Property Lines

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.312 ac, 4.09% Impervious, Inflow Depth = 1.04" for 100-Year event
Inflow = 1.72 cfs @ 12.27 hrs, Volume= 0.286 af
Primary = 1.72 cfs @ 12.27 hrs, Volume= 0.286 af, Atten= 0%, Lag= 0.0 min
Routed to Pond AP-2 : Union St

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-1: Northern Property Lines



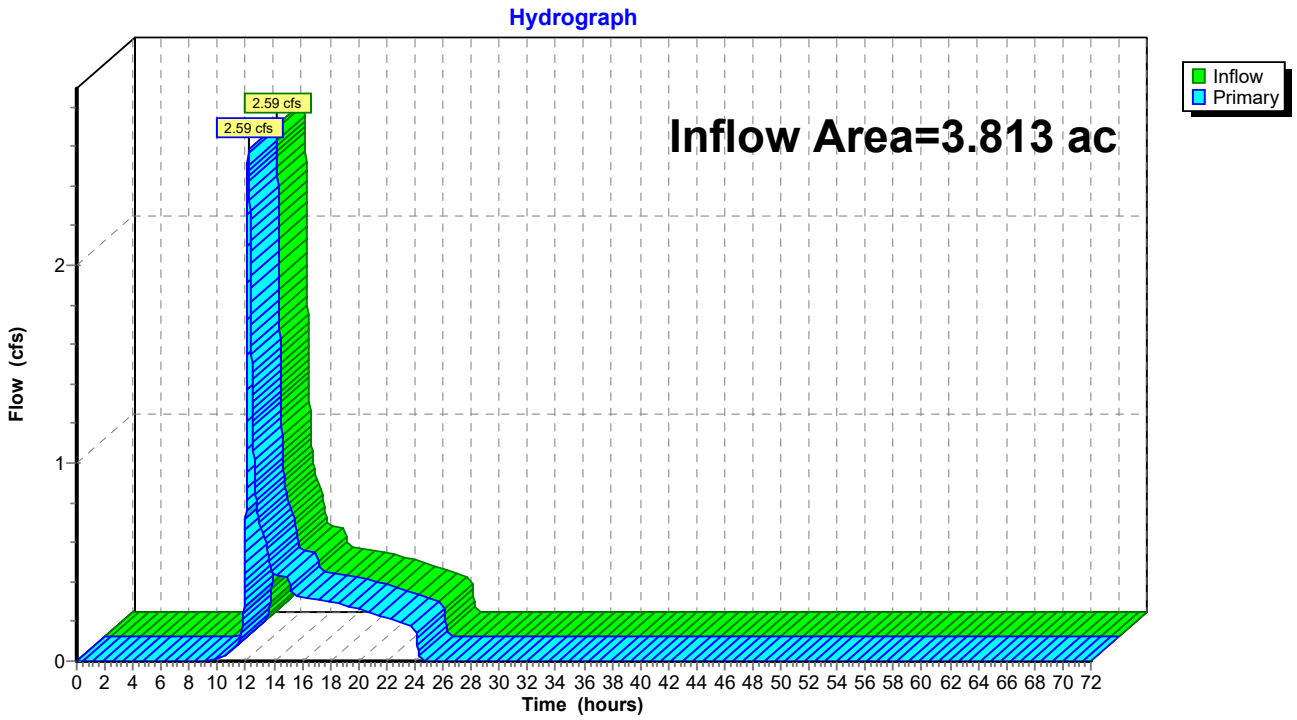
Summary for Pond AP-2: Union St

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.813 ac, 7.29% Impervious, Inflow Depth = 1.30" for 100-Year event
Inflow = 2.59 cfs @ 12.16 hrs, Volume= 0.412 af
Primary = 2.59 cfs @ 12.16 hrs, Volume= 0.412 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-2: Union St



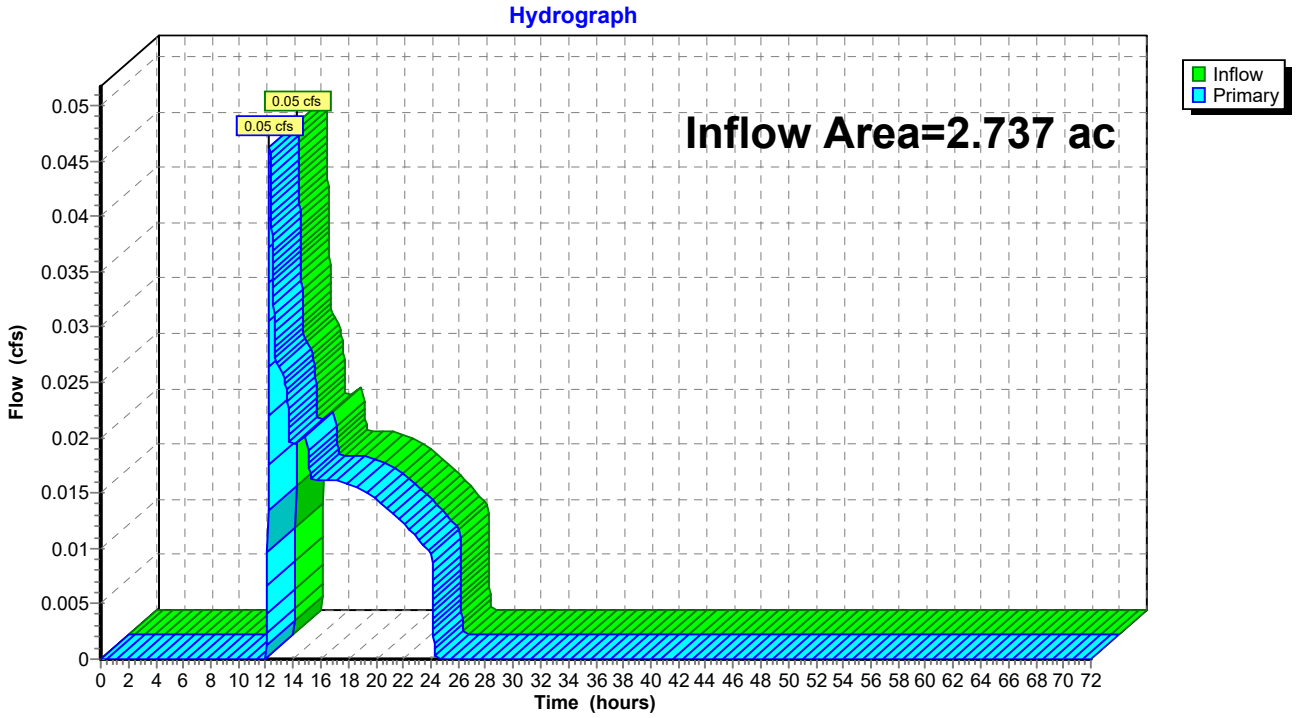
Summary for Pond AP-3: South-western Property Lines

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.737 ac, 4.28% Impervious, Inflow Depth = 0.07" for 100-Year event
Inflow = 0.05 cfs @ 12.28 hrs, Volume= 0.017 af
Primary = 0.05 cfs @ 12.28 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-3: South-western Property Lines



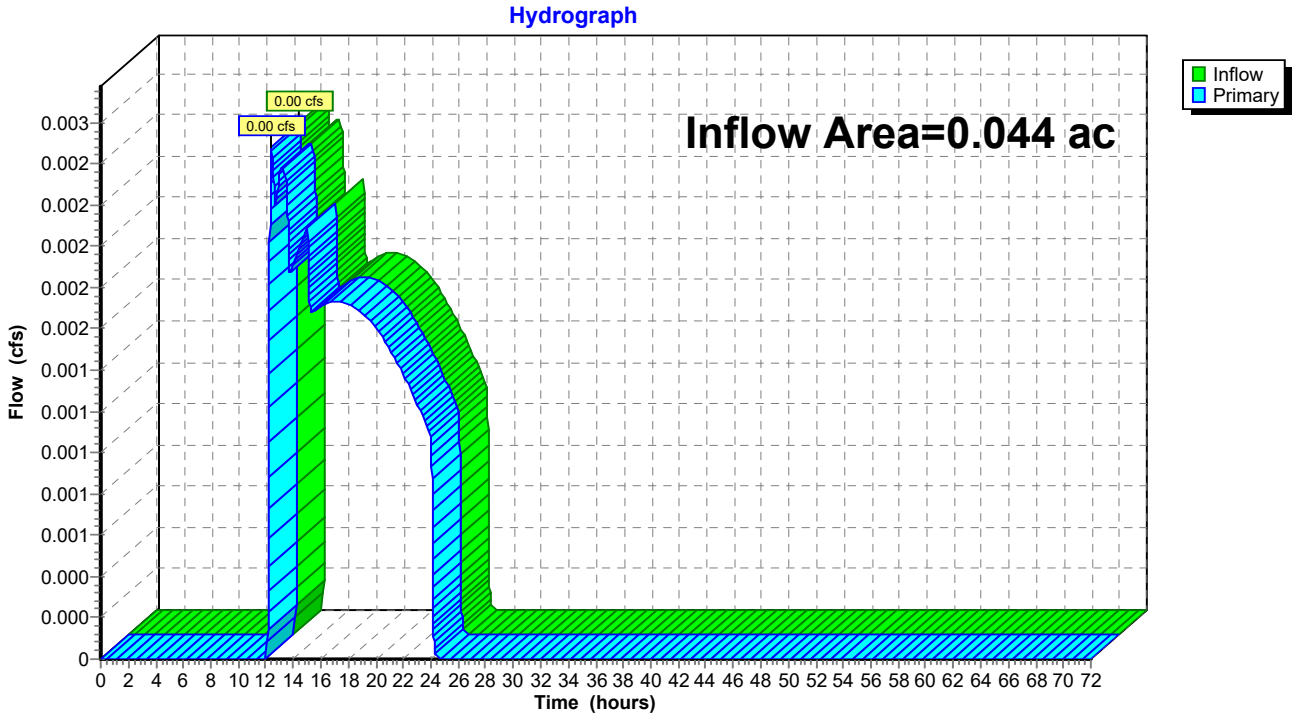
Summary for Pond AP-4: Small southern property line segment

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.044 ac, 0.00% Impervious, Inflow Depth = 0.45" for 100-Year event
Inflow = 0.00 cfs @ 12.39 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 12.39 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-4: Small southern property line segment



Summary for Pond EP-1: Western Depression

[92] Warning: Device #1 is above defined storage

Inflow Area = 2.409 ac, 4.86% Impervious, Inflow Depth = 0.95" for 100-Year event
Inflow = 1.22 cfs @ 12.22 hrs, Volume= 0.190 af
Outflow = 0.31 cfs @ 13.20 hrs, Volume= 0.190 af, Atten= 74%, Lag= 58.9 min
Discarded = 0.31 cfs @ 13.20 hrs, Volume= 0.190 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond AP-3 : South-western Property Lines

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 336.56' @ 13.20 hrs Surf.Area= 5,582 sf Storage= 1,048 cf

Plug-Flow detention time= 37.6 min calculated for 0.190 af (100% of inflow)
Center-of-Mass det. time= 37.6 min (1,026.2 - 988.7)

Volume	Invert	Avail.Storage	Storage Description
#1	336.20'	4,959 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

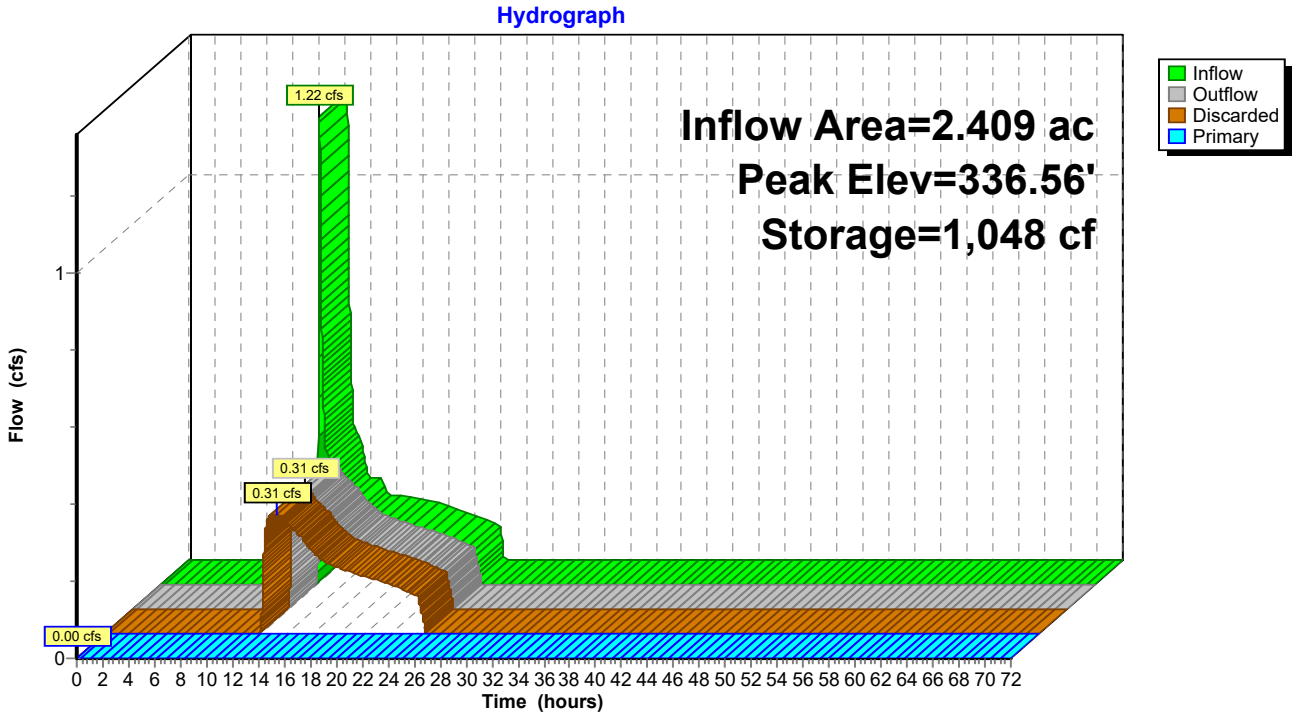
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
336.20	269	0	0
337.00	12,128	4,959	4,959

Device	Routing	Invert	Outlet Devices
#1	Primary	337.00'	**27.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Discarded	336.20'	**2.410 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.31 cfs @ 13.20 hrs HW=336.56' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.31 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=336.20' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond EP-1: Western Depression



Events for Subcatchment EX-1: Subcat EX-1

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.36	0.00	0.000	0.00
10-Year	5.22	0.06	0.048	0.17
25-Year	6.37	0.26	0.121	0.44
100-Year	**8.16**	**1.72**	**0.286**	**1.04**

Events for Subcatchment EX-2: Subcat EX-2

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.36	0.09	0.014	0.33
10-Year	5.22	0.65	0.048	1.16
25-Year	6.37	1.09	0.076	1.82
100-Year	**8.16**	**1.86**	**0.125**	**3.00**

Events for Subcatchment EX-3: Subcat EX-3

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.36	0.00	0.000	0.00
10-Year	5.22	0.04	0.029	0.14
25-Year	6.37	0.13	0.077	0.38
100-Year	**8.16**	**1.22**	**0.190**	**0.95**

Events for Subcatchment EX-4: Subcat EX-4

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.36	0.00	0.000	0.00
10-Year	5.22	0.00	0.001	0.04
25-Year	6.37	0.01	0.005	0.19
100-Year	**8.16**	**0.05**	**0.017**	**0.61**

Events for Subcatchment EX-5: Subcat EX-5

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.36	0.00	0.000	0.00
10-Year	5.22	0.00	0.000	0.01
25-Year	6.37	0.00	0.000	0.12
100-Year	**8.16**	**0.00**	**0.002**	**0.45**

Events for Pond AP-1: Northern Property Lines

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (acre-feet)
2-Year	0.00	0.00	**0.00**	**0.000**
10-Year	0.06	0.06	0.00	0.000
25-Year	0.26	0.26	0.00	0.000
100-Year	**1.72**	**1.72**	0.00	0.000

Events for Pond AP-2: Union St

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (acre-feet)
2-Year	0.09	0.09	**0.00**	**0.000**
10-Year	0.65	0.65	0.00	0.000
25-Year	1.10	1.10	0.00	0.000
100-Year	**2.59**	**2.59**	0.00	0.000

Events for Pond AP-3: South-western Property Lines

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (acre-feet)
2-Year	0.00	0.00	**0.00**	**0.000**
10-Year	0.00	0.00	0.00	0.000
25-Year	0.01	0.01	0.00	0.000
100-Year	**0.05**	**0.05**	0.00	0.000

Events for Pond AP-4: Small southern property line segment

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (acre-feet)
2-Year	0.00	0.00	**0.00**	**0.000**
10-Year	0.00	0.00	0.00	0.000
25-Year	0.00	0.00	0.00	0.000
100-Year	**0.00**	**0.00**	0.00	0.000

Events for Pond EP-1: Western Depression

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Year	0.00	0.00	0.00	**0.00**	336.20	0
10-Year	0.04	0.04	0.04	0.00	336.23	12
25-Year	0.13	0.11	0.11	0.00	336.31	122
100-Year	**1.22**	**0.31**	**0.31**	0.00	**336.56**	**1,048**

POST-DEVELOPMENT HYDROCAD CALCULATIONS

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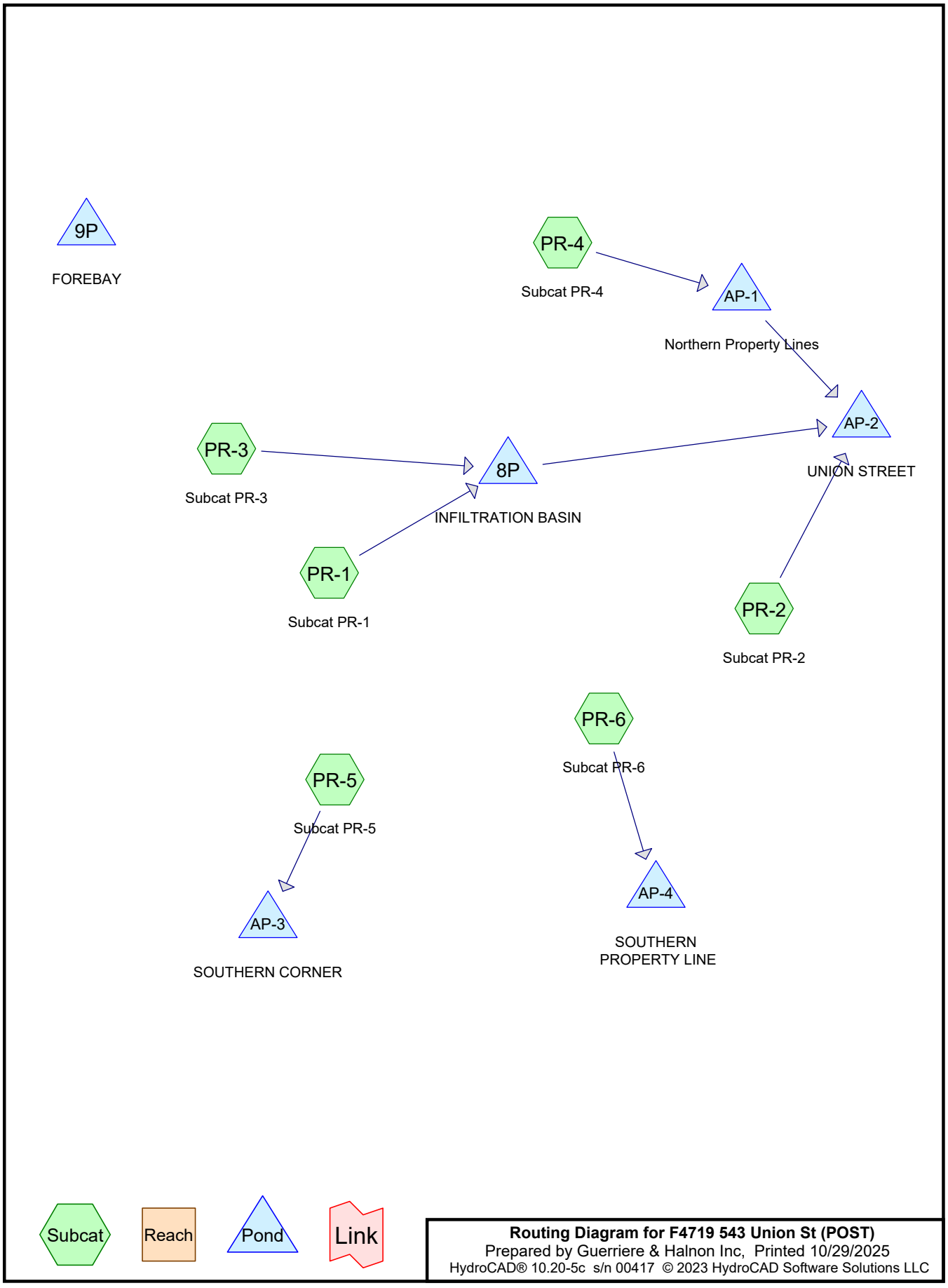


Routing Diagram for F4719 543 Union St (POST)
Prepared by Guerriere & Halnon Inc, Printed 10/29/2025

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NOAA10 24-hr	D	Default	24.00	1	3.36	2
2	10-Year	NOAA10 24-hr	D	Default	24.00	1	5.22	2
3	25-Year	NOAA10 24-hr	D	Default	24.00	1	6.37	2
4	100-Year	NOAA10 24-hr	D	Default	24.00	1	8.16	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.181	54	1/2 acre lots, 25% imp, HSG A (PR-1, PR-2)
3.588	39	>75% Grass cover, Good, HSG A (PR-1, PR-2, PR-3, PR-4, PR-5, PR-6)
0.226	30	Meadow, non-grazed, HSG A (PR-1, PR-2)
0.371	98	Paved parking, HSG A (PR-1, PR-2, PR-3)
0.446	98	Paved roads w/curbs & sewers, HSG A (PR-1, PR-2)
0.337	98	Roofs, HSG A (PR-1, PR-2, PR-3)
0.117	98	Unconnected pavement, HSG A (PR-1, PR-2)
0.234	98	Water Surface, HSG A (PR-1)
1.070	30	Woods, Good, HSG A (PR-1, PR-3, PR-4, PR-5, PR-6)
6.569	**51**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
6.569	HSG A	PR-1, PR-2, PR-3, PR-4, PR-5, PR-6
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
6.569		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.181	0.000	0.000	0.000	0.000	0.181	1/2 acre lots, 25% imp	PR-1, PR-2
3.588	0.000	0.000	0.000	0.000	3.588	>75% Grass cover, Good	PR-1, PR-2, PR-3, PR-4, PR-5, PR-6
0.226	0.000	0.000	0.000	0.000	0.226	Meadow, non-grazed	PR-1, PR-2
0.371	0.000	0.000	0.000	0.000	0.371	Paved parking	PR-1, PR-2, PR-3
0.446	0.000	0.000	0.000	0.000	0.446	Paved roads w/curbs & sewers	PR-1, PR-2
0.337	0.000	0.000	0.000	0.000	0.337	Roofs	PR-1, PR-2, PR-3
0.117	0.000	0.000	0.000	0.000	0.117	Unconnected pavement	PR-1, PR-2
0.234	0.000	0.000	0.000	0.000	0.234	Water Surface	PR-1

Ground Covers (all nodes) (continued)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
1.070	0.000	0.000	0.000	0.000	1.070	Woods, Good	PR-1, PR-3, PR-4, PR-5, PR-6
6.569	**0.000**	**0.000**	**0.000**	**0.000**	**6.569**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	8P	323.22	323.10	23.1	0.0052	0.013	0.0	12.0	0.0	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR-1: Subcat PR-1 Runoff Area=4.003 ac 31.34% Impervious Runoff Depth=0.33"
Tc=6.0 min CN=56 Runoff=0.75 cfs 0.111 af

Subcatchment PR-2: Subcat PR-2 Runoff Area=0.504 ac 26.92% Impervious Runoff Depth=0.21"
Tc=6.0 min UI Adjusted CN=52 Runoff=0.02 cfs 0.009 af

Subcatchment PR-3: Subcat PR-3 Runoff Area=1.853 ac 8.54% Impervious Runoff Depth=0.02"
Tc=6.0 min CN=41 Runoff=0.01 cfs 0.002 af

Subcatchment PR-4: Subcat PR-4 Runoff Area=0.107 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=33 Runoff=0.00 cfs 0.000 af

Subcatchment PR-5: Subcat PR-5 Runoff Area=0.057 ac 0.00% Impervious Runoff Depth=0.00"
Tc=0.0 min CN=35 Runoff=0.00 cfs 0.000 af

Subcatchment PR-6: Subcat PR-6 Runoff Area=0.044 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af

Pond 8P: INFILTRATION BASIN Peak Elev=324.29' Storage=1,375 cf Inflow=0.75 cfs 0.113 af
Discarded=0.09 cfs 0.113 af Primary=0.00 cfs 0.000 af Outflow=0.09 cfs 0.113 af

Pond 9P: FOREBAY Peak Elev=0.00' Storage=0 cf

Pond AP-1: Northern Property Lines Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Pond AP-2: UNION STREET Inflow=0.02 cfs 0.009 af
Primary=0.02 cfs 0.009 af

Pond AP-3: SOUTHERN CORNER Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Pond AP-4: SOUTHERN PROPERTY LINE Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 6.569 ac Runoff Volume = 0.122 af Average Runoff Depth = 0.22"
76.42% Pervious = 5.020 ac 23.58% Impervious = 1.549 ac

Summary for Subcatchment PR-1: Subcat PR-1

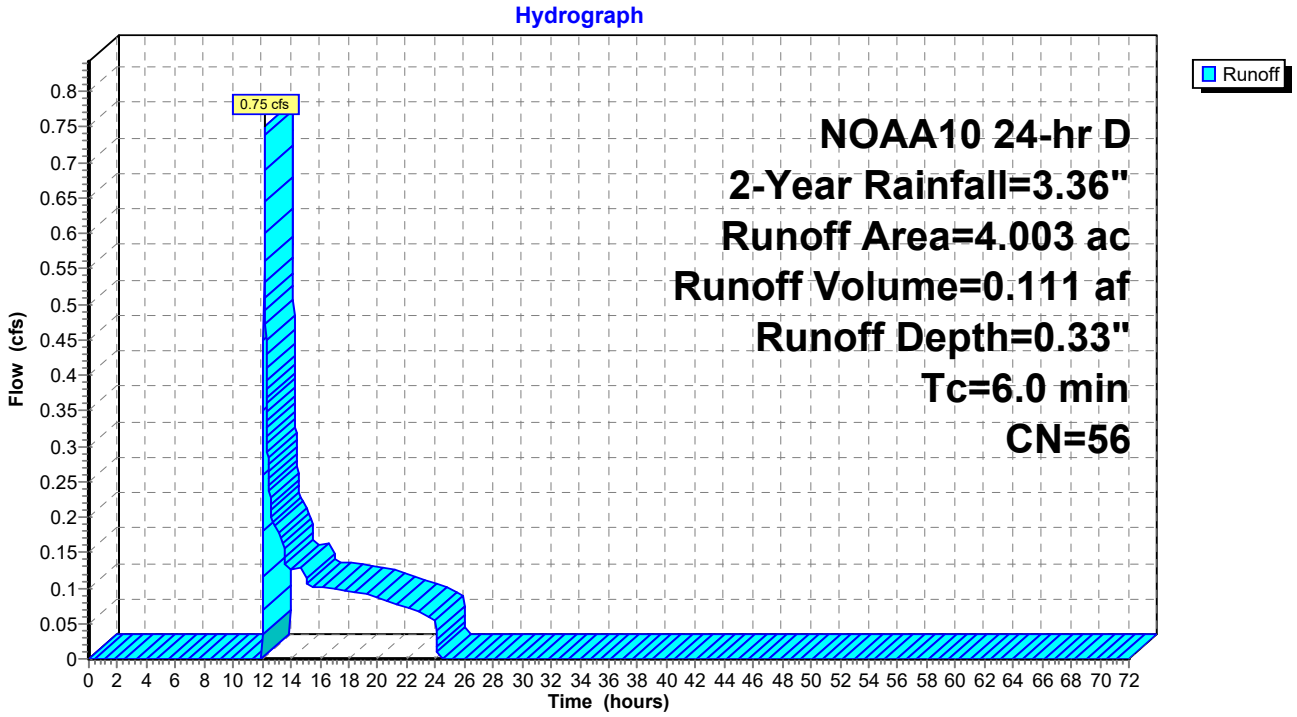
Runoff = 0.75 cfs @ 12.16 hrs, Volume= 0.111 af, Depth= 0.33"
Routed to Pond 8P : INFILTRATION BASIN

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.36"

Area (ac)	CN	Description
0.177	54	1/2 acre lots, 25% imp, HSG A
2.088	39	>75% Grass cover, Good, HSG A
0.146	30	Meadow, non-grazed, HSG A
0.314	98	Paved parking, HSG A
0.381	98	Paved roads w/curbs & sewers, HSG A
0.186	98	Roofs, HSG A
0.096	98	Unconnected pavement, HSG A
0.234	98	Water Surface, HSG A
0.382	30	Woods, Good, HSG A
4.003	56	Weighted Average
2.749		68.66% Pervious Area
1.255		31.34% Impervious Area
0.096		7.63% Unconnected

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

Subcatchment PR-1: Subcat PR-1



Summary for Subcatchment PR-2: Subcat PR-2

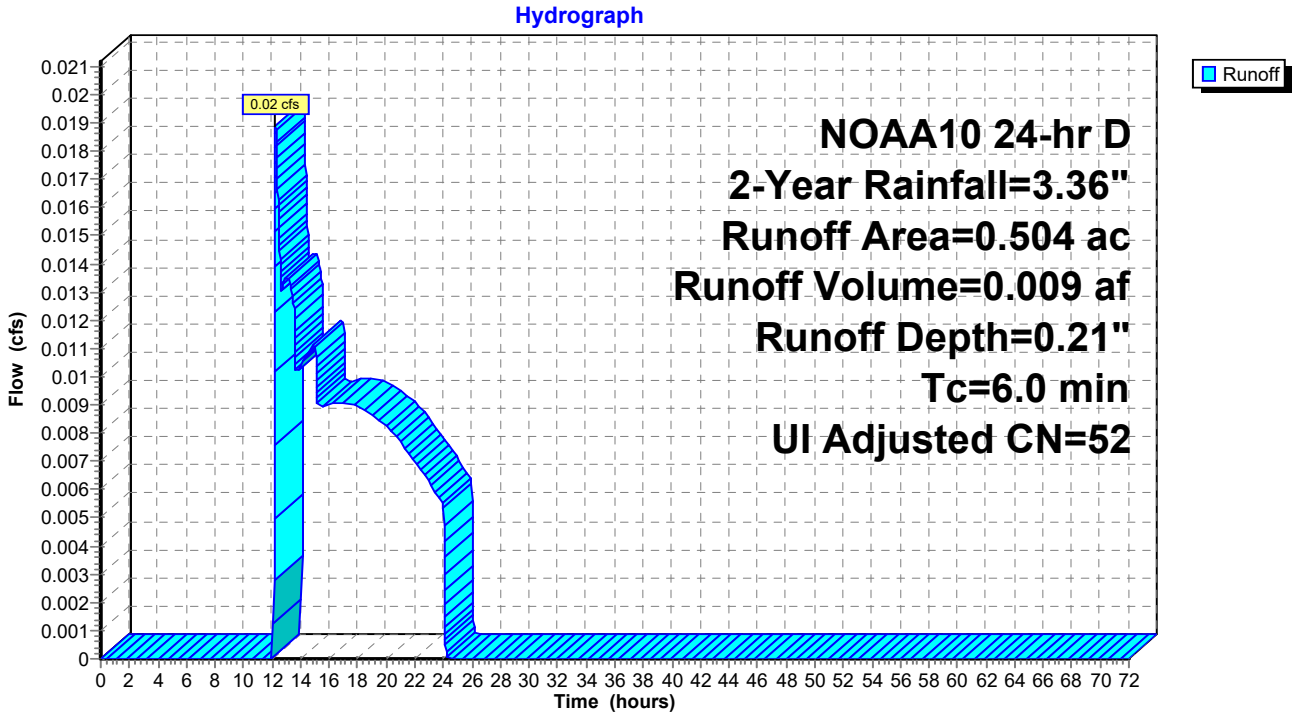
Runoff = 0.02 cfs @ 12.26 hrs, Volume= 0.009 af, Depth= 0.21"
Routed to Pond AP-2 : UNION STREET

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.36"

Area (ac)	CN	Adj	Description
0.004	54		1/2 acre lots, 25% imp, HSG A
0.285	39		>75% Grass cover, Good, HSG A
0.081	30		Meadow, non-grazed, HSG A
0.019	98		Paved parking, HSG A
0.065	98		Paved roads w/curbs & sewers, HSG A
0.030	98		Roofs, HSG A
0.021	98		Unconnected pavement, HSG A
0.504	53	52	Weighted Average, UI Adjusted
0.368			73.08% Pervious Area
0.136			26.92% Impervious Area
0.021			15.29% Unconnected

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

Subcatchment PR-2: Subcat PR-2



Summary for Subcatchment PR-3: Subcat PR-3

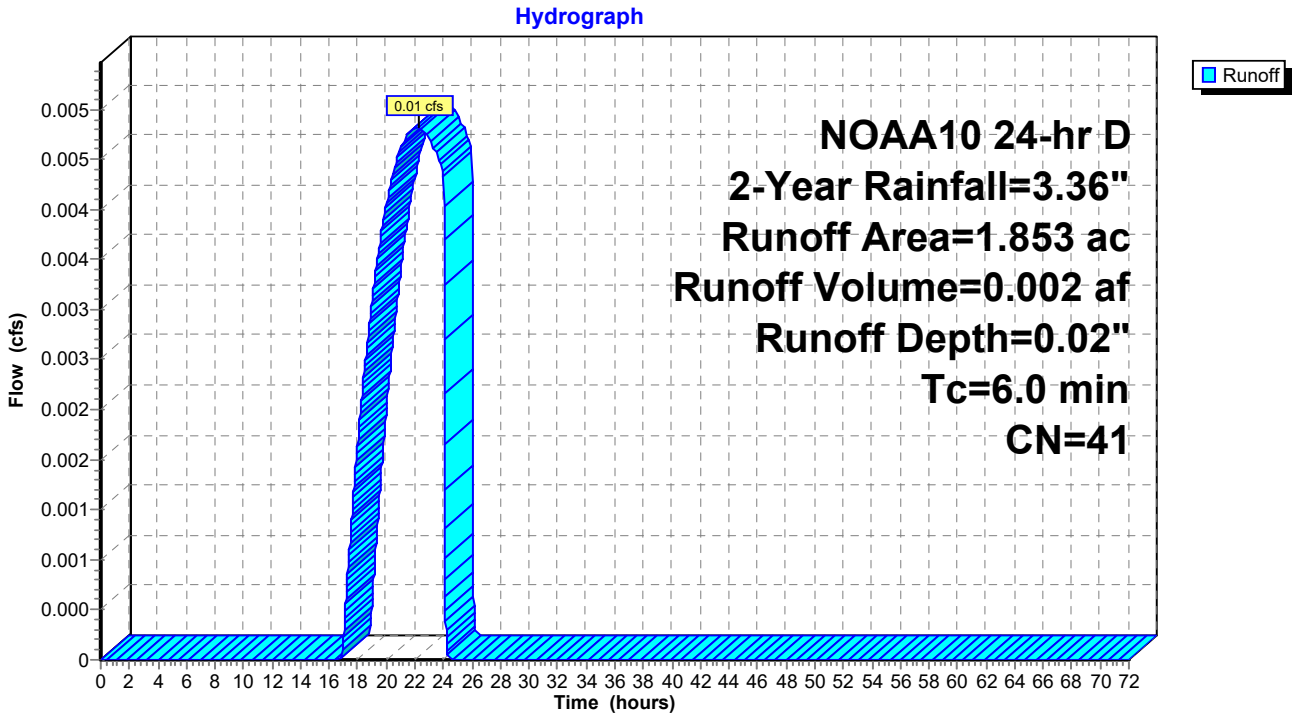
Runoff = 0.01 cfs @ 22.34 hrs, Volume= 0.002 af, Depth= 0.02"
Routed to Pond 8P : INFILTRATION BASIN

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.36"

Area (ac)	CN	Description
1.152	39	>75% Grass cover, Good, HSG A
0.038	98	Paved parking, HSG A
0.120	98	Roofs, HSG A
0.543	30	Woods, Good, HSG A
1.853	41	Weighted Average
1.695		91.46% Pervious Area
0.158		8.54% Impervious Area

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

Subcatchment PR-3: Subcat PR-3



Summary for Subcatchment PR-4: Subcat PR-4

[45] Hint: Runoff=Zero

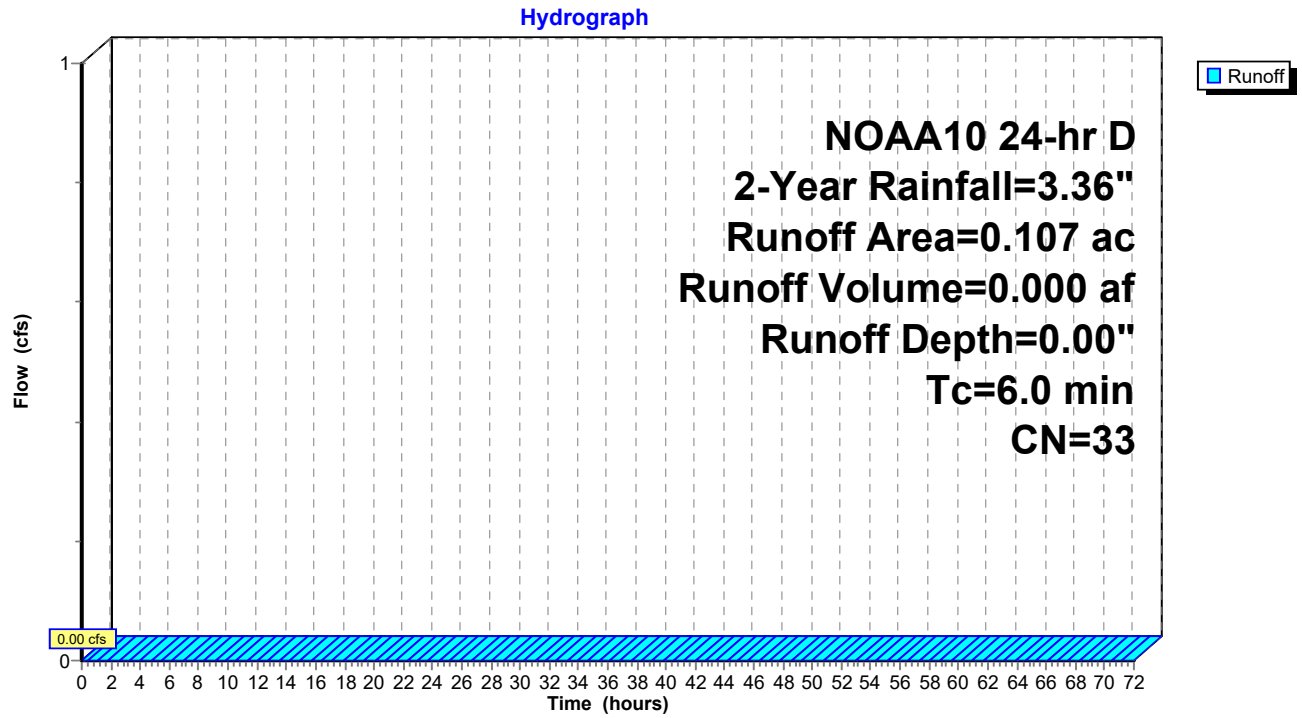
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Pond AP-1 : Northern Property Lines

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.36"

Area (ac)	CN	Description
0.031	39	>75% Grass cover, Good, HSG A
0.077	30	Woods, Good, HSG A
0.107	33	Weighted Average
0.107		100.00% Pervious Area

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

Subcatchment PR-4: Subcat PR-4



Summary for Subcatchment PR-5: Subcat PR-5

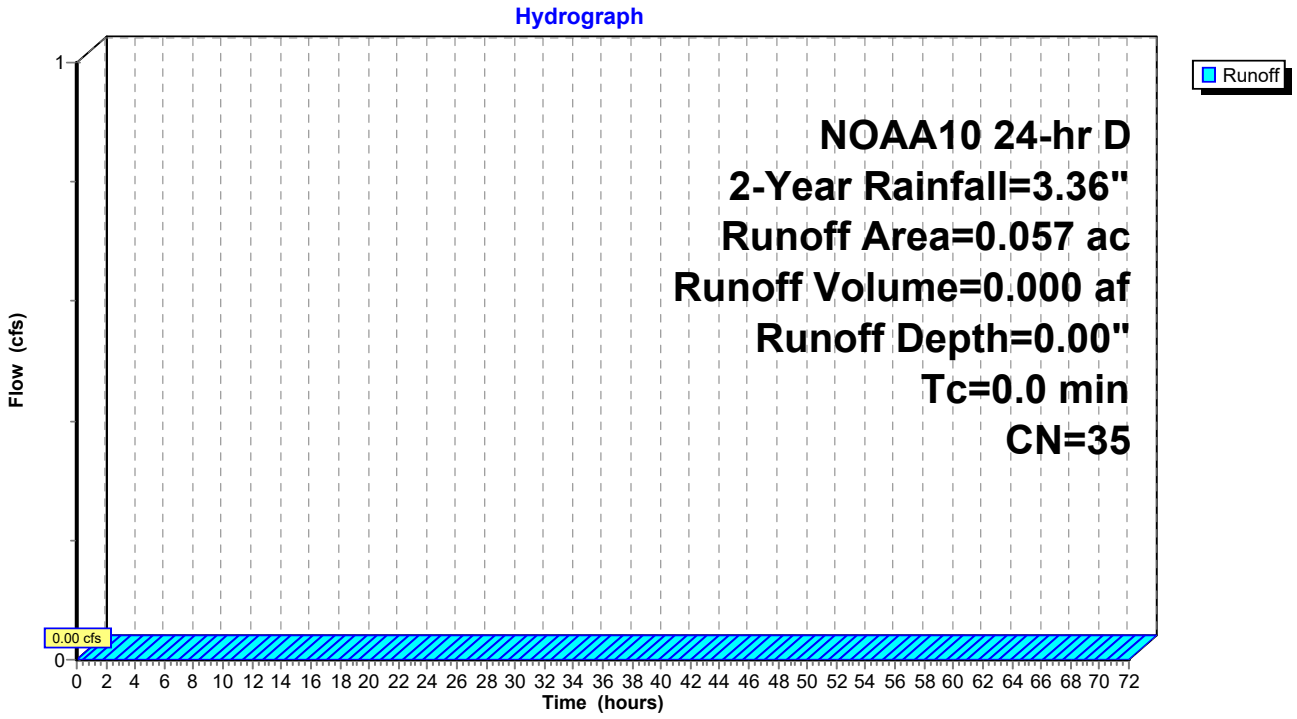
[46] Hint: Tc=0 (Instant runoff peak depends on dt)
[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Pond AP-3 : SOUTHERN CORNER

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.36"

Area (ac)	CN	Description
0.033	39	>75% Grass cover, Good, HSG A
0.024	30	Woods, Good, HSG A
0.057	35	Weighted Average
0.057		100.00% Pervious Area

Subcatchment PR-5: Subcat PR-5



Summary for Subcatchment PR-6: Subcat PR-6

[45] Hint: Runoff=Zero

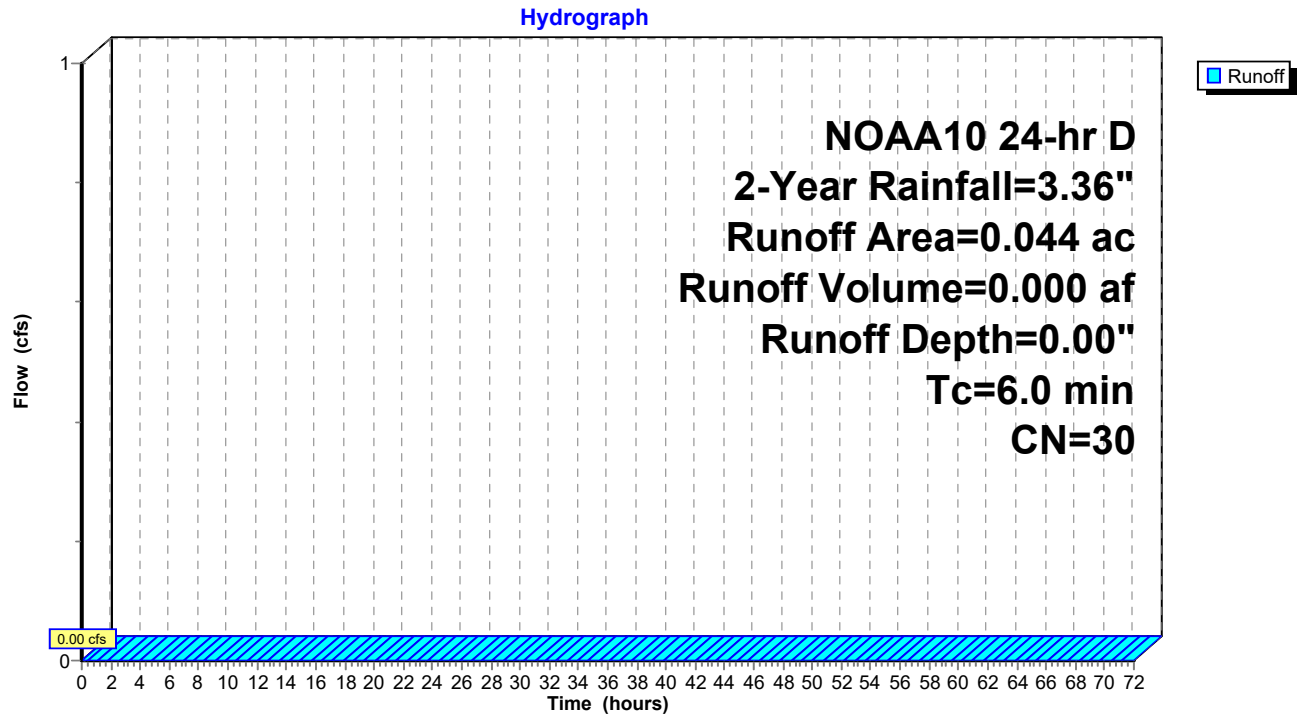
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Pond AP-4 : SOUTHERN PROPERTY LINE

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.36"

Area (ac)	CN	Description
0.000	39	>75% Grass cover, Good, HSG A
0.044	30	Woods, Good, HSG A
0.044	30	Weighted Average
0.044		100.00% Pervious Area

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

Subcatchment PR-6: Subcat PR-6



Summary for Pond 8P: INFILTRATION BASIN

Inflow Area = 5.857 ac, 24.13% Impervious, Inflow Depth = 0.23" for 2-Year event
Inflow = 0.75 cfs @ 12.16 hrs, Volume= 0.113 af
Outflow = 0.09 cfs @ 20.68 hrs, Volume= 0.113 af, Atten= 88%, Lag= 511.5 min
Discarded = 0.09 cfs @ 20.68 hrs, Volume= 0.113 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond AP-2 : UNION STREET

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 324.29' @ 20.68 hrs Surf.Area= 1,454 sf Storage= 1,375 cf

Plug-Flow detention time= 204.2 min calculated for 0.113 af (100% of inflow)
Center-of-Mass det. time= 204.2 min (1,208.1 - 1,003.9)

Volume	Invert	Avail.Storage	Storage Description
#1	324.00'	11,011 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	324.00'	28,569 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		39,579 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
324.00	1,367	0	0
325.00	1,670	1,519	1,519
326.00	1,999	1,835	3,353
327.00	2,354	2,177	5,530
328.00	2,734	2,544	8,074
329.00	3,140	2,937	11,011

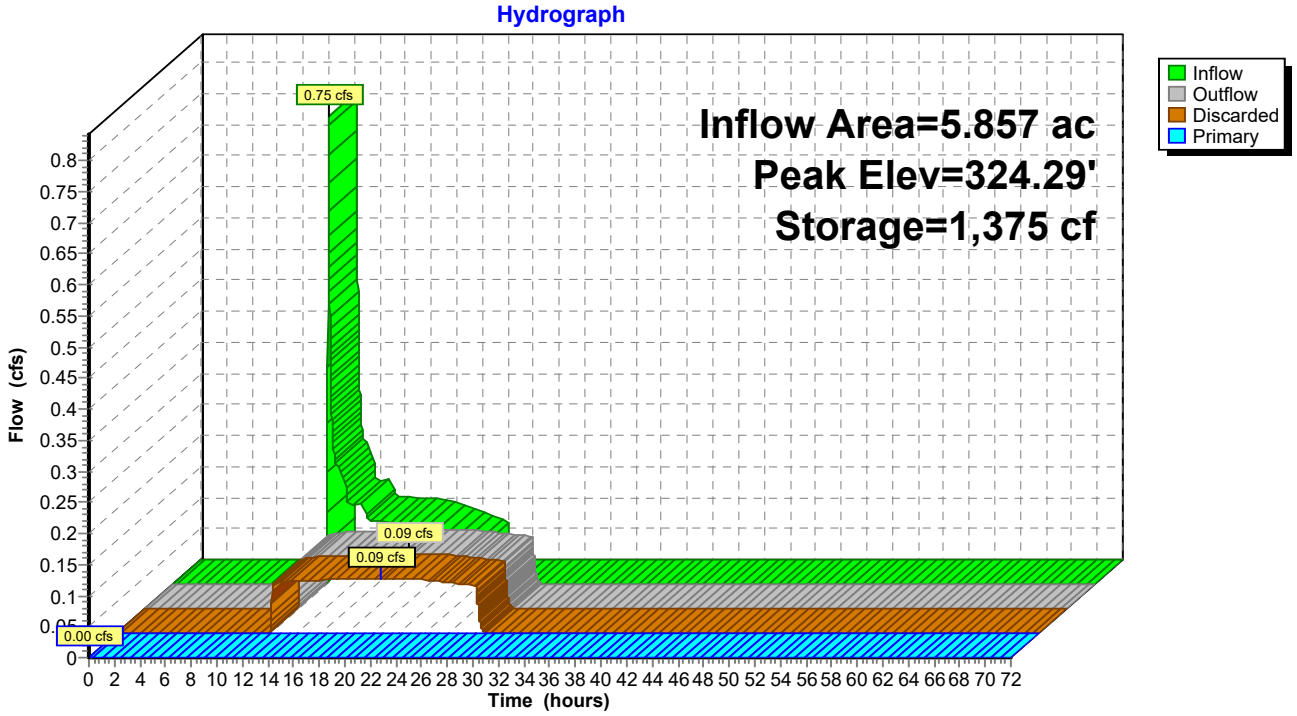
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
324.00	3,156	0	0
325.00	4,745	3,951	3,951
326.00	5,423	5,084	9,035
327.00	6,131	5,777	14,812
328.00	6,871	6,501	21,313
329.00	7,641	7,256	28,569

Device	Routing	Invert	Outlet Devices
#1	Discarded	324.00'	**2.420 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 320.00' Phase-In= 0.01'
#2	Device 3	328.20'	**24.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	323.22'	**12.0" Round Culvert** L= 23.1' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 323.22' / 323.10' S= 0.0052 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Discarded OutFlow Max=0.09 cfs @ 20.68 hrs HW=324.29' (Free Discharge)
└**1=Exfiltration** (Controls 0.09 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=324.00' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Passes 0.00 cfs of 1.47 cfs potential flow)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 8P: INFILTRATION BASIN



Summary for Pond 9P: FOREBAY

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	324.00'	583 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
324.00	490	0	0
325.00	676	583	583

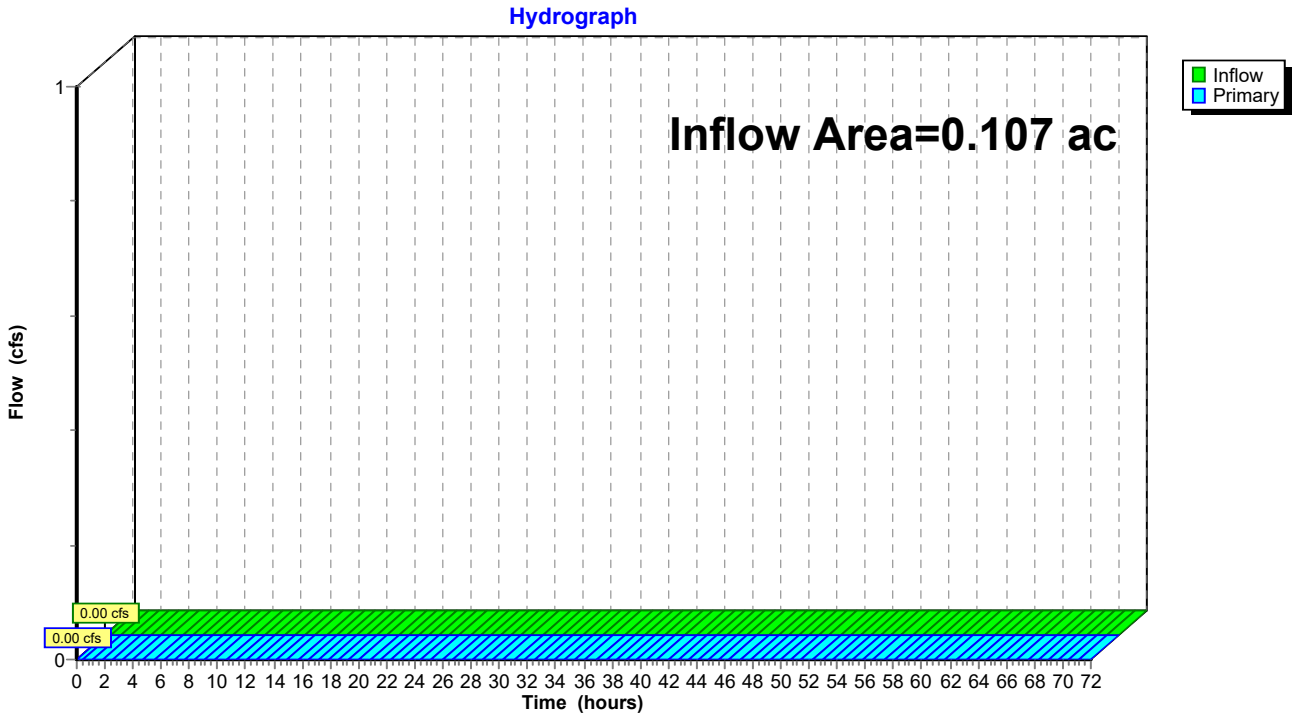
Summary for Pond AP-1: Northern Property Lines

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.107 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Routed to Pond AP-2 : UNION STREET

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-1: Northern Property Lines



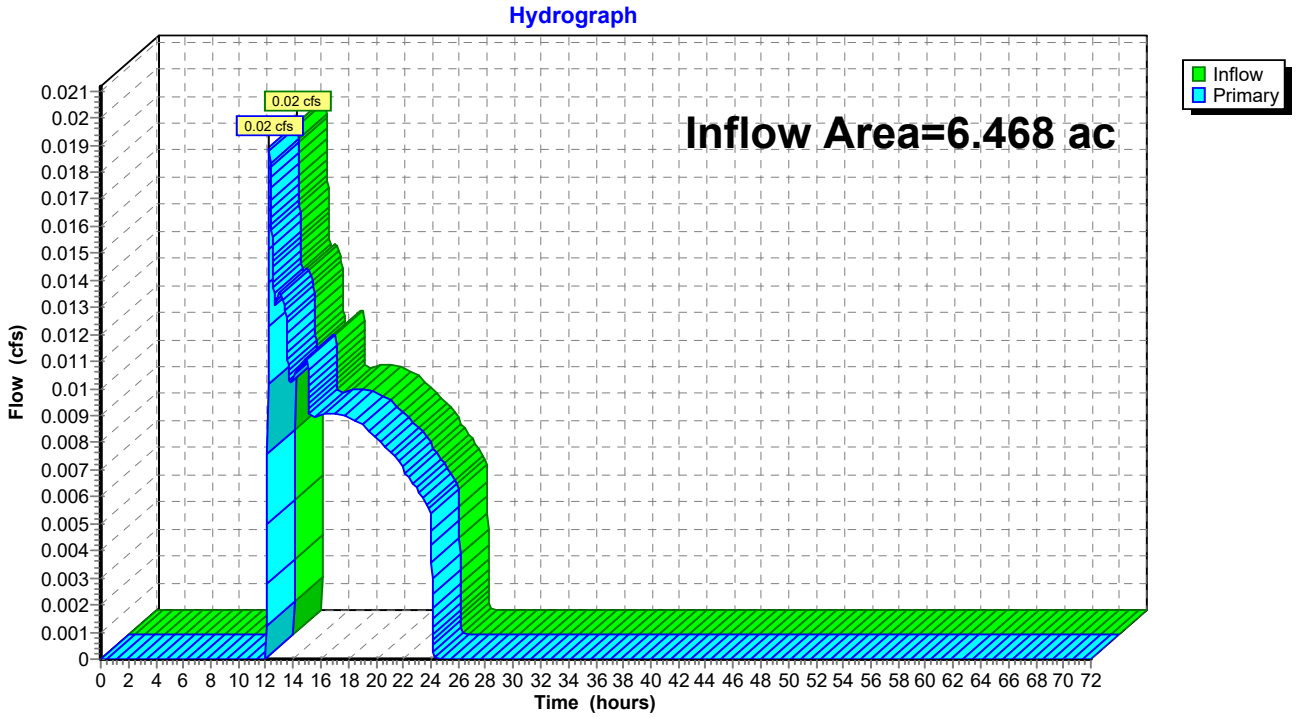
Summary for Pond AP-2: UNION STREET

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.468 ac, 23.95% Impervious, Inflow Depth = 0.02" for 2-Year event
Inflow = 0.02 cfs @ 12.26 hrs, Volume= 0.009 af
Primary = 0.02 cfs @ 12.26 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-2: UNION STREET



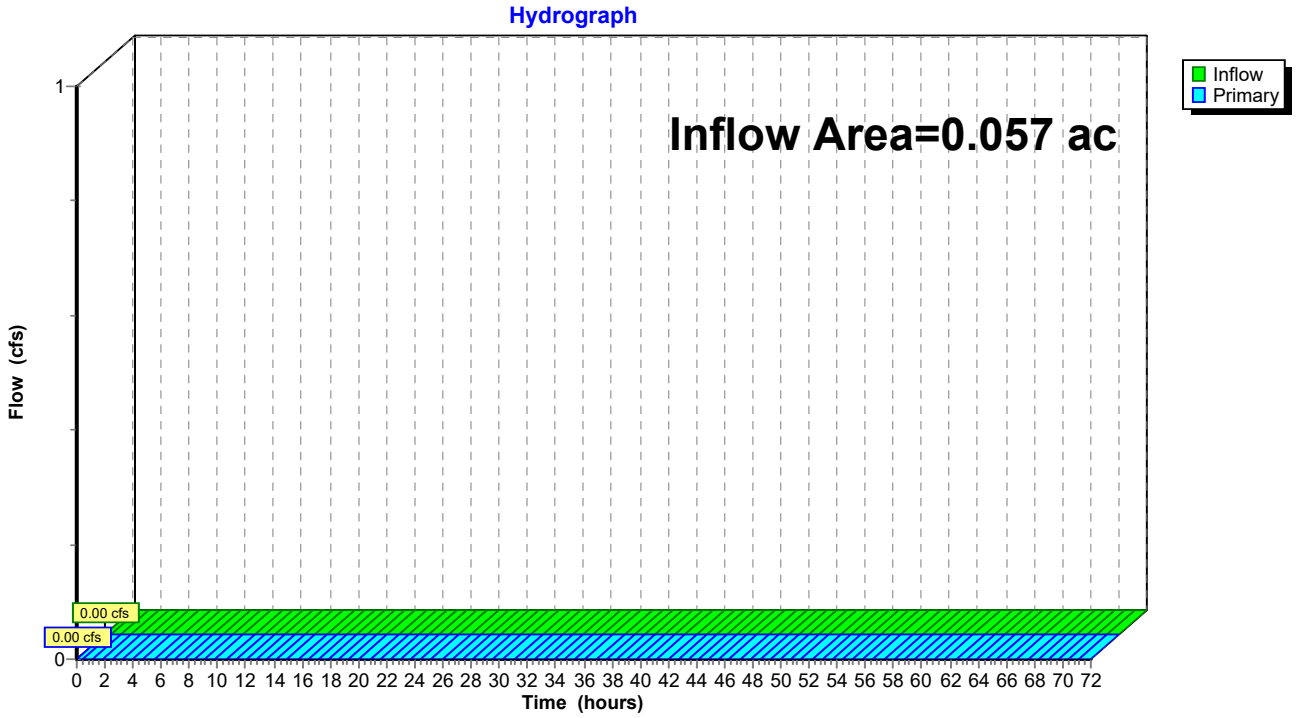
Summary for Pond AP-3: SOUTHERN CORNER

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.057 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-3: SOUTHERN CORNER



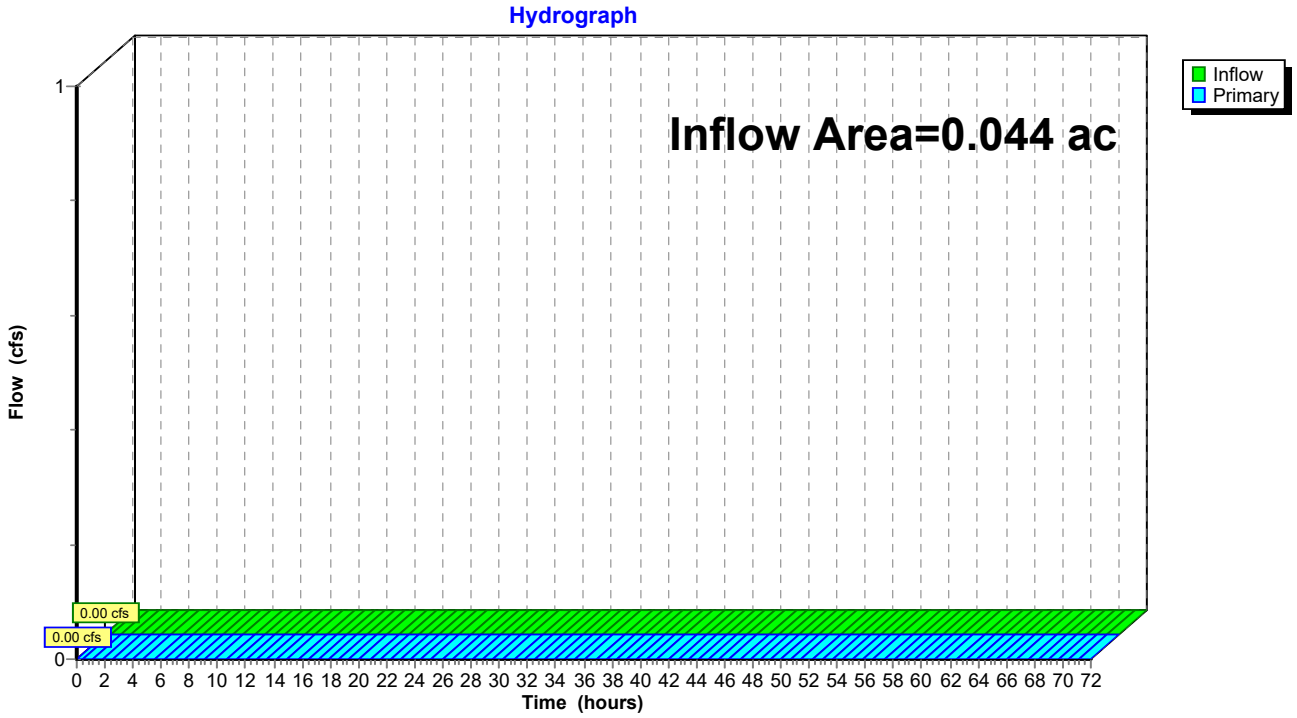
Summary for Pond AP-4: SOUTHERN PROPERTY LINE

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.044 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-4: SOUTHERN PROPERTY LINE



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR-1: Subcat PR-1 Runoff Area=4.003 ac 31.34% Impervious Runoff Depth=1.16"
Tc=6.0 min CN=56 Runoff=5.19 cfs 0.386 af

Subcatchment PR-2: Subcat PR-2 Runoff Area=0.504 ac 26.92% Impervious Runoff Depth=0.90"
Tc=6.0 min UI Adjusted CN=52 Runoff=0.46 cfs 0.038 af

Subcatchment PR-3: Subcat PR-3 Runoff Area=1.853 ac 8.54% Impervious Runoff Depth=0.33"
Tc=6.0 min CN=41 Runoff=0.10 cfs 0.051 af

Subcatchment PR-4: Subcat PR-4 Runoff Area=0.107 ac 0.00% Impervious Runoff Depth=0.06"
Tc=6.0 min CN=33 Runoff=0.00 cfs 0.001 af

Subcatchment PR-5: Subcat PR-5 Runoff Area=0.057 ac 0.00% Impervious Runoff Depth=0.11"
Tc=0.0 min CN=35 Runoff=0.00 cfs 0.001 af

Subcatchment PR-6: Subcat PR-6 Runoff Area=0.044 ac 0.00% Impervious Runoff Depth=0.01"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af

Pond 8P: INFILTRATION BASIN Peak Elev=326.03' Storage=12,640 cf Inflow=5.23 cfs 0.437 af
Discarded=0.16 cfs 0.437 af Primary=0.00 cfs 0.000 af Outflow=0.16 cfs 0.437 af

Pond 9P: FOREBAY Peak Elev=0.00' Storage=0 cf

Pond AP-1: Northern Property Lines Inflow=0.00 cfs 0.001 af
Primary=0.00 cfs 0.001 af

Pond AP-2: UNION STREET Inflow=0.46 cfs 0.038 af
Primary=0.46 cfs 0.038 af

Pond AP-3: SOUTHERN CORNER Inflow=0.00 cfs 0.001 af
Primary=0.00 cfs 0.001 af

Pond AP-4: SOUTHERN PROPERTY LINE Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 6.569 ac Runoff Volume = 0.476 af Average Runoff Depth = 0.87"
76.42% Pervious = 5.020 ac 23.58% Impervious = 1.549 ac

Summary for Subcatchment PR-1: Subcat PR-1

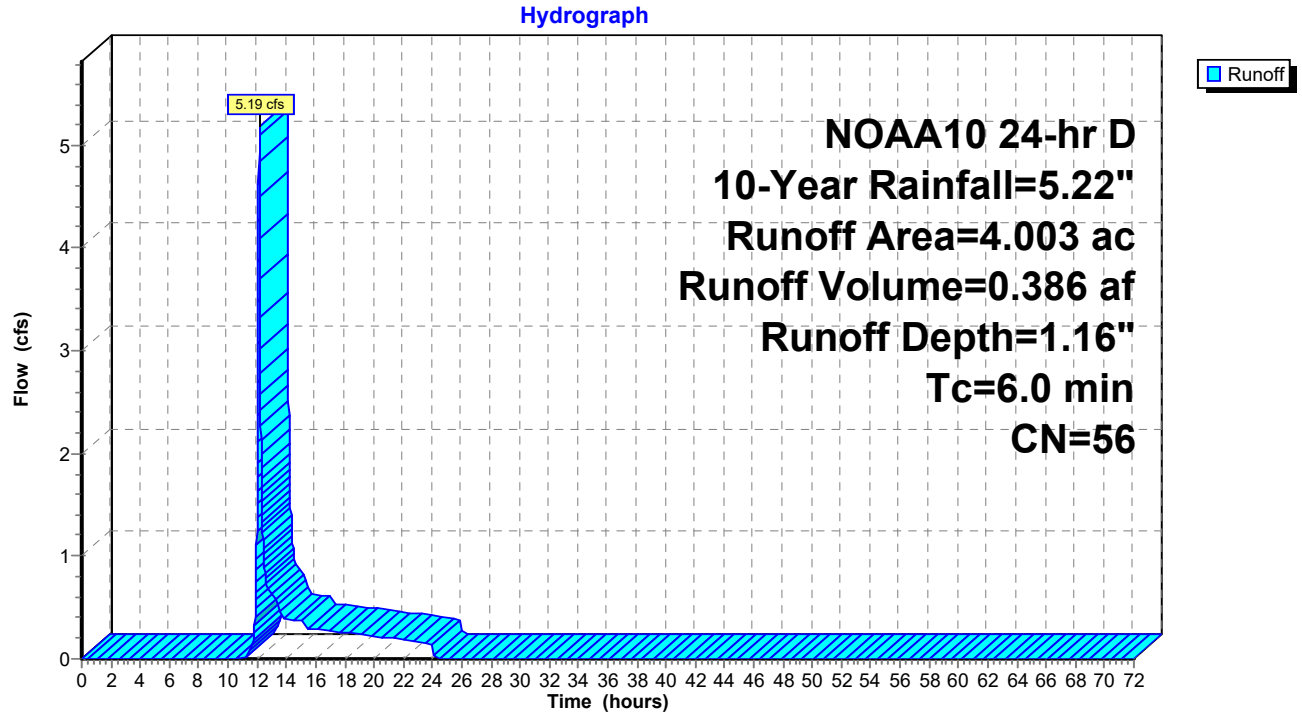
Runoff = 5.19 cfs @ 12.14 hrs, Volume= 0.386 af, Depth= 1.16"
Routed to Pond 8P : INFILTRATION BASIN

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.22"

Area (ac)	CN	Description
0.177	54	1/2 acre lots, 25% imp, HSG A
2.088	39	>75% Grass cover, Good, HSG A
0.146	30	Meadow, non-grazed, HSG A
0.314	98	Paved parking, HSG A
0.381	98	Paved roads w/curbs & sewers, HSG A
0.186	98	Roofs, HSG A
0.096	98	Unconnected pavement, HSG A
0.234	98	Water Surface, HSG A
0.382	30	Woods, Good, HSG A
4.003	56	Weighted Average
2.749		68.66% Pervious Area
1.255		31.34% Impervious Area
0.096		7.63% Unconnected

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

Subcatchment PR-1: Subcat PR-1



Summary for Subcatchment PR-2: Subcat PR-2

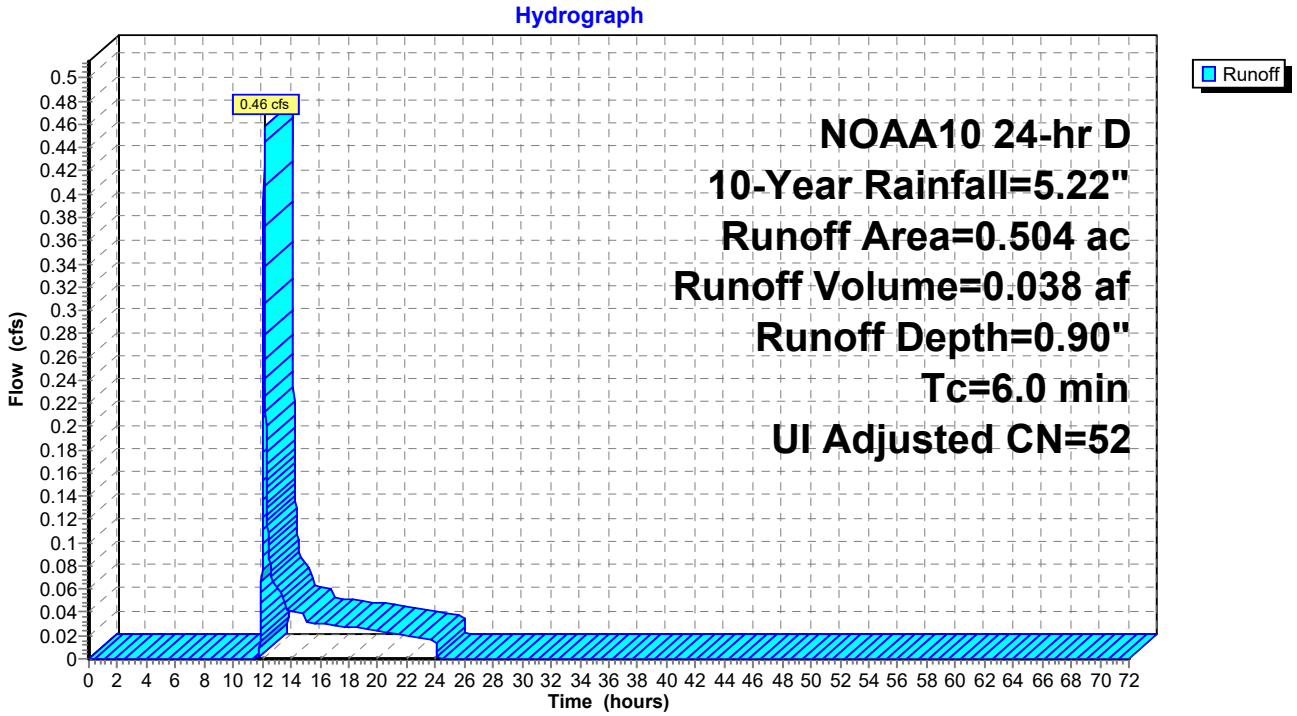
Runoff = 0.46 cfs @ 12.14 hrs, Volume= 0.038 af, Depth= 0.90"
Routed to Pond AP-2 : UNION STREET

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.22"

Area (ac)	CN	Adj	Description
0.004	54		1/2 acre lots, 25% imp, HSG A
0.285	39		>75% Grass cover, Good, HSG A
0.081	30		Meadow, non-grazed, HSG A
0.019	98		Paved parking, HSG A
0.065	98		Paved roads w/curbs & sewers, HSG A
0.030	98		Roofs, HSG A
0.021	98		Unconnected pavement, HSG A
0.504	53	52	Weighted Average, UI Adjusted
0.368			73.08% Pervious Area
0.136			26.92% Impervious Area
0.021			15.29% Unconnected

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

Subcatchment PR-2: Subcat PR-2



Summary for Subcatchment PR-3: Subcat PR-3

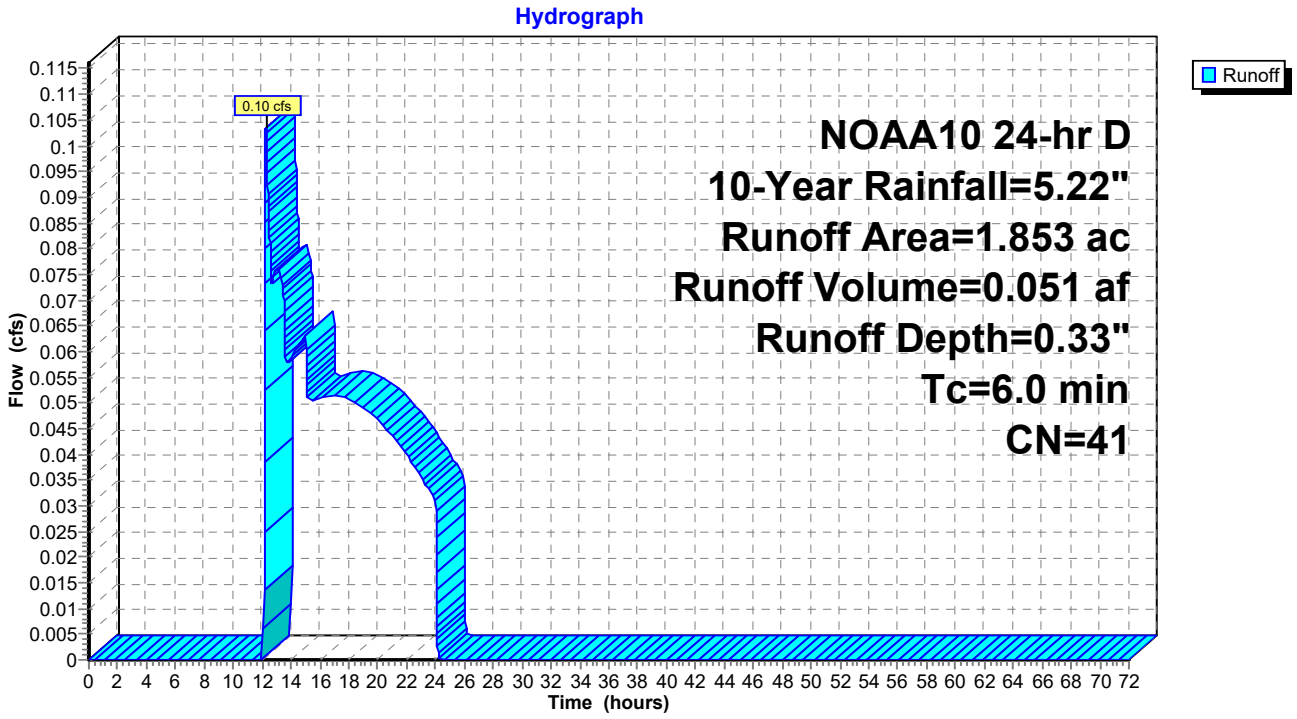
Runoff = 0.10 cfs @ 12.26 hrs, Volume= 0.051 af, Depth= 0.33"
Routed to Pond 8P : INFILTRATION BASIN

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.22"

Area (ac)	CN	Description
1.152	39	>75% Grass cover, Good, HSG A
0.038	98	Paved parking, HSG A
0.120	98	Roofs, HSG A
0.543	30	Woods, Good, HSG A
1.853	41	Weighted Average
1.695		91.46% Pervious Area
0.158		8.54% Impervious Area

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

Subcatchment PR-3: Subcat PR-3



Summary for Subcatchment PR-4: Subcat PR-4

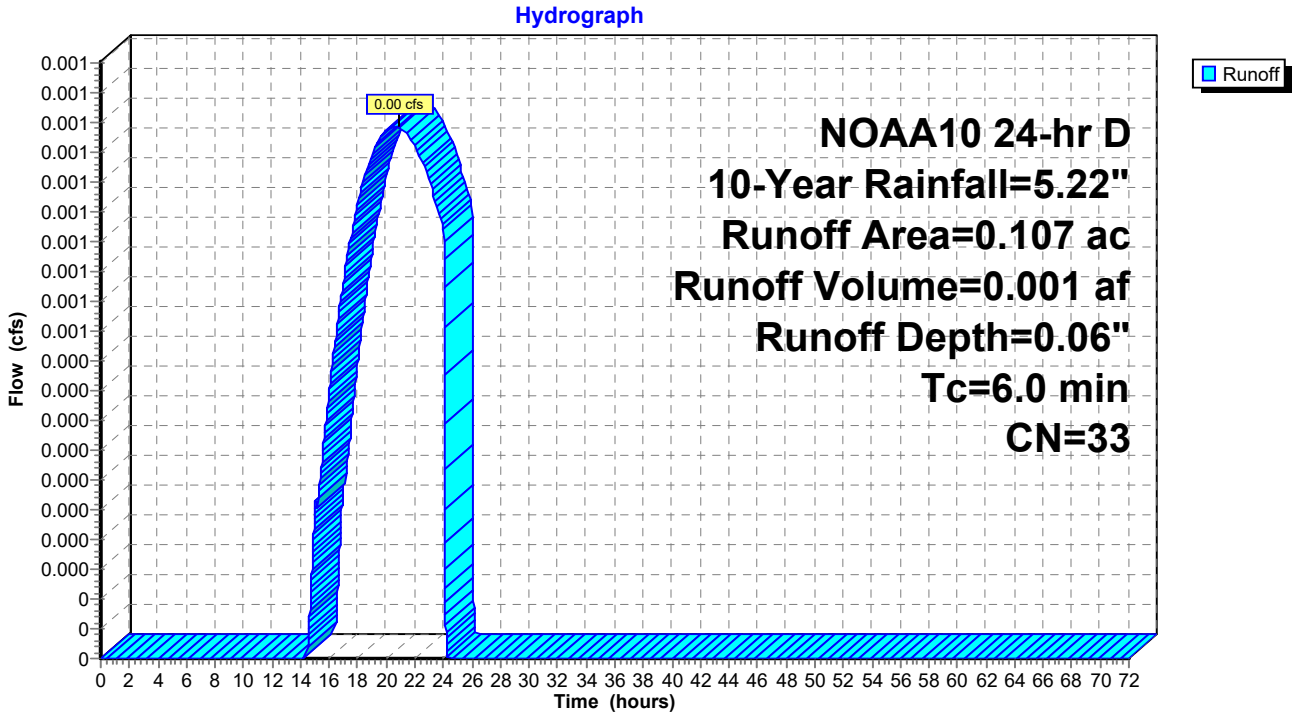
Runoff = 0.00 cfs @ 20.83 hrs, Volume= 0.001 af, Depth= 0.06"
Routed to Pond AP-1 : Northern Property Lines

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.22"

Area (ac)	CN	Description
0.031	39	>75% Grass cover, Good, HSG A
0.077	30	Woods, Good, HSG A
0.107	33	Weighted Average
0.107		100.00% Pervious Area

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

Subcatchment PR-4: Subcat PR-4



Summary for Subcatchment PR-5: Subcat PR-5

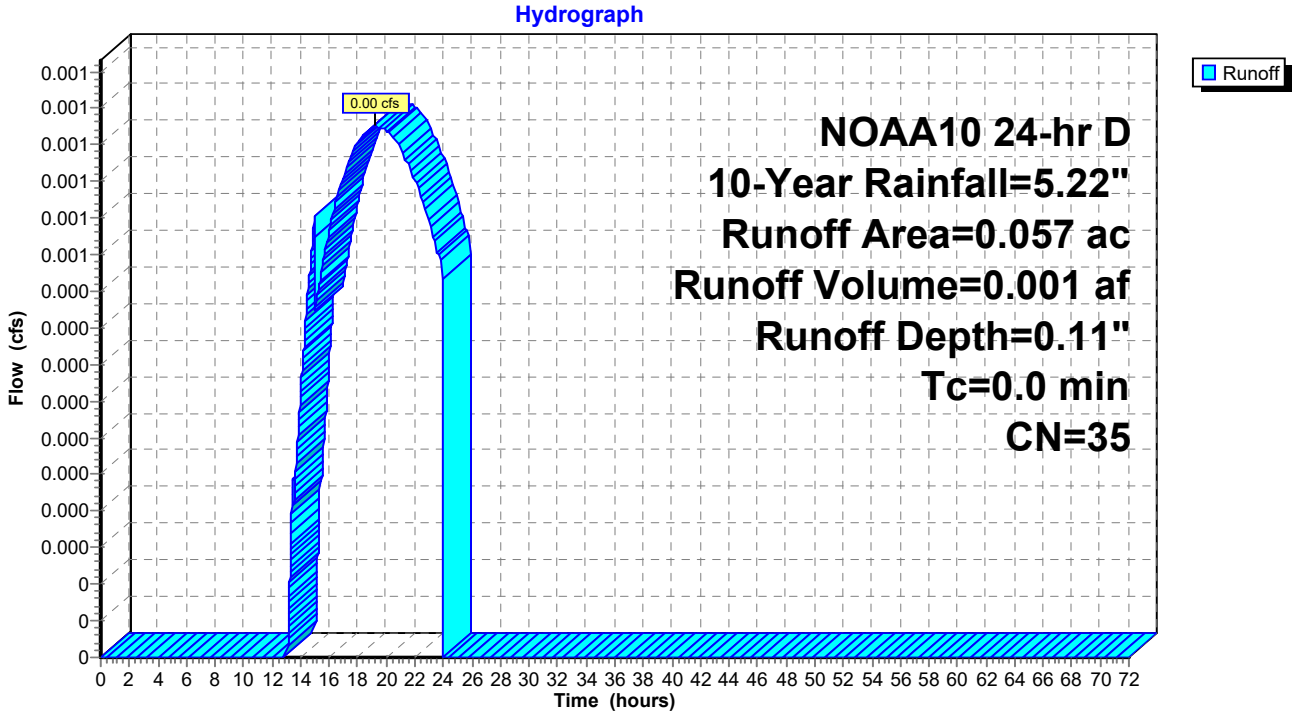
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.00 cfs @ 19.19 hrs, Volume= 0.001 af, Depth= 0.11"
Routed to Pond AP-3 : SOUTHERN CORNER

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.22"

Area (ac)	CN	Description
0.033	39	>75% Grass cover, Good, HSG A
0.024	30	Woods, Good, HSG A
0.057	35	Weighted Average
0.057		100.00% Pervious Area

Subcatchment PR-5: Subcat PR-5



Summary for Subcatchment PR-6: Subcat PR-6

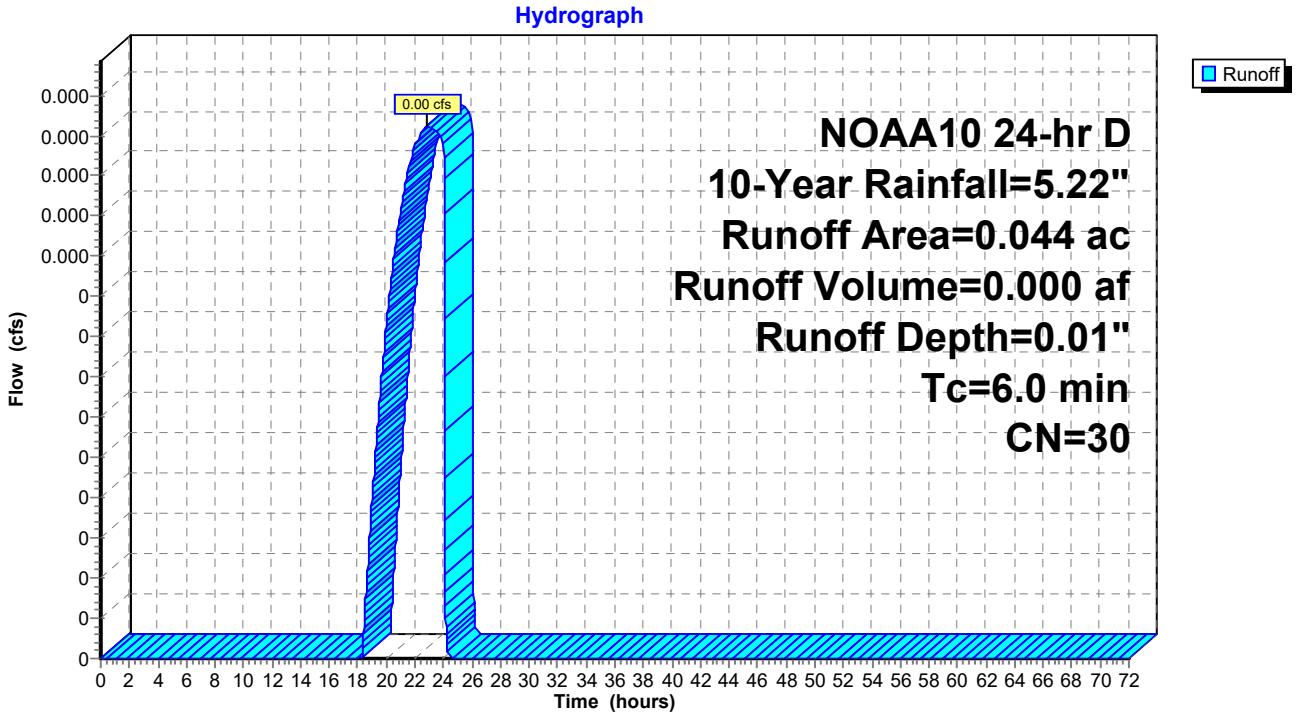
Runoff = 0.00 cfs @ 22.85 hrs, Volume= 0.000 af, Depth= 0.01"
Routed to Pond AP-4 : SOUTHERN PROPERTY LINE

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.22"

Area (ac)	CN	Description
0.000	39	>75% Grass cover, Good, HSG A
0.044	30	Woods, Good, HSG A
0.044	30	Weighted Average
0.044		100.00% Pervious Area

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

Subcatchment PR-6: Subcat PR-6



Summary for Pond 8P: INFILTRATION BASIN

Inflow Area = 5.857 ac, 24.13% Impervious, Inflow Depth = 0.89" for 10-Year event
Inflow = 5.23 cfs @ 12.14 hrs, Volume= 0.437 af
Outflow = 0.16 cfs @ 24.04 hrs, Volume= 0.437 af, Atten= 97%, Lag= 713.7 min
Discarded = 0.16 cfs @ 24.04 hrs, Volume= 0.437 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond AP-2 : UNION STREET

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 326.03' @ 24.04 hrs Surf.Area= 2,011 sf Storage= 12,640 cf

Plug-Flow detention time= 921.6 min calculated for 0.437 af (100% of inflow)
Center-of-Mass det. time= 921.7 min (1,866.4 - 944.7)

Volume	Invert	Avail.Storage	Storage Description
#1	324.00'	11,011 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	324.00'	28,569 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		39,579 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
324.00	1,367	0	0
325.00	1,670	1,519	1,519
326.00	1,999	1,835	3,353
327.00	2,354	2,177	5,530
328.00	2,734	2,544	8,074
329.00	3,140	2,937	11,011

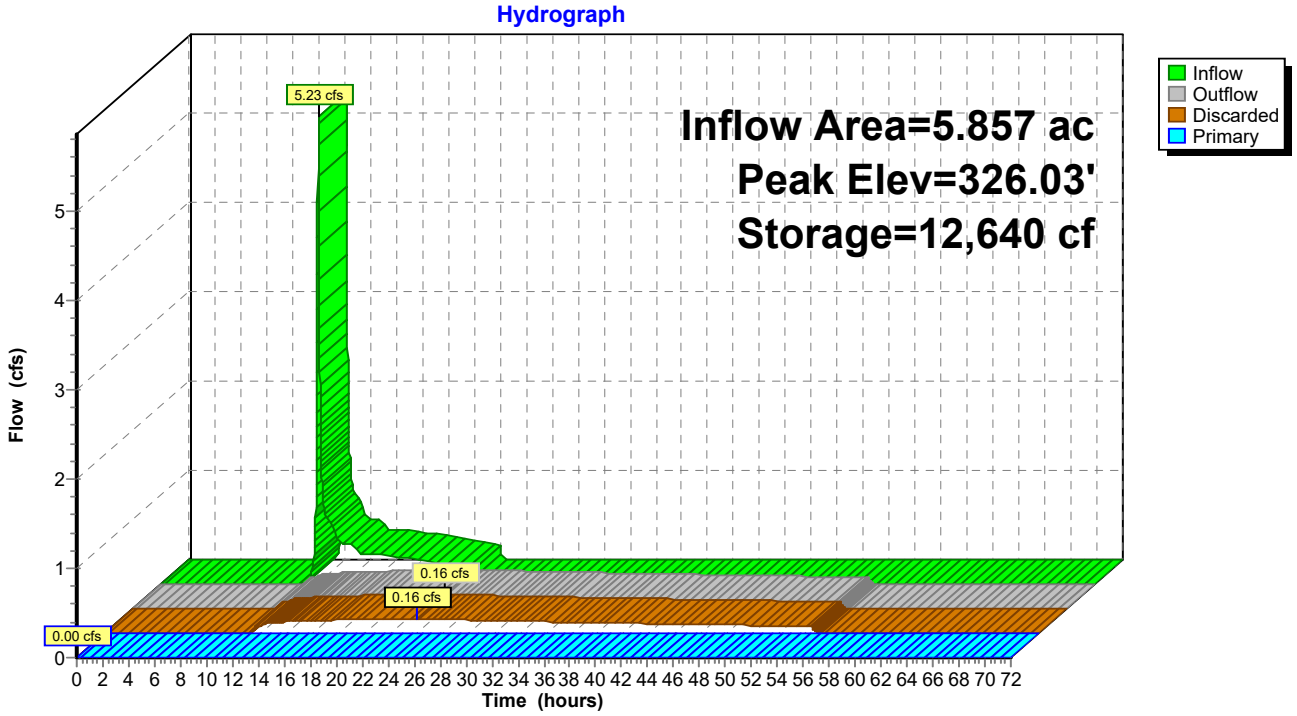
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
324.00	3,156	0	0
325.00	4,745	3,951	3,951
326.00	5,423	5,084	9,035
327.00	6,131	5,777	14,812
328.00	6,871	6,501	21,313
329.00	7,641	7,256	28,569

Device	Routing	Invert	Outlet Devices
#1	Discarded	324.00'	**2.420 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 320.00' Phase-In= 0.01'
#2	Device 3	328.20'	**24.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	323.22'	**12.0" Round Culvert** L= 23.1' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 323.22' / 323.10' S= 0.0052 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Discarded OutFlow Max=0.16 cfs @ 24.04 hrs HW=326.03' (Free Discharge)
└**1=Exfiltration** (Controls 0.16 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=324.00' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Passes 0.00 cfs of 1.47 cfs potential flow)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 8P: INFILTRATION BASIN



Summary for Pond 9P: FOREBAY

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	324.00'	583 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
324.00	490	0	0
325.00	676	583	583

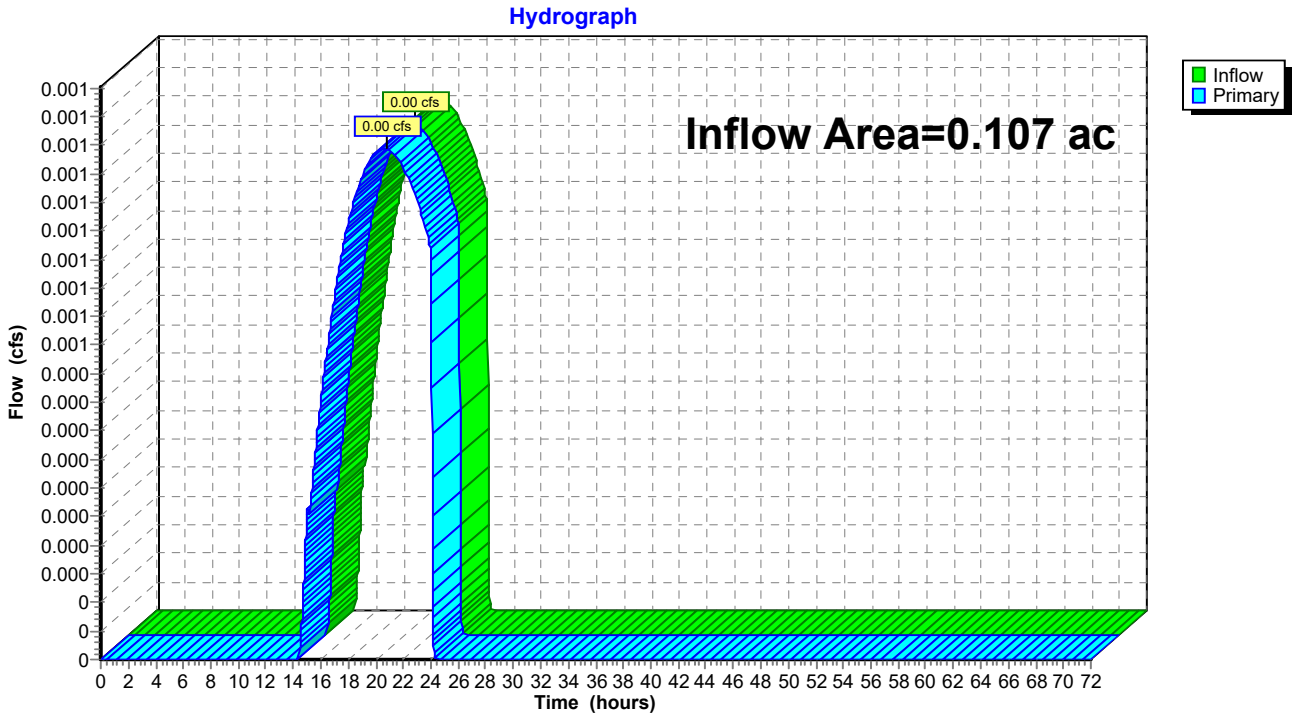
Summary for Pond AP-1: Northern Property Lines

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.107 ac, 0.00% Impervious, Inflow Depth = 0.06" for 10-Year event
Inflow = 0.00 cfs @ 20.83 hrs, Volume= 0.001 af
Primary = 0.00 cfs @ 20.83 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min
Routed to Pond AP-2 : UNION STREET

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-1: Northern Property Lines



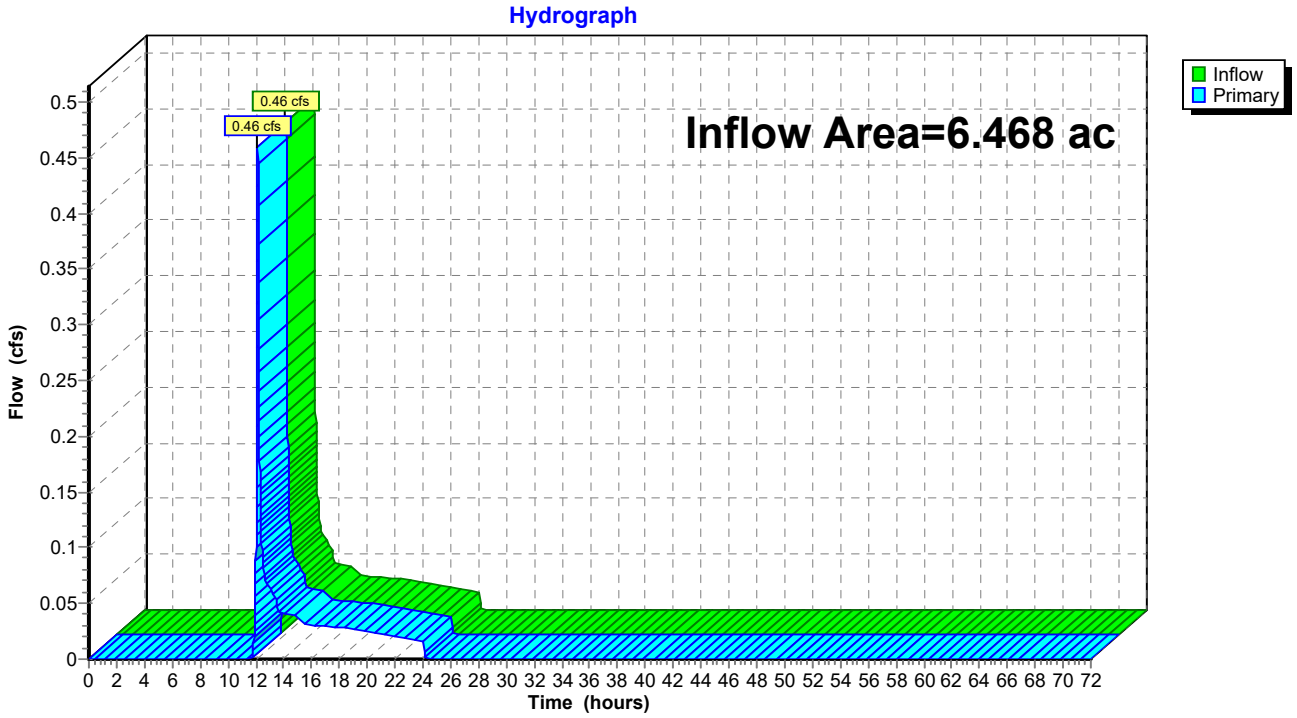
Summary for Pond AP-2: UNION STREET

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.468 ac, 23.95% Impervious, Inflow Depth = 0.07" for 10-Year event
Inflow = 0.46 cfs @ 12.14 hrs, Volume= 0.038 af
Primary = 0.46 cfs @ 12.14 hrs, Volume= 0.038 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-2: UNION STREET



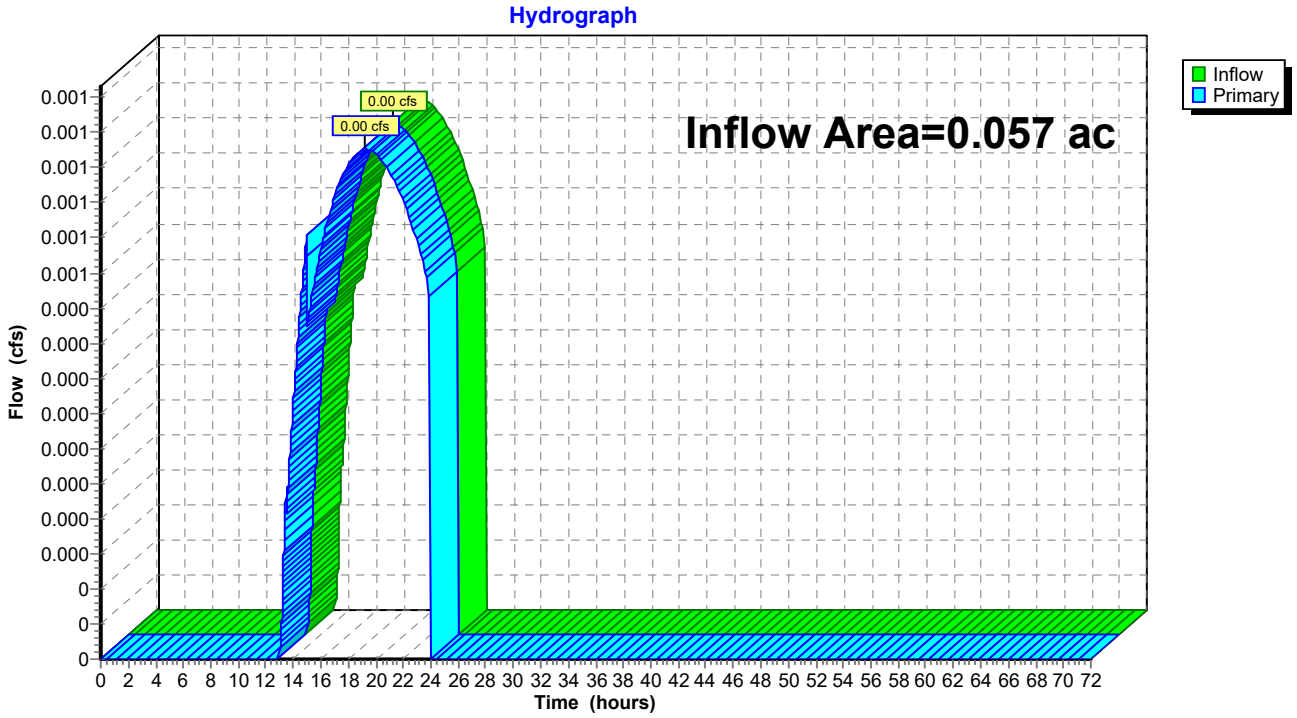
Summary for Pond AP-3: SOUTHERN CORNER

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.057 ac, 0.00% Impervious, Inflow Depth = 0.11" for 10-Year event
Inflow = 0.00 cfs @ 19.19 hrs, Volume= 0.001 af
Primary = 0.00 cfs @ 19.19 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-3: SOUTHERN CORNER



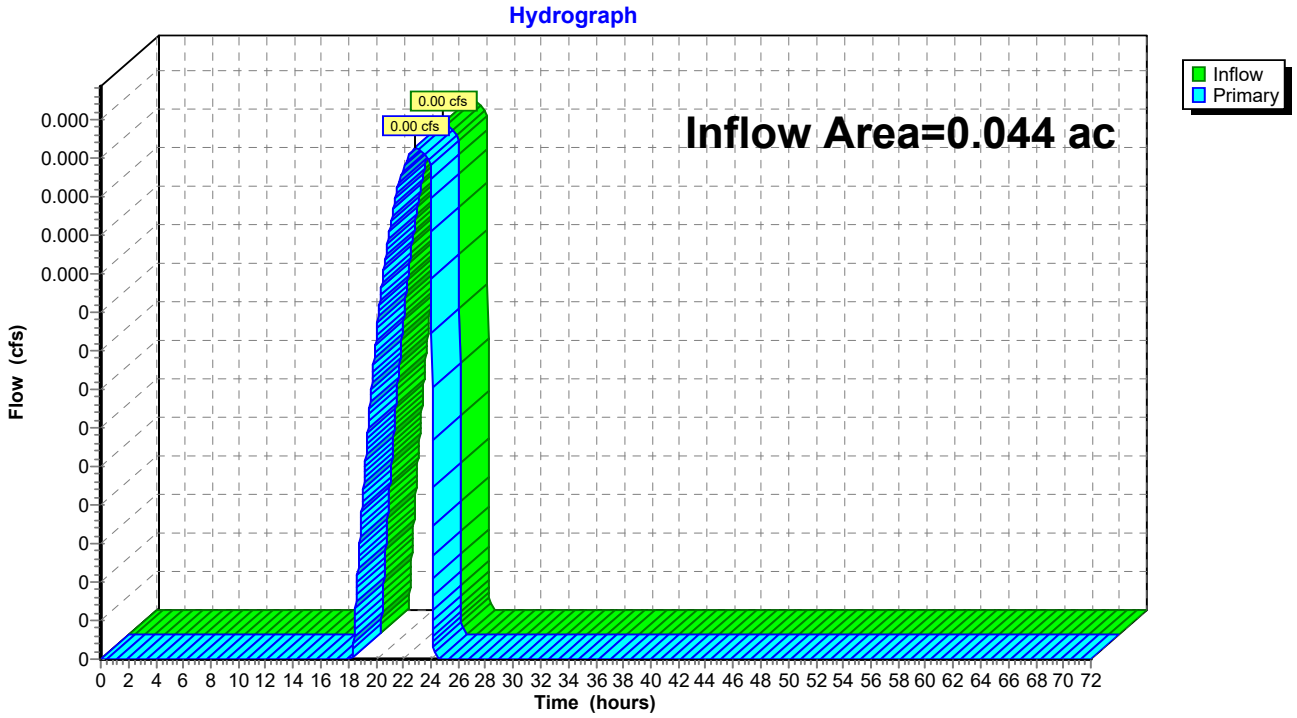
Summary for Pond AP-4: SOUTHERN PROPERTY LINE

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.044 ac, 0.00% Impervious, Inflow Depth = 0.01" for 10-Year event
Inflow = 0.00 cfs @ 22.85 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 22.85 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-4: SOUTHERN PROPERTY LINE



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR-1: Subcat PR-1 Runoff Area=4.003 ac 31.34% Impervious Runoff Depth=1.82"
Tc=6.0 min CN=56 Runoff=8.70 cfs 0.607 af

Subcatchment PR-2: Subcat PR-2 Runoff Area=0.504 ac 26.92% Impervious Runoff Depth=1.49"
Tc=6.0 min UI Adjusted CN=52 Runoff=0.85 cfs 0.062 af

Subcatchment PR-3: Subcat PR-3 Runoff Area=1.853 ac 8.54% Impervious Runoff Depth=0.68"
Tc=6.0 min CN=41 Runoff=0.82 cfs 0.105 af

Subcatchment PR-4: Subcat PR-4 Runoff Area=0.107 ac 0.00% Impervious Runoff Depth=0.24"
Tc=6.0 min CN=33 Runoff=0.00 cfs 0.002 af

Subcatchment PR-5: Subcat PR-5 Runoff Area=0.057 ac 0.00% Impervious Runoff Depth=0.33"
Tc=0.0 min CN=35 Runoff=0.00 cfs 0.002 af

Subcatchment PR-6: Subcat PR-6 Runoff Area=0.044 ac 0.00% Impervious Runoff Depth=0.12"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af

Pond 8P: INFILTRATION BASIN Peak Elev=327.23' Storage=22,334 cf Inflow=9.48 cfs 0.712 af
Discarded=0.22 cfs 0.712 af Primary=0.00 cfs 0.000 af Outflow=0.22 cfs 0.712 af

Pond 9P: FOREBAY Peak Elev=0.00' Storage=0 cf

Pond AP-1: Northern Property Lines Inflow=0.00 cfs 0.002 af
Primary=0.00 cfs 0.002 af

Pond AP-2: UNION STREET Inflow=0.85 cfs 0.065 af
Primary=0.85 cfs 0.065 af

Pond AP-3: SOUTHERN CORNER Inflow=0.00 cfs 0.002 af
Primary=0.00 cfs 0.002 af

Pond AP-4: SOUTHERN PROPERTY LINE Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 6.569 ac Runoff Volume = 0.779 af Average Runoff Depth = 1.42"
76.42% Pervious = 5.020 ac 23.58% Impervious = 1.549 ac

Summary for Subcatchment PR-1: Subcat PR-1

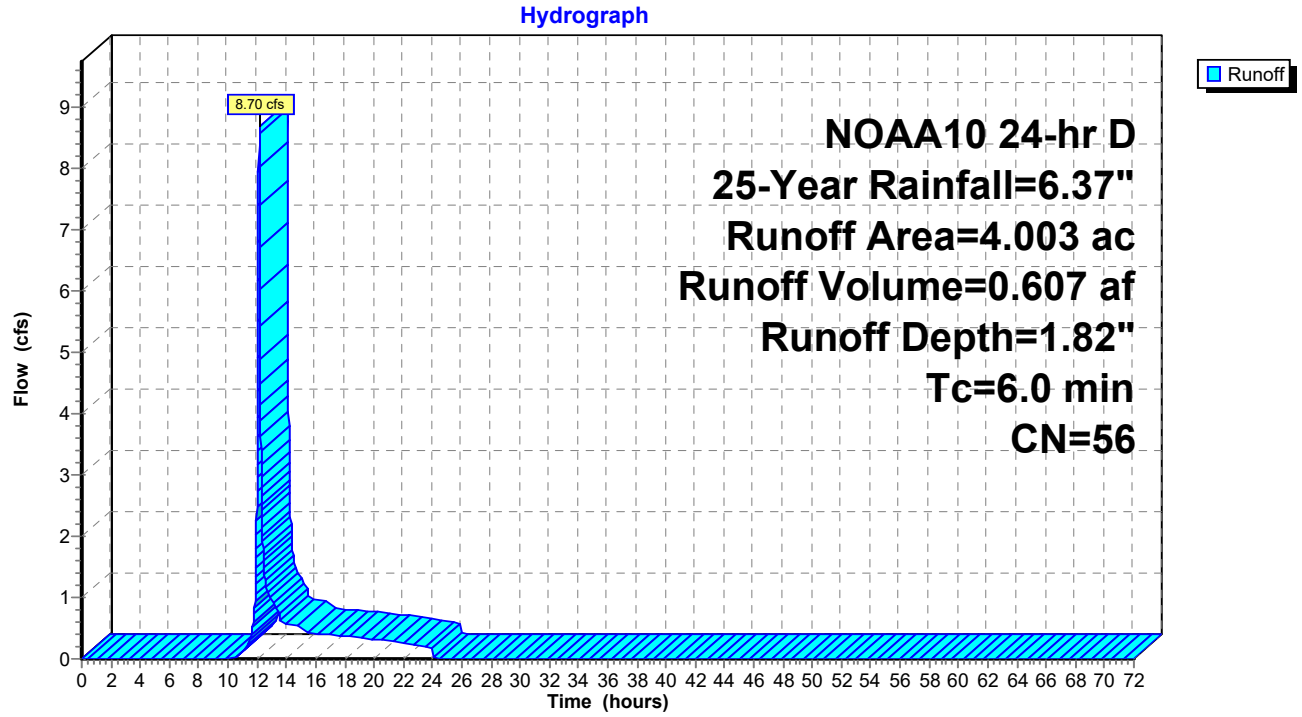
Runoff = 8.70 cfs @ 12.14 hrs, Volume= 0.607 af, Depth= 1.82"
Routed to Pond 8P : INFILTRATION BASIN

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.37"

Area (ac)	CN	Description
0.177	54	1/2 acre lots, 25% imp, HSG A
2.088	39	>75% Grass cover, Good, HSG A
0.146	30	Meadow, non-grazed, HSG A
0.314	98	Paved parking, HSG A
0.381	98	Paved roads w/curbs & sewers, HSG A
0.186	98	Roofs, HSG A
0.096	98	Unconnected pavement, HSG A
0.234	98	Water Surface, HSG A
0.382	30	Woods, Good, HSG A
4.003	56	Weighted Average
2.749		68.66% Pervious Area
1.255		31.34% Impervious Area
0.096		7.63% Unconnected

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

Subcatchment PR-1: Subcat PR-1



Summary for Subcatchment PR-2: Subcat PR-2

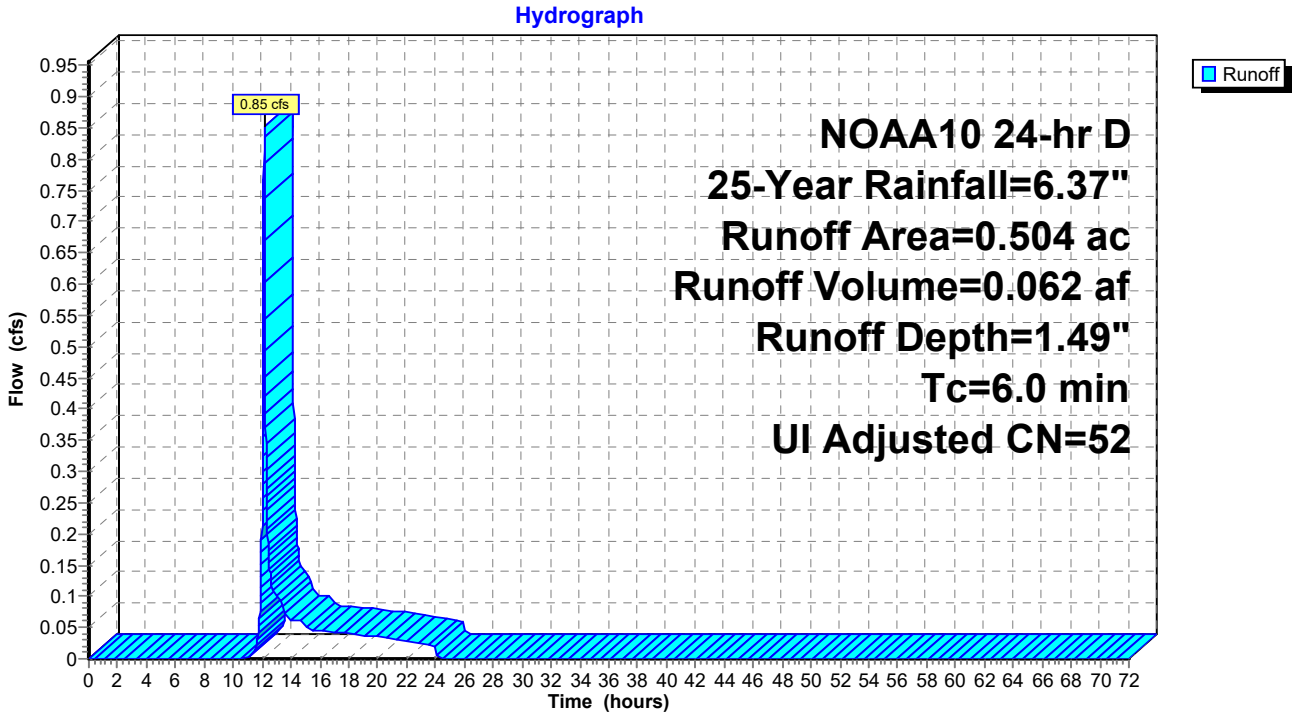
Runoff = 0.85 cfs @ 12.14 hrs, Volume= 0.062 af, Depth= 1.49"
Routed to Pond AP-2 : UNION STREET

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.37"

Area (ac)	CN	Adj	Description
0.004	54		1/2 acre lots, 25% imp, HSG A
0.285	39		>75% Grass cover, Good, HSG A
0.081	30		Meadow, non-grazed, HSG A
0.019	98		Paved parking, HSG A
0.065	98		Paved roads w/curbs & sewers, HSG A
0.030	98		Roofs, HSG A
0.021	98		Unconnected pavement, HSG A
0.504	53	52	Weighted Average, UI Adjusted
0.368			73.08% Pervious Area
0.136			26.92% Impervious Area
0.021			15.29% Unconnected

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

Subcatchment PR-2: Subcat PR-2



Summary for Subcatchment PR-3: Subcat PR-3

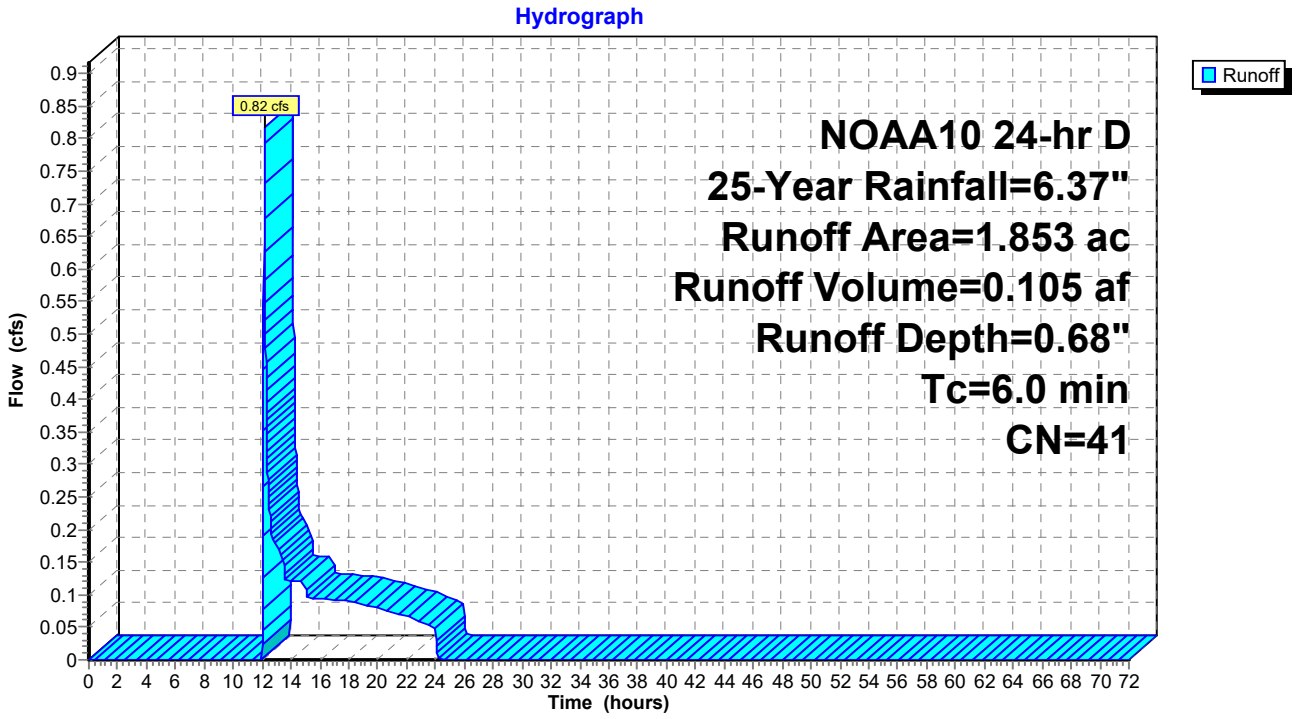
Runoff = 0.82 cfs @ 12.15 hrs, Volume= 0.105 af, Depth= 0.68"
Routed to Pond 8P : INFILTRATION BASIN

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.37"

Area (ac)	CN	Description
1.152	39	>75% Grass cover, Good, HSG A
0.038	98	Paved parking, HSG A
0.120	98	Roofs, HSG A
0.543	30	Woods, Good, HSG A
1.853	41	Weighted Average
1.695		91.46% Pervious Area
0.158		8.54% Impervious Area

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

Subcatchment PR-3: Subcat PR-3



Summary for Subcatchment PR-4: Subcat PR-4

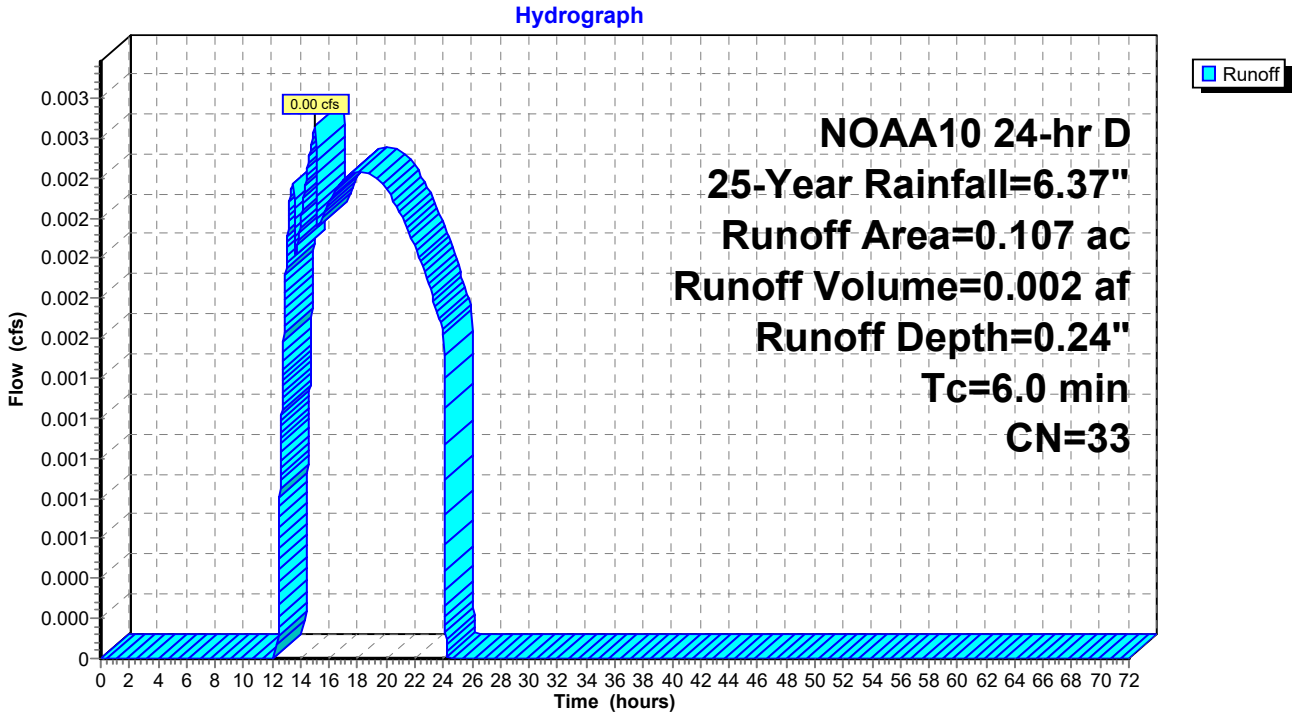
Runoff = 0.00 cfs @ 15.02 hrs, Volume= 0.002 af, Depth= 0.24"
Routed to Pond AP-1 : Northern Property Lines

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.37"

Area (ac)	CN	Description
0.031	39	>75% Grass cover, Good, HSG A
0.077	30	Woods, Good, HSG A
0.107	33	Weighted Average
0.107		100.00% Pervious Area

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

Subcatchment PR-4: Subcat PR-4



Summary for Subcatchment PR-5: Subcat PR-5

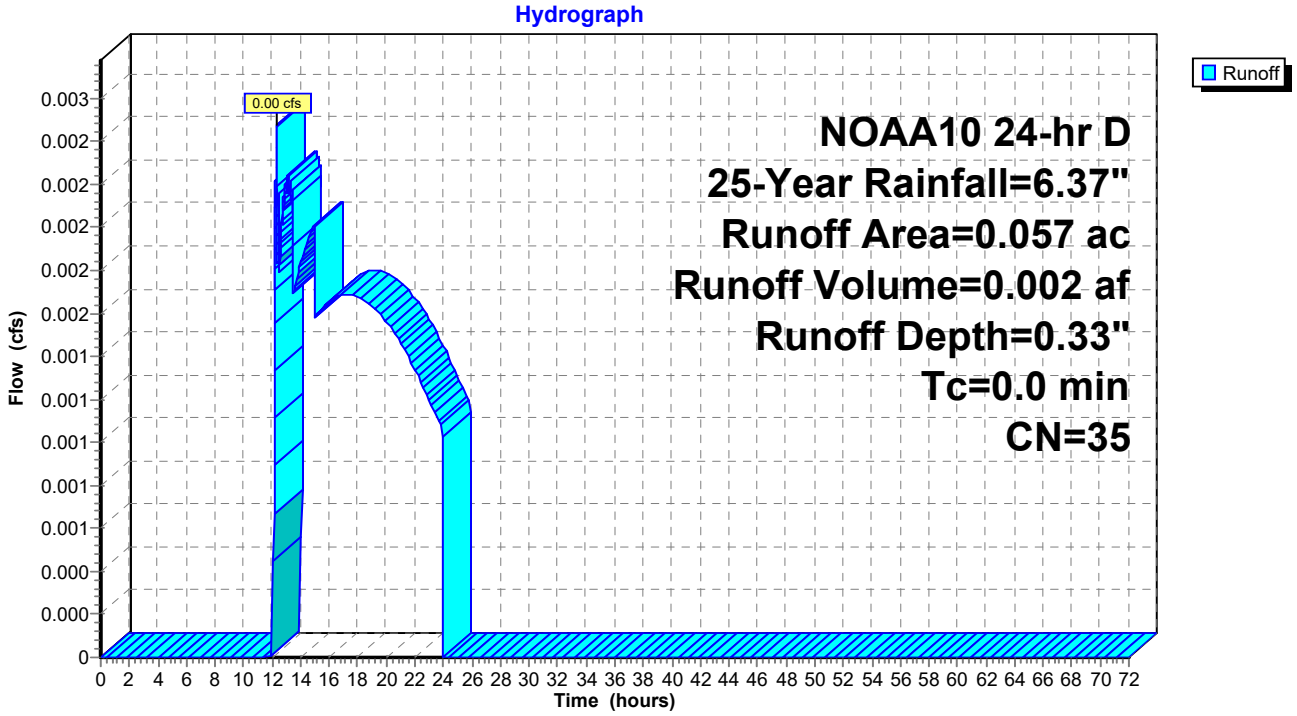
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.00 cfs @ 12.29 hrs, Volume= 0.002 af, Depth= 0.33"
Routed to Pond AP-3 : SOUTHERN CORNER

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.37"

Area (ac)	CN	Description
0.033	39	>75% Grass cover, Good, HSG A
0.024	30	Woods, Good, HSG A
0.057	35	Weighted Average
0.057		100.00% Pervious Area

Subcatchment PR-5: Subcat PR-5



Summary for Subcatchment PR-6: Subcat PR-6

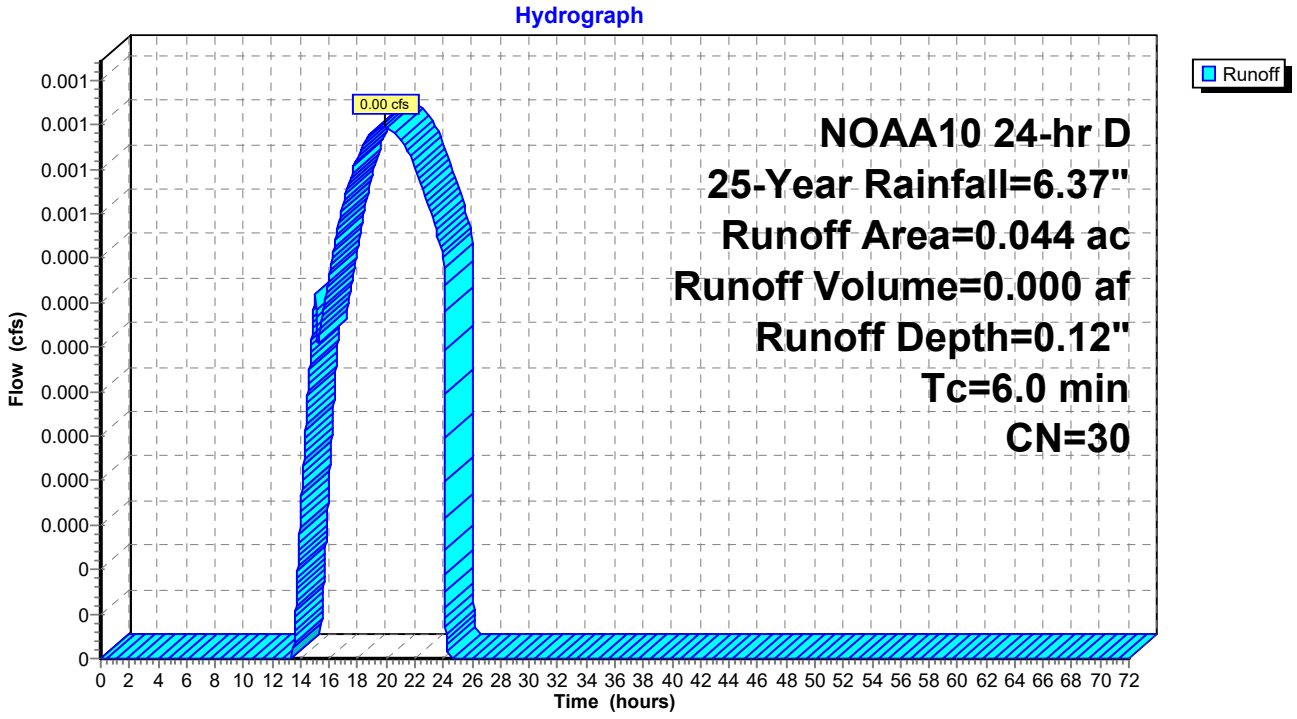
Runoff = 0.00 cfs @ 19.94 hrs, Volume= 0.000 af, Depth= 0.12"
Routed to Pond AP-4 : SOUTHERN PROPERTY LINE

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.37"

Area (ac)	CN	Description
0.000	39	>75% Grass cover, Good, HSG A
0.044	30	Woods, Good, HSG A
0.044	30	Weighted Average
0.044		100.00% Pervious Area

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

Subcatchment PR-6: Subcat PR-6



Summary for Pond 8P: INFILTRATION BASIN

Inflow Area = 5.857 ac, 24.13% Impervious, Inflow Depth = 1.46" for 25-Year event
Inflow = 9.48 cfs @ 12.14 hrs, Volume= 0.712 af
Outflow = 0.22 cfs @ 24.05 hrs, Volume= 0.712 af, Atten= 98%, Lag= 714.4 min
Discarded = 0.22 cfs @ 24.05 hrs, Volume= 0.712 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond AP-2 : UNION STREET

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 327.23' @ 24.05 hrs Surf.Area= 2,442 sf Storage= 22,334 cf

Plug-Flow detention time= 1,232.3 min calculated for 0.712 af (100% of inflow)
Center-of-Mass det. time= 1,232.6 min (2,156.8 - 924.3)

Volume	Invert	Avail.Storage	Storage Description
#1	324.00'	11,011 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	324.00'	28,569 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		39,579 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
324.00	1,367	0	0
325.00	1,670	1,519	1,519
326.00	1,999	1,835	3,353
327.00	2,354	2,177	5,530
328.00	2,734	2,544	8,074
329.00	3,140	2,937	11,011

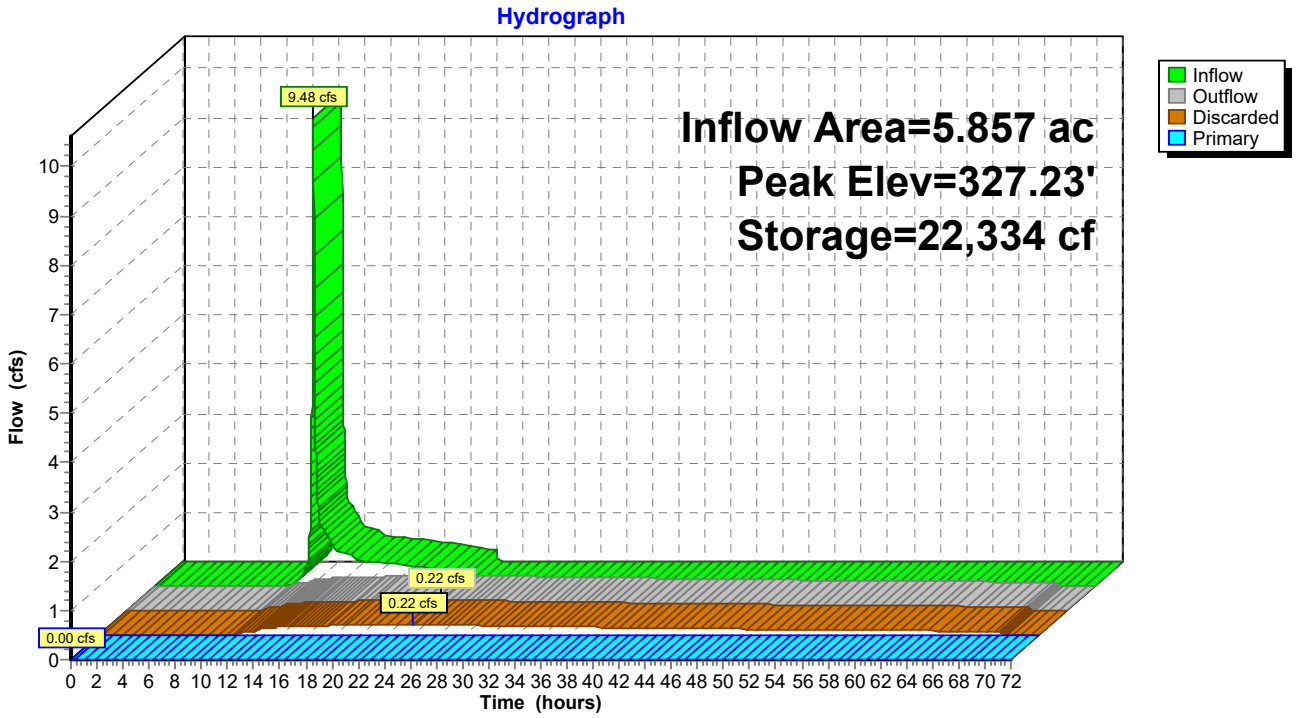
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
324.00	3,156	0	0
325.00	4,745	3,951	3,951
326.00	5,423	5,084	9,035
327.00	6,131	5,777	14,812
328.00	6,871	6,501	21,313
329.00	7,641	7,256	28,569

Device	Routing	Invert	Outlet Devices
#1	Discarded	324.00'	**2.420 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 320.00' Phase-In= 0.01'
#2	Device 3	328.20'	**24.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	323.22'	**12.0" Round Culvert** L= 23.1' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 323.22' / 323.10' S= 0.0052 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Discarded OutFlow Max=0.22 cfs @ 24.05 hrs HW=327.23' (Free Discharge)
└**1=Exfiltration** (Controls 0.22 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=324.00' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Passes 0.00 cfs of 1.47 cfs potential flow)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 8P: INFILTRATION BASIN



Summary for Pond 9P: FOREBAY

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	324.00'	583 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
324.00	490	0	0
325.00	676	583	583

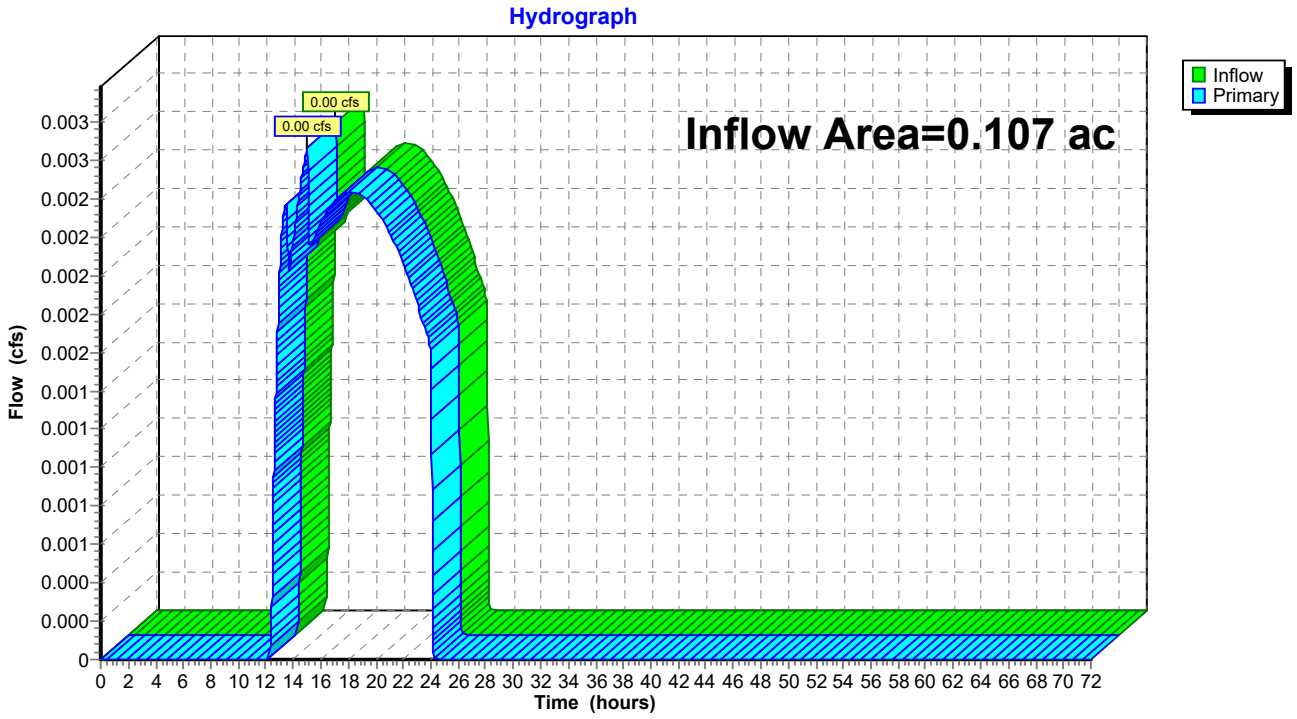
Summary for Pond AP-1: Northern Property Lines

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.107 ac, 0.00% Impervious, Inflow Depth = 0.24" for 25-Year event
Inflow = 0.00 cfs @ 15.02 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 15.02 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min
Routed to Pond AP-2 : UNION STREET

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-1: Northern Property Lines



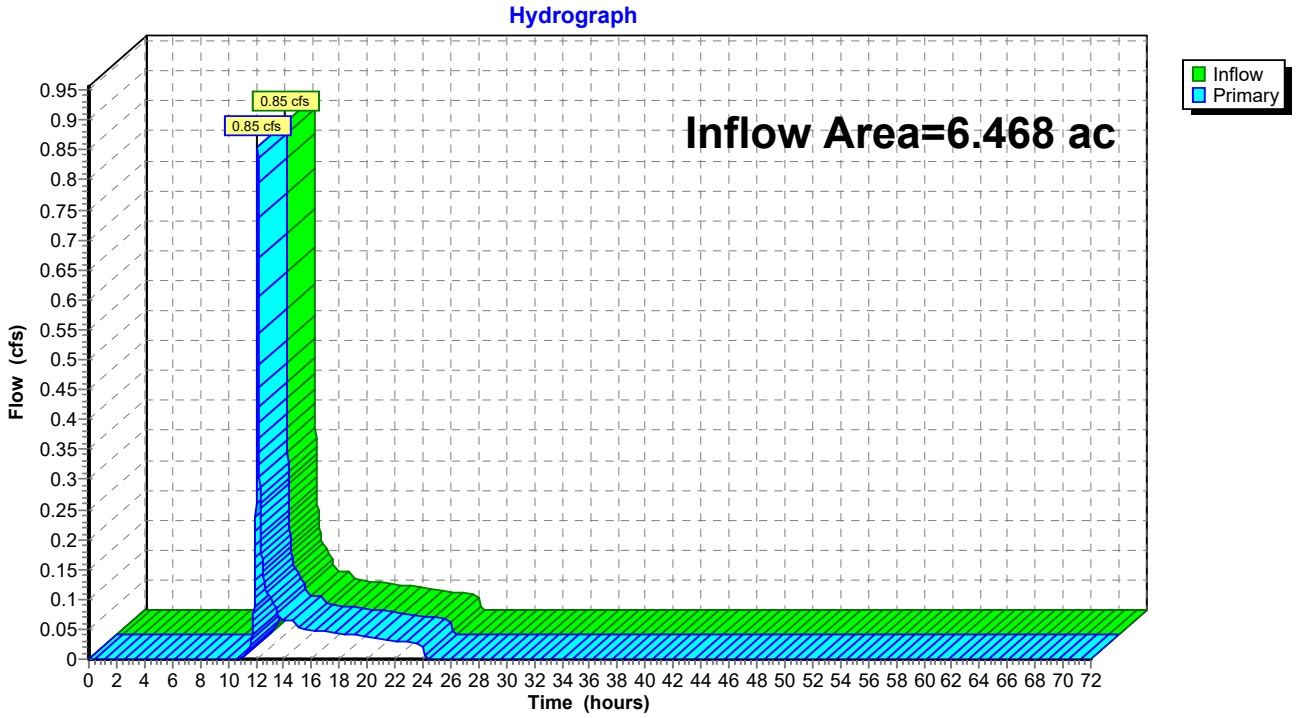
Summary for Pond AP-2: UNION STREET

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.468 ac, 23.95% Impervious, Inflow Depth = 0.12" for 25-Year event
Inflow = 0.85 cfs @ 12.14 hrs, Volume= 0.065 af
Primary = 0.85 cfs @ 12.14 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-2: UNION STREET



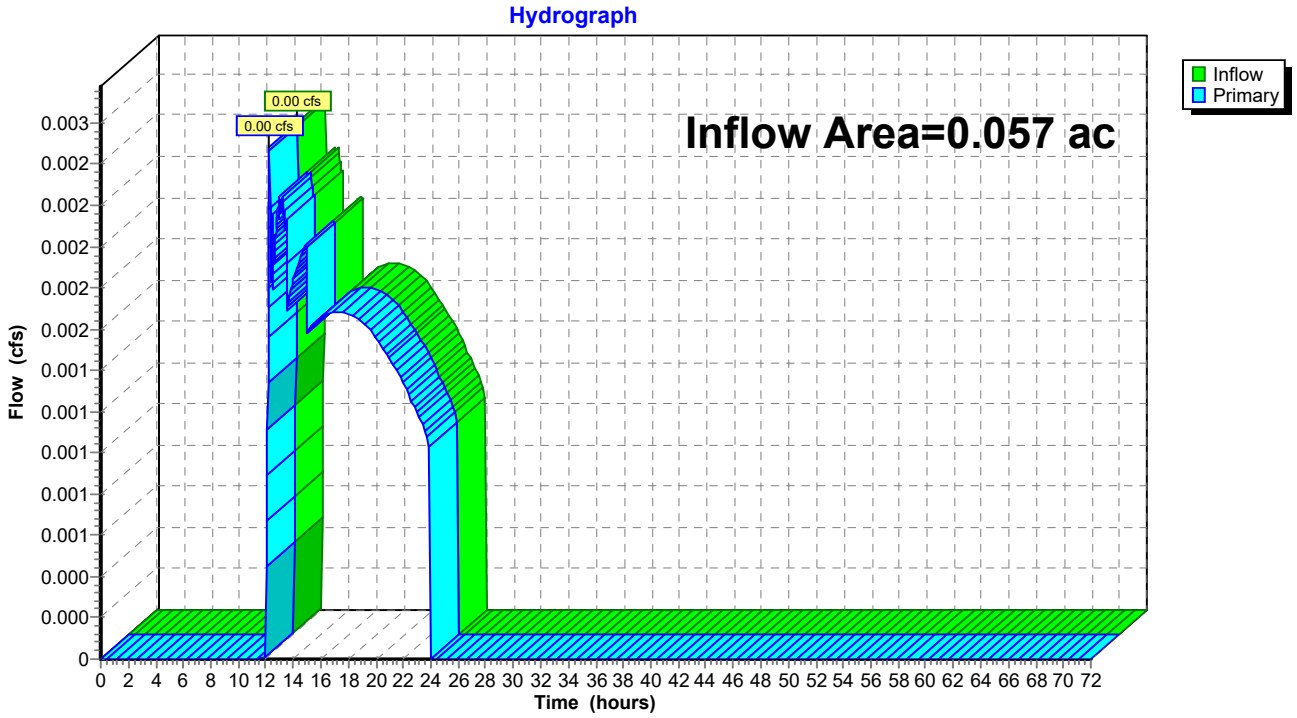
Summary for Pond AP-3: SOUTHERN CORNER

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.057 ac, 0.00% Impervious, Inflow Depth = 0.33" for 25-Year event
Inflow = 0.00 cfs @ 12.29 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 12.29 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-3: SOUTHERN CORNER



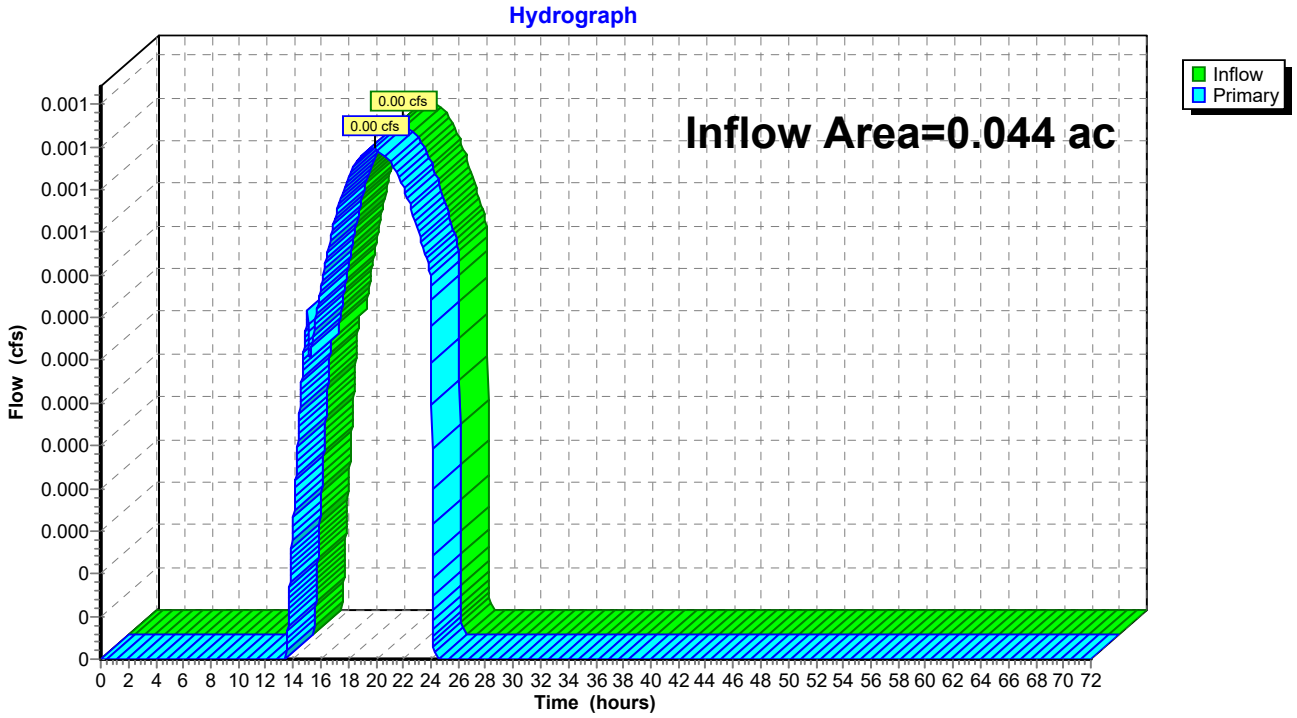
Summary for Pond AP-4: SOUTHERN PROPERTY LINE

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.044 ac, 0.00% Impervious, Inflow Depth = 0.12" for 25-Year event
Inflow = 0.00 cfs @ 19.94 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 19.94 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-4: SOUTHERN PROPERTY LINE



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR-1: Subcat PR-1 Runoff Area=4.003 ac 31.34% Impervious Runoff Depth=3.00"
Tc=6.0 min CN=56 Runoff=14.89 cfs 1.003 af

Subcatchment PR-2: Subcat PR-2 Runoff Area=0.504 ac 26.92% Impervious Runoff Depth=2.56"
Tc=6.0 min UI Adjusted CN=52 Runoff=1.57 cfs 0.108 af

Subcatchment PR-3: Subcat PR-3 Runoff Area=1.853 ac 8.54% Impervious Runoff Depth=1.42"
Tc=6.0 min CN=41 Runoff=2.66 cfs 0.219 af

Subcatchment PR-4: Subcat PR-4 Runoff Area=0.107 ac 0.00% Impervious Runoff Depth=0.69"
Tc=6.0 min CN=33 Runoff=0.03 cfs 0.006 af

Subcatchment PR-5: Subcat PR-5 Runoff Area=0.057 ac 0.00% Impervious Runoff Depth=0.86"
Tc=0.0 min CN=35 Runoff=0.05 cfs 0.004 af

Subcatchment PR-6: Subcat PR-6 Runoff Area=0.044 ac 0.00% Impervious Runoff Depth=0.45"
Tc=6.0 min CN=30 Runoff=0.00 cfs 0.002 af

Pond 8P: INFILTRATION BASIN Peak Elev=328.36' Storage=32,960 cf Inflow=17.53 cfs 1.222 af
Discarded=0.28 cfs 0.955 af Primary=0.43 cfs 0.209 af Outflow=0.70 cfs 1.164 af

Pond 9P: FOREBAY Peak Elev=0.00' Storage=0 cf

Pond AP-1: Northern Property Lines Inflow=0.03 cfs 0.006 af
Primary=0.03 cfs 0.006 af

Pond AP-2: UNION STREET Inflow=1.59 cfs 0.322 af
Primary=1.59 cfs 0.322 af

Pond AP-3: SOUTHERN CORNER Inflow=0.05 cfs 0.004 af
Primary=0.05 cfs 0.004 af

Pond AP-4: SOUTHERN PROPERTY LINE Inflow=0.00 cfs 0.002 af
Primary=0.00 cfs 0.002 af

Total Runoff Area = 6.569 ac Runoff Volume = 1.341 af Average Runoff Depth = 2.45"
76.42% Pervious = 5.020 ac 23.58% Impervious = 1.549 ac

Summary for Subcatchment PR-1: Subcat PR-1

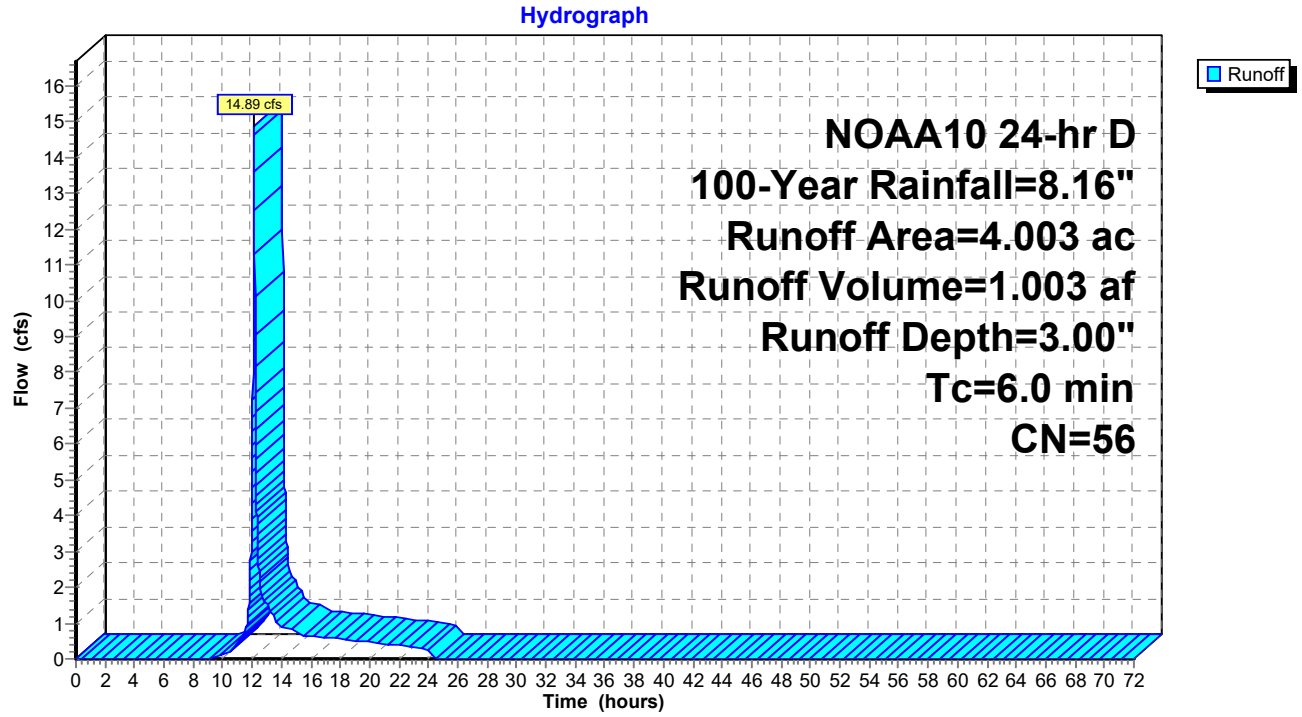
Runoff = 14.89 cfs @ 12.14 hrs, Volume= 1.003 af, Depth= 3.00"
Routed to Pond 8P : INFILTRATION BASIN

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.16"

Area (ac)	CN	Description
0.177	54	1/2 acre lots, 25% imp, HSG A
2.088	39	>75% Grass cover, Good, HSG A
0.146	30	Meadow, non-grazed, HSG A
0.314	98	Paved parking, HSG A
0.381	98	Paved roads w/curbs & sewers, HSG A
0.186	98	Roofs, HSG A
0.096	98	Unconnected pavement, HSG A
0.234	98	Water Surface, HSG A
0.382	30	Woods, Good, HSG A
4.003	56	Weighted Average
2.749		68.66% Pervious Area
1.255		31.34% Impervious Area
0.096		7.63% Unconnected

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

Subcatchment PR-1: Subcat PR-1



Summary for Subcatchment PR-2: Subcat PR-2

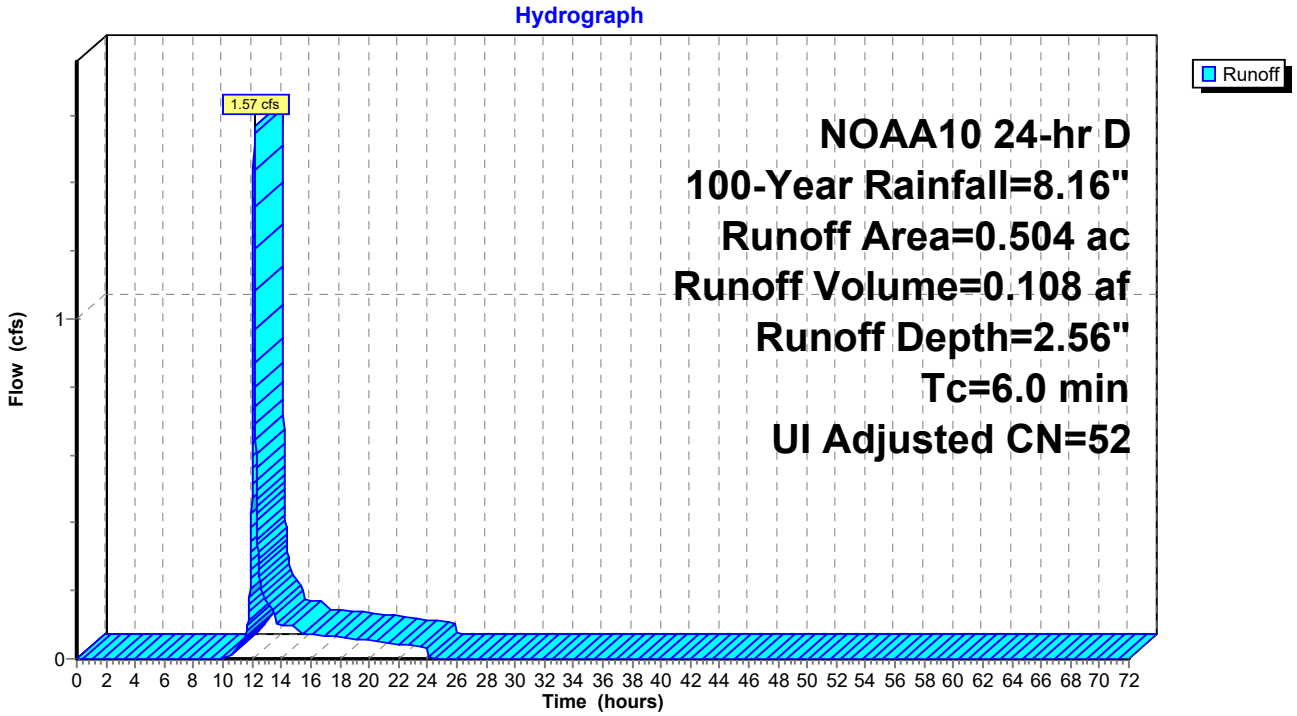
Runoff = 1.57 cfs @ 12.14 hrs, Volume= 0.108 af, Depth= 2.56"
Routed to Pond AP-2 : UNION STREET

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.16"

Area (ac)	CN	Adj	Description
0.004	54		1/2 acre lots, 25% imp, HSG A
0.285	39		>75% Grass cover, Good, HSG A
0.081	30		Meadow, non-grazed, HSG A
0.019	98		Paved parking, HSG A
0.065	98		Paved roads w/curbs & sewers, HSG A
0.030	98		Roofs, HSG A
0.021	98		Unconnected pavement, HSG A
0.504	53	52	Weighted Average, UI Adjusted
0.368			73.08% Pervious Area
0.136			26.92% Impervious Area
0.021			15.29% Unconnected

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

Subcatchment PR-2: Subcat PR-2



Summary for Subcatchment PR-3: Subcat PR-3

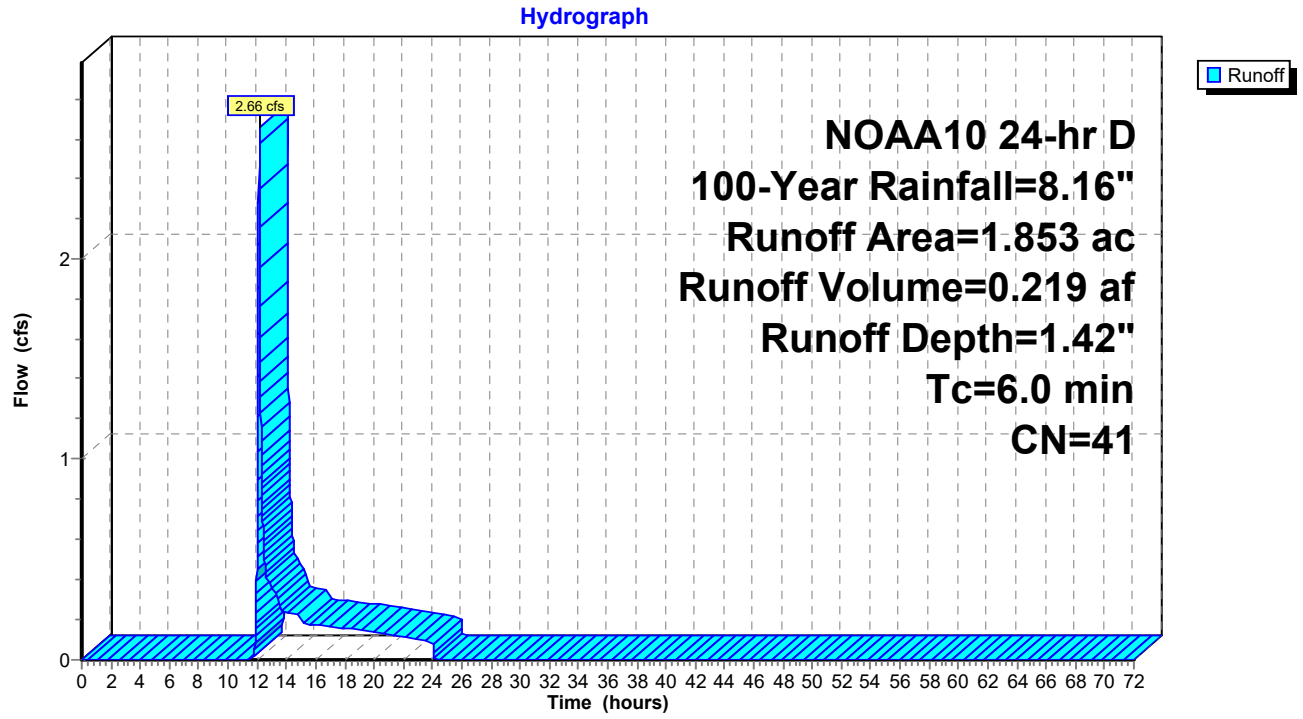
Runoff = 2.66 cfs @ 12.14 hrs, Volume= 0.219 af, Depth= 1.42"
Routed to Pond 8P : INFILTRATION BASIN

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.16"

Area (ac)	CN	Description
1.152	39	>75% Grass cover, Good, HSG A
0.038	98	Paved parking, HSG A
0.120	98	Roofs, HSG A
0.543	30	Woods, Good, HSG A
1.853	41	Weighted Average
1.695		91.46% Pervious Area
0.158		8.54% Impervious Area

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

Subcatchment PR-3: Subcat PR-3



Summary for Subcatchment PR-4: Subcat PR-4

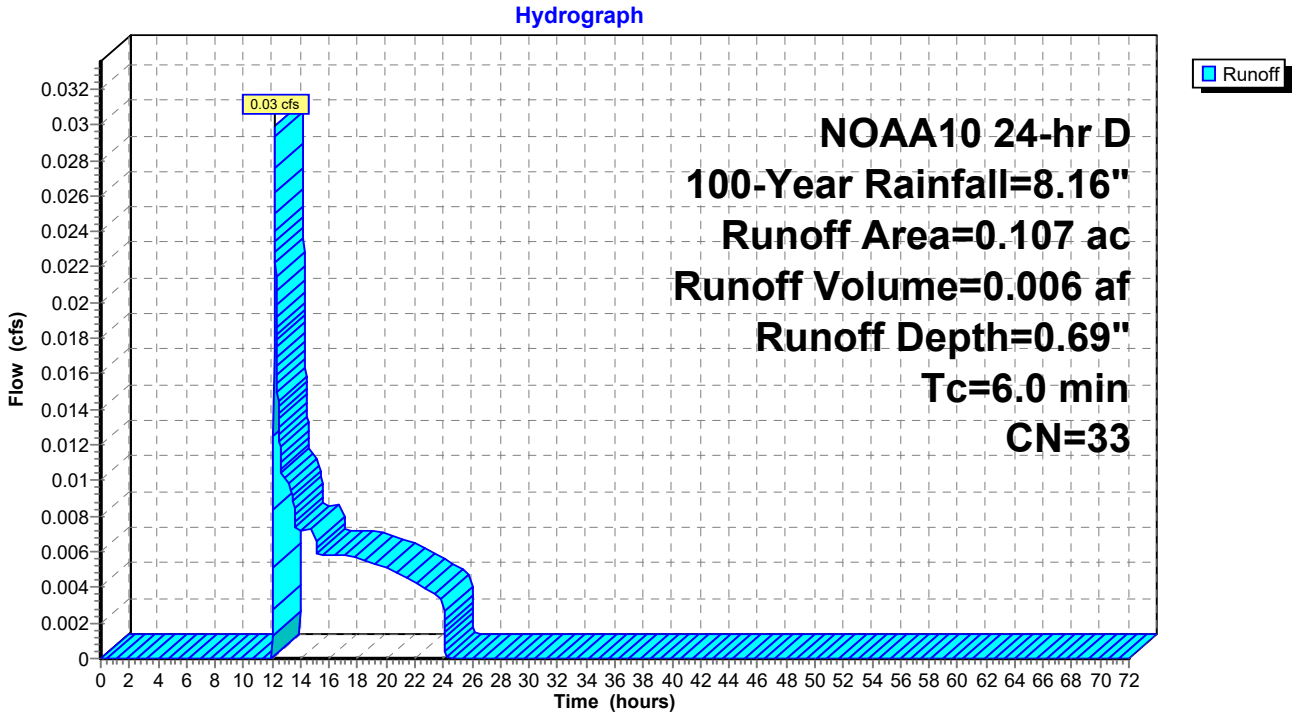
Runoff = 0.03 cfs @ 12.16 hrs, Volume= 0.006 af, Depth= 0.69"
Routed to Pond AP-1 : Northern Property Lines

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.16"

Area (ac)	CN	Description
0.031	39	>75% Grass cover, Good, HSG A
0.077	30	Woods, Good, HSG A
0.107	33	Weighted Average
0.107		100.00% Pervious Area

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

Subcatchment PR-4: Subcat PR-4



Summary for Subcatchment PR-5: Subcat PR-5

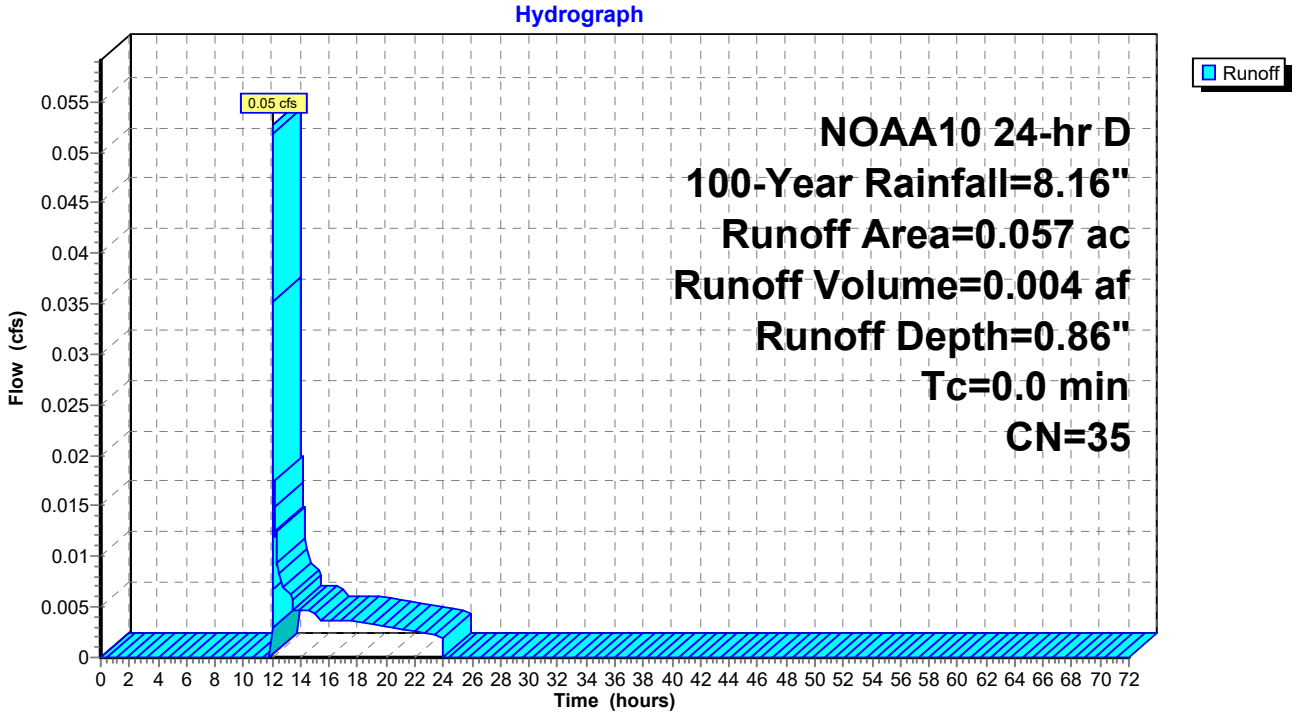
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.05 cfs @ 12.09 hrs, Volume= 0.004 af, Depth= 0.86"
Routed to Pond AP-3 : SOUTHERN CORNER

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.16"

Area (ac)	CN	Description
0.033	39	>75% Grass cover, Good, HSG A
0.024	30	Woods, Good, HSG A
0.057	35	Weighted Average
0.057		100.00% Pervious Area

Subcatchment PR-5: Subcat PR-5



Summary for Subcatchment PR-6: Subcat PR-6

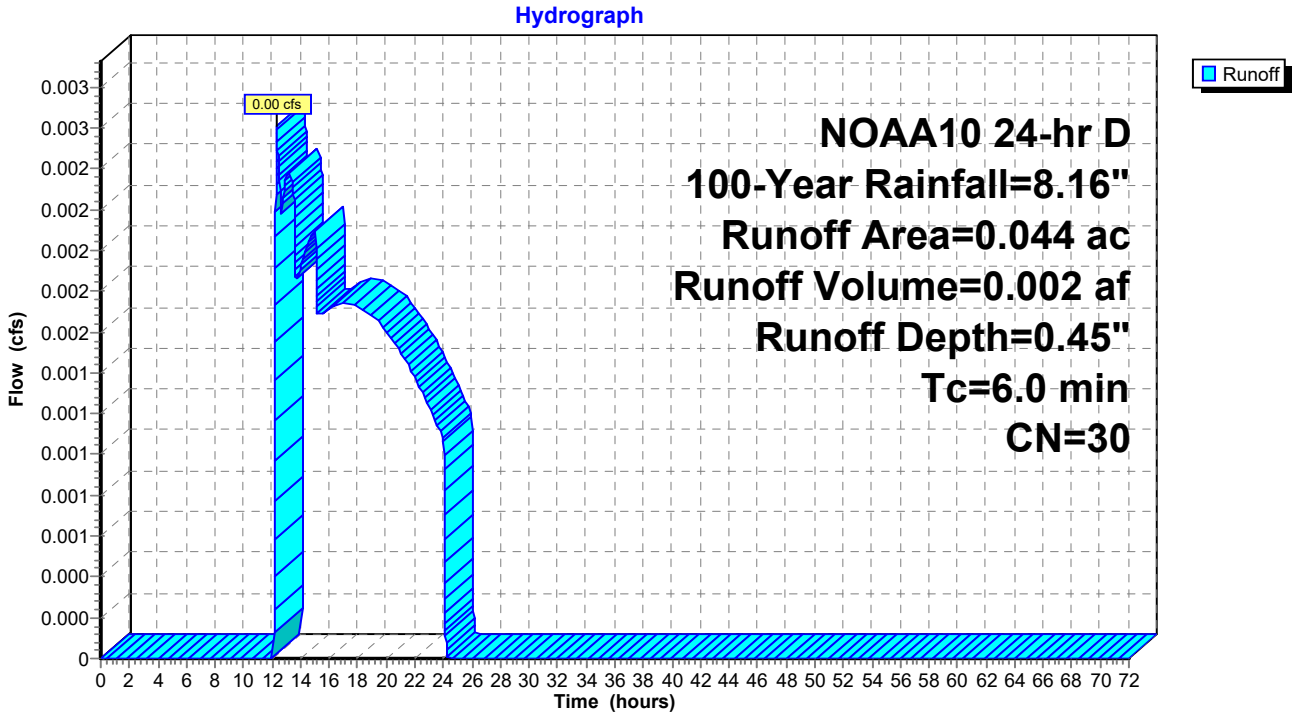
Runoff = 0.00 cfs @ 12.35 hrs, Volume= 0.002 af, Depth= 0.45"
Routed to Pond AP-4 : SOUTHERN PROPERTY LINE

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.16"

Area (ac)	CN	Description
0.000	39	>75% Grass cover, Good, HSG A
0.044	30	Woods, Good, HSG A
0.044	30	Weighted Average
0.044		100.00% Pervious Area

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

Subcatchment PR-6: Subcat PR-6



Summary for Pond 8P: INFILTRATION BASIN

Inflow Area = 5.857 ac, 24.13% Impervious, Inflow Depth = 2.50" for 100-Year event
Inflow = 17.53 cfs @ 12.14 hrs, Volume= 1.222 af
Outflow = 0.70 cfs @ 18.17 hrs, Volume= 1.164 af, Atten= 96%, Lag= 361.7 min
Discarded = 0.28 cfs @ 18.17 hrs, Volume= 0.955 af
Primary = 0.43 cfs @ 18.17 hrs, Volume= 0.209 af
Routed to Pond AP-2 : UNION STREET

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 328.36' @ 18.17 hrs Surf.Area= 2,882 sf Storage= 32,960 cf

Plug-Flow detention time= 1,124.7 min calculated for 1.164 af (95% of inflow)
Center-of-Mass det. time= 1,100.3 min (2,003.0 - 902.7)

Volume	Invert	Avail.Storage	Storage Description
#1	324.00'	11,011 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	324.00'	28,569 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) -Impervious
		39,579 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
324.00	1,367	0	0
325.00	1,670	1,519	1,519
326.00	1,999	1,835	3,353
327.00	2,354	2,177	5,530
328.00	2,734	2,544	8,074
329.00	3,140	2,937	11,011

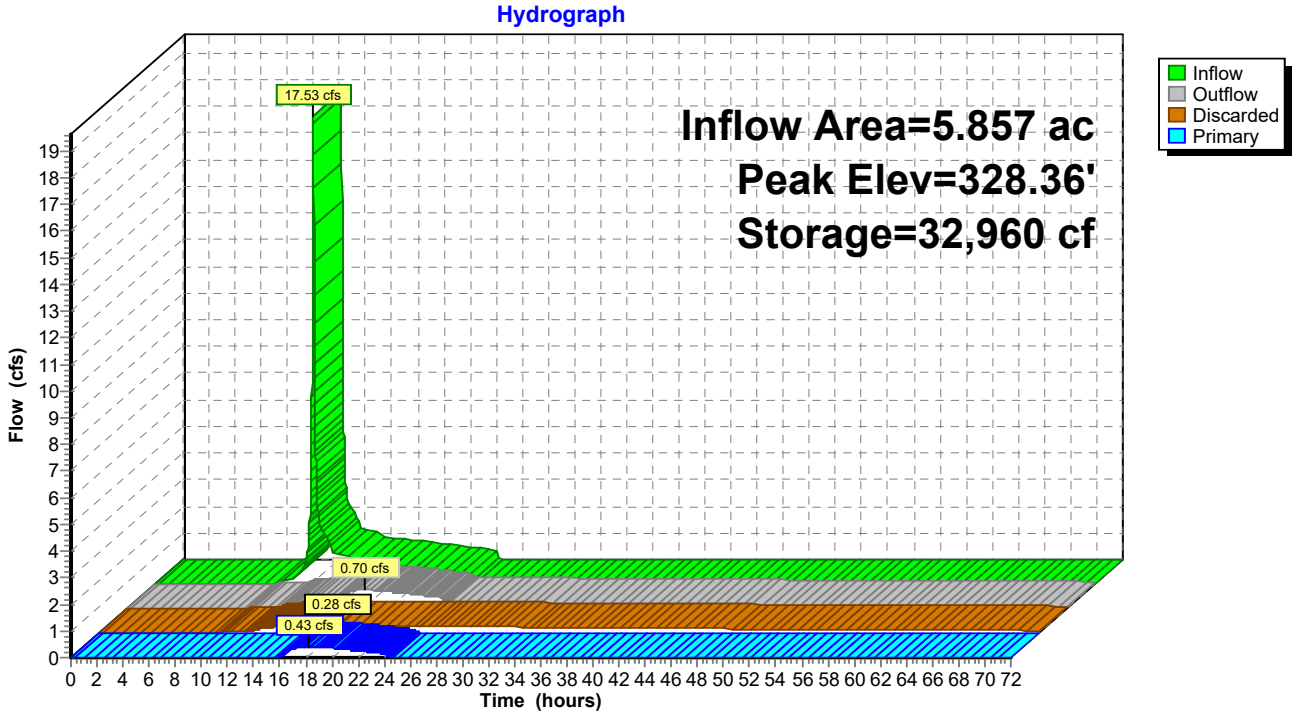
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
324.00	3,156	0	0
325.00	4,745	3,951	3,951
326.00	5,423	5,084	9,035
327.00	6,131	5,777	14,812
328.00	6,871	6,501	21,313
329.00	7,641	7,256	28,569

Device	Routing	Invert	Outlet Devices
#1	Discarded	324.00'	**2.420 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 320.00' Phase-In= 0.01'
#2	Device 3	328.20'	**24.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	323.22'	**12.0" Round Culvert** L= 23.1' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 323.22' / 323.10' S= 0.0052 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Discarded OutFlow Max=0.28 cfs @ 18.17 hrs HW=328.36' (Free Discharge)
└**1=Exfiltration** (Controls 0.28 cfs)

Primary OutFlow Max=0.43 cfs @ 18.17 hrs HW=328.36' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Passes 0.43 cfs of 8.15 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.43 cfs @ 1.30 fps)

Pond 8P: INFILTRATION BASIN



Summary for Pond 9P: FOREBAY

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	324.00'	583 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
324.00	490	0	0
325.00	676	583	583

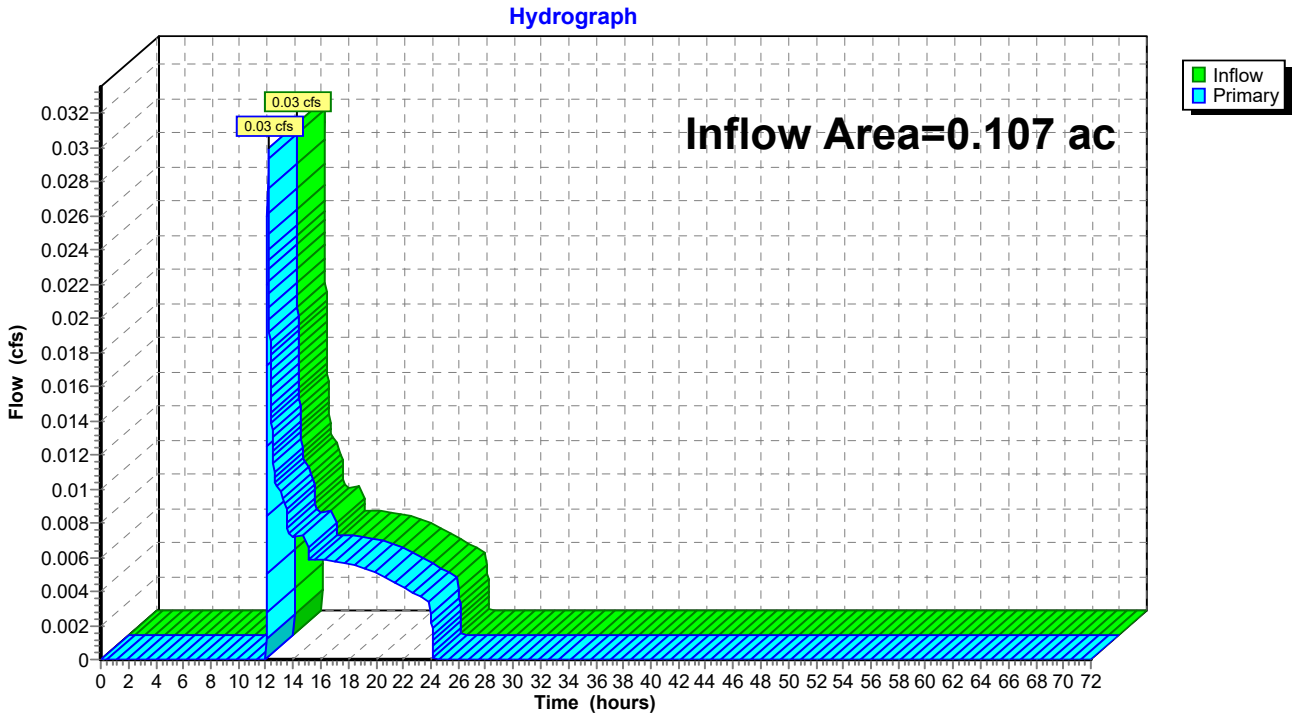
Summary for Pond AP-1: Northern Property Lines

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.107 ac, 0.00% Impervious, Inflow Depth = 0.69" for 100-Year event
Inflow = 0.03 cfs @ 12.16 hrs, Volume= 0.006 af
Primary = 0.03 cfs @ 12.16 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min
Routed to Pond AP-2 : UNION STREET

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-1: Northern Property Lines



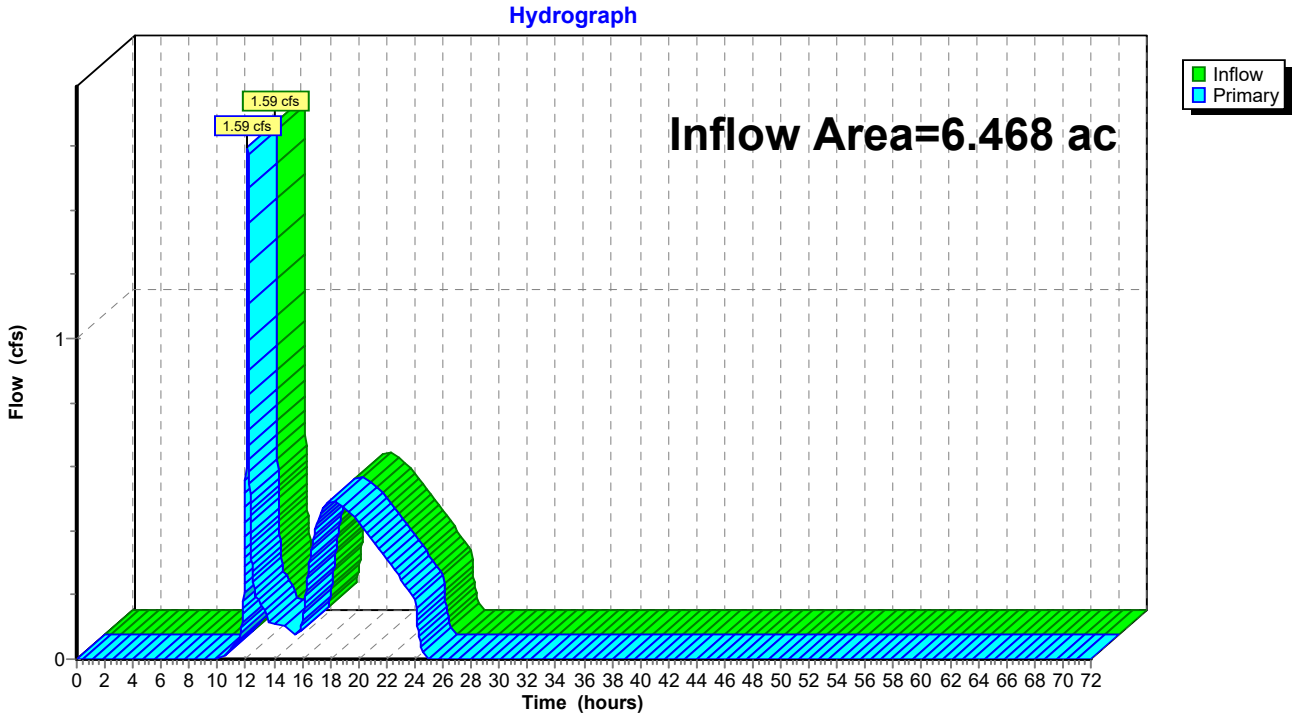
Summary for Pond AP-2: UNION STREET

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.468 ac, 23.95% Impervious, Inflow Depth = 0.60" for 100-Year event
Inflow = 1.59 cfs @ 12.14 hrs, Volume= 0.322 af
Primary = 1.59 cfs @ 12.14 hrs, Volume= 0.322 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-2: UNION STREET



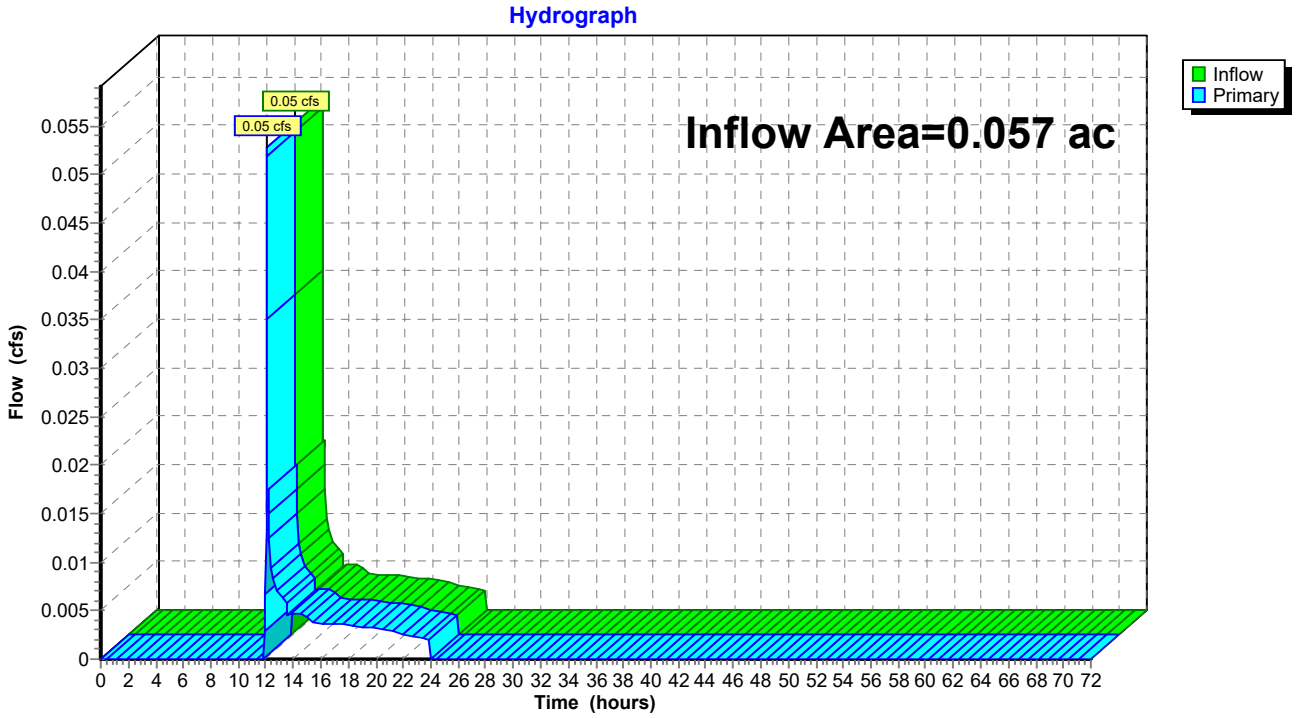
Summary for Pond AP-3: SOUTHERN CORNER

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.057 ac, 0.00% Impervious, Inflow Depth = 0.86" for 100-Year event
Inflow = 0.05 cfs @ 12.09 hrs, Volume= 0.004 af
Primary = 0.05 cfs @ 12.09 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-3: SOUTHERN CORNER



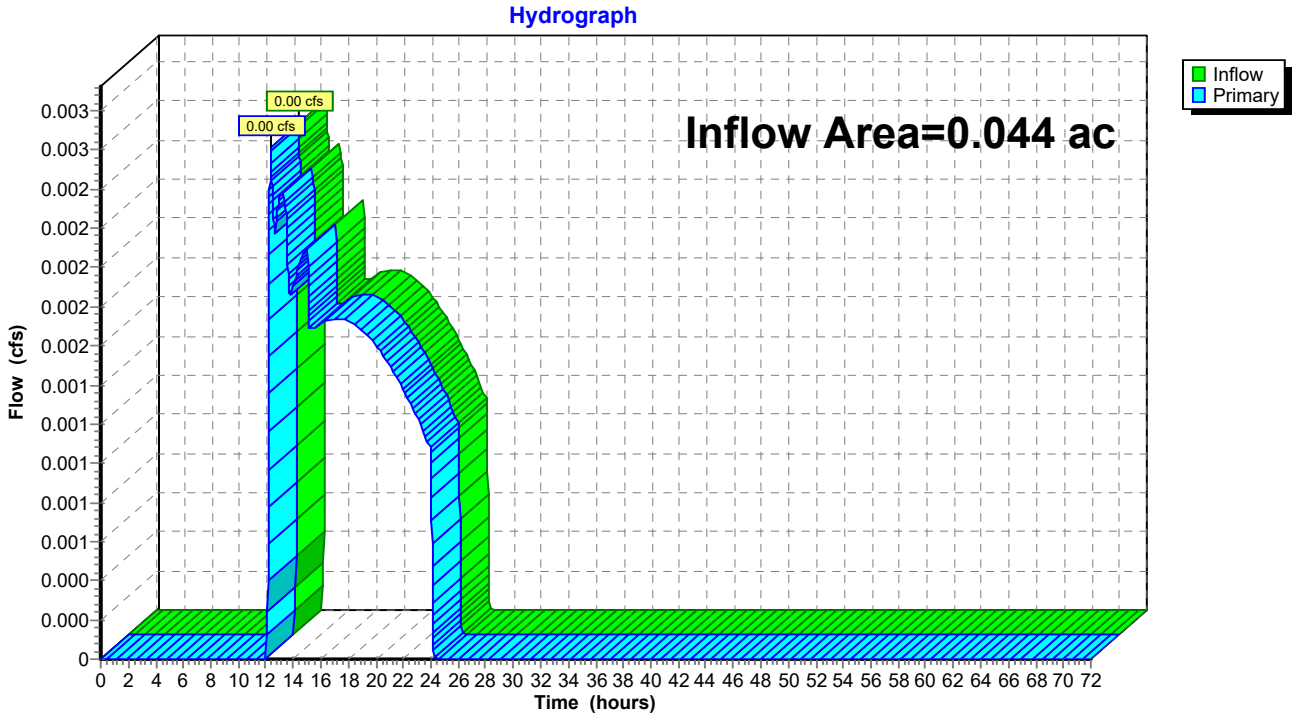
Summary for Pond AP-4: SOUTHERN PROPERTY LINE

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.044 ac, 0.00% Impervious, Inflow Depth = 0.45" for 100-Year event
Inflow = 0.00 cfs @ 12.35 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 12.35 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond AP-4: SOUTHERN PROPERTY LINE



Events for Subcatchment PR-1: Subcat PR-1

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.36	0.75	0.111	0.33
10-Year	5.22	5.19	0.386	1.16
25-Year	6.37	8.70	0.607	1.82
100-Year	**8.16**	**14.89**	**1.003**	**3.00**

Events for Subcatchment PR-2: Subcat PR-2

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.36	0.02	0.009	0.21
10-Year	5.22	0.46	0.038	0.90
25-Year	6.37	0.85	0.062	1.49
100-Year	**8.16**	**1.57**	**0.108**	**2.56**

Events for Subcatchment PR-3: Subcat PR-3

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.36	0.01	0.002	0.02
10-Year	5.22	0.10	0.051	0.33
25-Year	6.37	0.82	0.105	0.68
100-Year	**8.16**	**2.66**	**0.219**	**1.42**

Events for Subcatchment PR-4: Subcat PR-4

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.36	0.00	0.000	0.00
10-Year	5.22	0.00	0.001	0.06
25-Year	6.37	0.00	0.002	0.24
100-Year	**8.16**	**0.03**	**0.006**	**0.69**

Events for Subcatchment PR-5: Subcat PR-5

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.36	0.00	0.000	0.00
10-Year	5.22	0.00	0.001	0.11
25-Year	6.37	0.00	0.002	0.33
100-Year	**8.16**	**0.05**	**0.004**	**0.86**

Events for Subcatchment PR-6: Subcat PR-6

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.36	0.00	0.000	0.00
10-Year	5.22	0.00	0.000	0.01
25-Year	6.37	0.00	0.000	0.12
100-Year	**8.16**	**0.00**	**0.002**	**0.45**

Events for Pond 8P: INFILTRATION BASIN

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Year	0.75	0.09	0.09	0.00	324.29	1,375
10-Year	5.23	0.16	0.16	0.00	326.03	12,640
25-Year	9.48	0.22	0.22	0.00	327.23	22,334
100-Year	**17.53**	**0.70**	**0.28**	**0.43**	**328.36**	**32,960**

Events for Pond 9P: FOREBAY

Event	Elevation (feet)	Storage (cubic-feet)
2-Year	**0.00**	**0**
10-Year	0.00	0
25-Year	0.00	0
100-Year	0.00	0

Events for Pond AP-1: Northern Property Lines

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (acre-feet)
2-Year	0.00	0.00	**0.00**	**0.000**
10-Year	0.00	0.00	0.00	0.000
25-Year	0.00	0.00	0.00	0.000
100-Year	**0.03**	**0.03**	0.00	0.000

Events for Pond AP-2: UNION STREET

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (acre-feet)
2-Year	0.02	0.02	**0.00**	**0.000**
10-Year	0.46	0.46	0.00	0.000
25-Year	0.85	0.85	0.00	0.000
100-Year	**1.59**	**1.59**	0.00	0.000

Events for Pond AP-3: SOUTHERN CORNER

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (acre-feet)
2-Year	0.00	0.00	**0.00**	**0.000**
10-Year	0.00	0.00	0.00	0.000
25-Year	0.00	0.00	0.00	0.000
100-Year	**0.05**	**0.05**	0.00	0.000

Events for Pond AP-4: SOUTHERN PROPERTY LINE

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (acre-feet)
2-Year	0.00	0.00	**0.00**	**0.000**
10-Year	0.00	0.00	0.00	0.000
25-Year	0.00	0.00	0.00	0.000
100-Year	**0.00**	**0.00**	0.00	0.000

FOREBAY AND INFILTRATION BASIN STORAGE TABLES

Stage-Area-Storage for Pond 9P: FOREBAY

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
324.00	490	0
324.01	492	5
324.02	494	10
324.03	496	15
324.04	497	20
324.05	499	25
324.06	501	30
324.07	503	35
324.08	505	40
324.09	507	45
324.10	509	50
324.11	510	55
324.12	512	60
324.13	514	65
324.14	516	70
324.15	518	76
324.16	520	81
324.17	522	86
324.18	523	91
324.19	525	96
324.20	527	102
324.21	529	107
324.22	531	112
324.23	533	118
324.24	535	123
324.25	537	128
324.26	538	134
324.27	540	139
324.28	542	144
324.29	544	150
324.30	546	155
324.31	548	161
324.32	550	166
324.33	551	172
324.34	553	177
324.35	555	183
324.36	557	188
324.37	559	194
324.38	561	200
324.39	563	205
324.40	564	211
324.41	566	217
324.42	568	222
324.43	570	228
324.44	572	234
324.45	574	239
324.46	576	245
324.47	577	251
324.48	579	257
324.49	581	262
324.50	583	268
324.51	585	274
324.52	587	280
324.53	589	286
324.54	590	292
324.55	592	298
324.56	594	304
324.57	596	310
324.58	598	315
324.59	600	321
324.60	602	327
324.61	603	334
324.62	605	340
324.63	607	346
324.64	609	352
324.65	611	358
324.66	613	364
324.67	615	370
324.68	616	376
324.69	618	382
324.70	620	389
324.71	622	395
324.72	624	401
324.73	626	407
324.74	628	414
324.75	630	420
324.76	631	426
324.77	633	432
324.78	635	439
324.79	637	445
324.80	639	452
324.81	641	458
324.82	643	464
324.83	644	471
324.84	646	477
324.85	648	484
324.86	650	490
324.87	652	497
324.88	654	503
324.89	656	510
324.90	657	516
324.91	659	523
324.92	661	530
324.93	663	536
324.94	665	543
324.95	667	549
324.96	669	556
324.97	670	563
324.98	672	570
324.99	674	576
325.00	**676**	**583**

Stage-Area-Storage for Pond 8P: INFILTRATION BASIN

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
324.00	1,367	0
324.05	1,382	229
324.10	1,397	462
324.15	1,412	700
324.20	1,428	942
324.25	1,443	1,190
324.30	1,458	1,442
324.35	1,473	1,699
324.40	1,488	1,961
324.45	1,503	2,227
324.50	1,519	2,498
324.55	1,534	2,774
324.60	1,549	3,054
324.65	1,564	3,340
324.70	1,579	3,630
324.75	1,594	3,924
324.80	1,609	4,224
324.85	1,625	4,528
324.90	1,640	4,837
324.95	1,655	5,151
325.00	1,670	5,469
325.05	1,686	5,791
325.10	1,703	6,116
325.15	1,719	6,443
325.20	1,736	6,772
325.25	1,752	7,104
325.30	1,769	7,439
325.35	1,785	7,776
325.40	1,802	8,116
325.45	1,818	8,458
325.50	1,835	8,802
325.55	1,851	9,150
325.60	1,867	9,499
325.65	1,884	9,851
325.70	1,900	10,206
325.75	1,917	10,563
325.80	1,933	10,923
325.85	1,950	11,286
325.90	1,966	11,650
325.95	1,983	12,018
326.00	1,999	12,388
326.05	2,017	12,760
326.10	2,035	13,135
326.15	2,052	13,513
326.20	2,070	13,893
326.25	2,088	14,276
326.30	2,106	14,662
326.35	2,123	15,050
326.40	2,141	15,441
326.45	2,159	15,835
326.50	2,177	16,231
326.55	2,194	16,630
326.60	2,212	17,032
326.65	2,230	17,436
326.70	2,247	17,843
326.75	2,265	18,253
326.80	2,283	18,665
326.85	2,301	19,080
326.90	2,318	19,498
326.95	2,336	19,918
327.00	2,354	20,341
327.05	2,373	20,767
327.10	2,392	21,195
327.15	2,411	21,626
327.20	2,430	22,060
327.25	2,449	22,497
327.30	2,468	22,937
327.35	2,487	23,379
327.40	2,506	23,825
327.45	2,525	24,273
327.50	2,544	24,724
327.55	2,563	25,177
327.60	2,582	25,634
327.65	2,601	26,093
327.70	2,620	26,555
327.75	2,639	27,020
327.80	2,658	27,487
327.85	2,677	27,958
327.90	2,696	28,431
327.95	2,715	28,907
328.00	2,734	29,386
328.05	2,754	29,868
328.10	2,775	30,352
328.15	2,795	30,840
328.20	2,815	31,331
328.25	2,836	31,824
328.30	2,856	32,320
328.35	2,876	32,820
328.40	2,896	33,322
328.45	2,917	33,827
328.50	2,937	34,336
328.55	2,957	34,847
328.60	2,978	35,361
328.65	2,998	35,878
328.70	3,018	36,398
328.75	3,039	36,921
328.80	3,059	37,446
328.85	3,079	37,975
328.90	3,099	38,507
328.95	3,120	39,041
329.00	**3,140**	**39,579**

BASIN OUTLET ELEVATION
WATER QUALITY VOLUME PROVIDED

RATIONAL PIPE SIZING CALCULATIONS

Land Use Coefficients "C"								
Pave	0.90							
Gravel	0.80							
Wetland	0.72							
Grass	0.30							
Woods	0.25							
Roof	0.90							
	Land Use Area							Weighted
Area	Impervious	Gravel	Wetland	Pervious	Woods	Roof	Total	"C"
	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	
CB-1	0.052			0.000	0.000	0.000	0.052	0.90
CB-2	0.191			0.266	0.259	0.012	0.728	0.45
CB-3	0.111			0.281	0.000	0.041	0.433	0.51
CB-4	0.185			0.492	0.108	0.083	0.868	0.48
CB-5	0.135			0.299	0.015	0.021	0.470	0.50
CB-6	0.144			0.368	0.000	0.021	0.533	0.49
CB-7	0.193			1.462	0.157	0.041	1.853	0.37
CB-8	0.084			0.198	0.000	0.009	0.291	0.49
CB-9	0.031			0.000	0.000	0.000	0.031	0.90
CB-10	0.031			0.032	0.000	0.000	0.063	0.60
SUBTOTAL	1.157	0.000	0.000	3.398	0.539	0.228	5.322	
OVERALL								
TOTALS	1.157			3.398	0.539	0.228	5.322	

Franklin, MA 01757-0235

DESIGN COMPUTATIONS FOR STORM DRAINS

Prepared By MAH Date 10/10/2025 Revised

Checked By _____ Date Revised

Drainage Area	Upper Structure	Lower Structure	Sum of CA's (sf)	Time of Concentration (Tc) (min)	Rainfall Intensity (I) (in/hr)	Actual Peak Flow Rate (Q) (cfs)	Pipe Diameter (in)	Slope (ft/ft)	Roughness Coefficient (n)	Design Flow Full (Q) (cfs)	Velocity Flow Full (V) (fps)	Actual Velocity (V) (fps)	Length of Pipe (L)* (ft)	Time in pipe (min)	Total Fall (ft)	Invert Elevation Elev. Upper End	Invert Elevation Elev. Lower End	Rim Elev Elev. Upper End	Rim Elev Elev. Lower End	Destination
	CB-1	DMH-1	0.05	6.00	8.02	0.38	12	0.005	0.011	2.98	3.79	0.48	10.0	0.04	0.05	327.80	327.75	330.69	331.16	
	CB-2	DMH-1	0.33	6.00	8.02	2.62	12	0.005	0.011	3.06	3.89	3.34	20.9	0.09	0.11	327.86	327.75	330.69	331.16	
	CB-3	DMH-3	0.22	6.00	8.02	1.77	12	0.019	0.011	5.82	7.41	2.26	11.0	0.02	0.21	330.90	330.69	334.90	335.15	
	CB-4	DMH-3	0.42	6.00	8.02	3.33	12	0.010	0.011	4.17	5.31	4.25	21.4	0.07	0.21	330.90	330.69	334.90	335.15	
	CB-5	DMH-4	0.23	6.00	8.02	1.88	12	0.006	0.011	3.16	4.02	2.39	7.1	0.03	0.04	334.00	333.96	338.01	338.19	
	CB-6	DMH-4	0.26	6.00	8.02	2.08	12	0.005	0.011	2.96	3.77	2.64	20.2	0.09	0.10	334.00	333.90	338.02	338.19	
	CB-7	DMH-5	0.69	6.00	8.02	5.52	15	0.006	0.011	5.91	4.82	4.50	128.3	0.44	0.77	330.69	329.92	334.10	340.22	
	CB-8	DMH-2	0.14	6.00	8.02	1.15	12	0.005	0.011	2.97	3.78	1.46	108.9	0.48	0.54	328.10	327.56	333.10	333.07	
	CB-9	WQU-1	0.03	6.00	8.02	0.22	12	0.007	0.011	3.41	4.34	0.28	6.1	0.02	0.04	324.80	324.76	327.80	327.60	Infiltration Basin #1
	CB-10	WQU-1	0.04	6.00	8.02	0.30	12	0.005	0.011	3.02	3.84	0.38	39.0	0.17	0.20	325.00	324.80	328.80	327.60	
	DMH-5	DMH-4	0.69	6.44	8.02	5.52	18	0.005	0.011	8.82	4.99	3.12	107.1	0.36	0.54	329.67	329.13	340.22	338.19	
	DMH-4	DMH-3	1.18	6.80	8.02	9.47	24	0.005	0.011	18.90	6.02	3.02	174.4	0.48	0.87	328.63	327.76	338.19	335.15	
	DMH-3	FES #2	1.82	7.28	7.44	13.53	24	0.005	0.011	19.02	6.05	4.31	49.4	0.14	0.25	327.66	327.41	335.15		
	DMH-1	DMH-2	0.37	6.09	8.02	3.00	15	0.005	0.011	5.42	4.42	2.44	59.5	0.22	0.30	327.50	327.20	331.16	333.07	
	DMH-2	FES #1	0.52	6.48	8.02	4.15	15	0.005	0.011	5.42	4.42	3.38	81.2	0.31	0.41	327.10	326.69	333.07		
	WQU-1	DMH-8	0.07	6.17	8.02	0.52	12	0.005	0.011	2.91	3.70	0.67	23.1	0.10	0.11	324.66	324.55	327.60	326.60	

NRCS SOIL SURVEY

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 Norfolk and Suffolk Counties, Massachusetts

543 Union Street, Franklin, MA

July 17, 2025

Preface

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

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

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

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

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

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

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Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

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

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

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:2,550 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 35, 70, 140, 210

Feet: 0, 100, 200, 400, 600

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

MAP LEGEND

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

Soils
- Soil 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: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 20, Aug 27, 2024

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

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

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background 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
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	24.4	96.0%
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	0.2	0.6%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	0.2	0.7%
653	Udorthents, sandy	0.7	2.7%
Totals for Area of Interest		**25.4**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

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

Norfolk and Suffolk Counties, Massachusetts

254A—Merrimac fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tyqr
Elevation: 0 to 1,100 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Merrimac and similar soils: 86 percent
Minor components: 14 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): Summit, shoulder, backslope, footslope
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 3 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): 1
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash

Hydric soil rating: No

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): Head slope, nose slope, side slope, crest, 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: 3 percent
Landform: Dunes, deltas, outwash terraces, outwash plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Walpole

Percent of map unit: 1 percent
Landform: Depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F144AY028MA - Wet Outwash
Hydric soil rating: Yes

260B—Sudbury fine sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: vky4
Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Sudbury

Setting

Landform: Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable coarse-loamy eolian deposits over loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 11 inches: sandy loam
H2 - 11 to 22 inches: sandy loam
H3 - 22 to 60 inches: gravelly coarse sand

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: No

Minor Components

Walpole

Percent of map unit: 5 percent
Landform: Terraces
Hydric soil rating: Yes

Merrimac

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

Deerfield

Percent of map unit: 5 percent
Landform: Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread

Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

310B—Woodbridge fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t2ql
Elevation: 0 to 1,470 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Woodbridge, fine sandy loam, and similar soils: 82 percent
Minor components: 18 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge, Fine Sandy Loam

Setting

Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
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 8 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Moderately well drained
Runoff class: Medium
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 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Paxton

Percent of map unit: 10 percent
Landform: Drumlins, ground moraines, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury

Percent of map unit: 8 percent
Landform: Depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Toeslope, backslope, footslope
Landform position (three-dimensional): Base slope, head slope, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

653—Udorthents, sandy

Map Unit Setting

National map unit symbol: vky8
Elevation: 0 to 3,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Udorthents

Setting

Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Riser, tread
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Excavated and filled sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: variable

H2 - 6 to 60 inches: variable

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: Unranked

Minor Components

Udorthents

Percent of map unit: 8 percent
Hydric soil rating: Unranked

Urban land

Percent of map unit: 5 percent
Hydric soil rating: Unranked

Swansea

Percent of map unit: 2 percent
Landform: Bogs
Hydric soil rating: Yes

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.

Map Scale: 1:2,550 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 35 70 140 210

Feet
0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 20, Aug 27, 2024

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

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

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background 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
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	A	24.4	96.0%
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	B	0.2	0.6%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	C/D	0.2	0.7%
653	Udorthents, sandy	A	0.7	2.7%
Totals for Area of Interest			**25.4**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

TSS REMOVAL CALCULATIONS

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

Location: 543 Union Street - Infiltration Basin #1

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	25%	1.00	25%	75%
Infiltration Basin #1	80%	75%	60%	15%

Total TSS Removal = 85%

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

Project: F-4719

Prepared By: Michael Hassett

Date: 2025-10-10

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

Location: 543 Union Street - Infiltration Basin #1

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	0.25	1.00	0.25	0.75
Sediment Forebay	0.25	0.75	0.19	0.56

Pretreatment

Total TSS Removal = 44%

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

Project: F-4719

Prepared By: Michael Hassett

Date: 2025-10-10

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

Location: 543 Union Street - Water Quality Unit (WQU-1)

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	25%	1.00	25%	75%
Contech Hydrodynamic Separator Manhole	50%	75%	37.5%	37.5%

Total TSS Removal = 62.5%*

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

*see stormwater report for calculations demonstrating that on average, 80% TSS removal across the site is achieved

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

Project: F-4719

Prepared By: Michael Hassett

Date: 2025-10-10

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

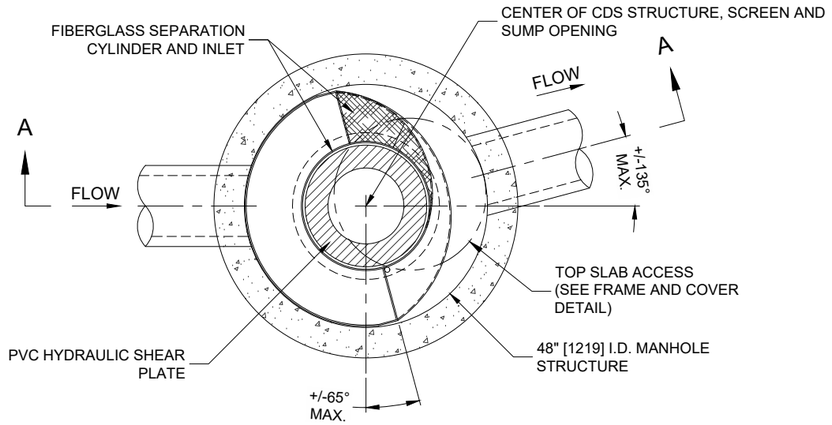
1. From MassDEP Stormwater Handbook Vol. 1

INSPECTION FORM

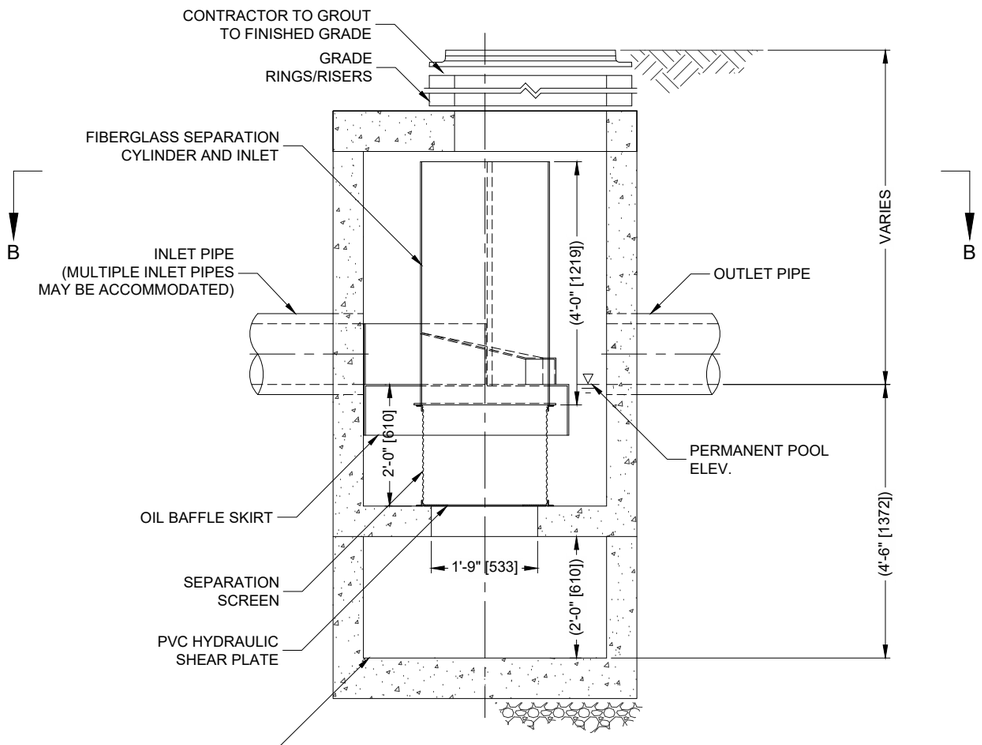
Post Construction Inspection Report
543 Union Street
Franklin, Massachusetts

INSPECTION DATE:						
Person Inspecting		Weather				Other Personnel Present
		Clear				
Item	**N/A***	**sat.****	**NMR*****	**CAM****	**MCA***	**Comments:**
Pavement Swept						
Catch Basins						
CB-1						
CB-2						
CB-3						
CB-4						
CB-5						
CB-6						
CB-7						
CB-8						
CB-9						
CB-10						
Cultec Chambers						
Separator Row						
Inspection Port						
Infiltration Basin #1						
Sediment Forebay						
Infiltration Basin						
FES-1						
FES-2						
OCS #1						
NMR* normal maintenance requested						
N/A* not applicable at the time of inspection						
CAM* corrective action - minor						
SAT* satisfactory conditions as compliant						
MCA* Major corrective action						

CONTECH INSTALLATION AND MAINTENANCE DOCUMENTS



PLAN VIEW B-B
N.T.S.



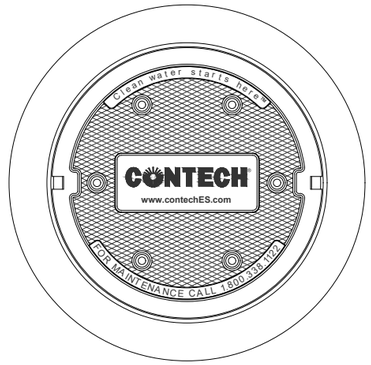
ELEVATION A-A
N.T.S.

CDS2015-4-C DESIGN NOTES

CDS2015-4-C RATED TREATMENT CAPACITY IS 1.4 CFS, OR PER LOCAL REGULATIONS.

THE STANDARD CDS2015-4-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			
WATER QUALITY FLOW RATE (CFS OR L/s)			*
PEAK FLOW RATE (CFS OR L/s)			*
RETURN PERIOD OF PEAK FLOW (YRS)			*
SCREEN APERTURE (2400 OR 4700)			*
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*
RIM ELEVATION			*
ANTI-FLOTATION BALLAST		WIDTH	HEIGHT
		*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
3. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
4. STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 2', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO..
5. IF REQUIRED, PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.
6. CDS STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE.
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS2015-4-C
ONLINE CDS
STANDARD DETAIL

SECTION (_____)
STORM WATER TREATMENT DEVICE

1.0 GENERAL

1.1 This item shall govern the furnishing and installation of the CDS® by Contech Engineered Solutions LLC, complete and operable as shown and as specified herein, in accordance with the requirements of the plans and contract documents.

1.2 The Contractor shall furnish all labor, equipment and materials necessary to install the storm water treatment device(s) (SWTD) and appurtenances specified in the Drawings and these specifications.

1.3 The manufacturer of the SWTD shall be one that is regularly engaged in the engineering design and production of systems deployed for the treatment of storm water runoff for at least five (5) years and which have a history of successful production, acceptable to the Engineer. In accordance with the Drawings, the SWTD(s) shall be a CDS® device manufactured by:

Contech Engineered Solutions LLC
9025 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

1.4 Related Sections

1.4.1 Section 02240: Dewatering
1.4.2 Section 02260: Excavation Support and Protection
1.4.3 Section 02315: Excavation and Fill
1.4.4 Section 02340: Soil Stabilization

1.5 All components shall be subject to inspection by the engineer at the place of manufacture and/or installation. All components are subject to being rejected or identified for repair if the quality of materials and manufacturing do not comply with the requirements of this specification. Components which have been identified as defective may be subject for repair where final acceptance of the component is contingent on the discretion of the Engineer.

1.6 The manufacturer shall guarantee the SWTD components against all manufacturer originated defects in materials or workmanship for a period of twelve (12) months from the date the components are delivered to the owner for installation. The manufacturer shall upon its determination repair, correct or replace any manufacturer originated defects advised in writing to the manufacturer within the referenced warranty period. The use of SWTD components shall be limited to the application for which it was specifically designed.

1.7 The SWTD manufacturer shall submit to the Engineer of Record a “Manufacturer’s Performance Certification” certifying that each SWTD is capable of achieving the specified removal efficiencies listed in these specifications. The certification shall be supported by independent third-party research

1.8 No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the Engineer of Record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

2.0 MATERIALS

2.1 Housing unit of stormwater treatment device shall be constructed of pre-cast or cast-in-place concrete, no exceptions. Precast concrete components shall conform to applicable sections of ASTM C 478, ASTM C 857 and ASTM C 858 and the following:

- 2.1.1 Concrete shall achieve a minimum 28-day compressive strength of 4,000 pounds per square-inch (psi);
- 2.1.2 Unless otherwise noted, the precast concrete sections shall be designed to withstand lateral earth and AASHTO H-20 traffic loads;
- 2.1.3 Cement shall be Type III Portland Cement conforming to ASTM C 150;
- 2.1.4 Aggregates shall conform to ASTM C 33;
- 2.1.5 Reinforcing steel shall be deformed billet-steel bars, welded steel wire or deformed welded steel wire conforming to ASTM A 615, A 185, or A 497.
- 2.1.6 Joints shall be sealed with preformed joint sealing compound conforming to ASTM C 990.
- 2.1.7 Shipping of components shall not be initiated until a minimum compressive strength of 4,000 psi is attained or five (5) calendar days after fabrication has expired, whichever occurs first.

2.2 Internal Components and appurtenances shall conform to the following:

- 2.2.1 Screen and support structure shall be manufactured of Type 316 and 316L stainless steel conforming to ASTM F 1267-01;
- 2.2.2 Hardware shall be manufactured of Type 316 stainless steel conforming to ASTM A 320;
- 2.2.3 Fiberglass components shall conform to applicable sections of ASTM D-4097
- 2.2.4 Access system(s) conform to the following:
- 2.2.5 Manhole castings shall be designed to withstand AASHTO H-20 loadings and manufactured of cast-iron conforming to ASTM A 48 Class 30.

3.0 PERFORMANCE

3.1 The SWTD shall be sized to either achieve an 80 percent average annual reduction in the total suspended solid load or treat a flow rate designated by the jurisdiction in which the project is located. Both methods should be sized using a particle size distribution having a mean particle size (d_{50}) of 125 microns unless otherwise stated.

3.2 The SWTD shall be capable of capturing and retaining 100 percent of pollutants greater than or equal to 2.4 millimeters (mm) regardless of the pollutant's specific gravity (i.e.: floatable and neutrally buoyant materials) for flows up to the device's rated-treatment capacity. The

SWTD shall be designed to retain all previously captured pollutants addressed by this subsection under all flow conditions. The SWTD shall be capable of capturing and retaining total petroleum hydrocarbons. The SWTD shall be capable of achieving a removal efficiency of 92 and 78 percent when the device is operating at 25 and 50 percent of its rated-treatment capacity. These removal efficiencies shall be based on independent third-party research for influent oil concentrations representative of storm water runoff (20 ± 5 mg/L). The SWTD shall be greater than 99 percent effective in controlling dry-weather accidental oil spills.

3.3 The SWTD shall be designed with a sump chamber for the storage of captured sediments and other negatively buoyant pollutants in between maintenance cycles. The minimum storage capacity provided by the sump chamber shall be in accordance with the volume listed in Table 1. The boundaries of the sump chamber shall be limited to that which do not degrade the SWTD's treatment efficiency as captured pollutants accumulate. The sump chamber shall be separate from the treatment processing portion(s) of the SWTD to minimize the probability of fine particle re-suspension. In order to not restrict the Owner's ability to maintain the SWTD, the minimum dimension providing access from the ground surface to the sump chamber shall be 16 inches in diameter.

3.4 The SWTD shall be designed to capture and retain Total Petroleum Hydrocarbons generated by wet-weather flow and dry-weather gross spills and have a capacity listed in Table 1 of the required unit.

3.5 The SWTD shall convey the flow from the peak storm event of the drainage network, in accordance with required hydraulic upstream conditions as defined by the Engineer. If a substitute SWTD is proposed, supporting documentation shall be submitted that demonstrates equal or better upstream hydraulic conditions compared to that specified herein. This documentation shall be signed and sealed by a Professional Engineer registered in the State of the work. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.6 The SWTD shall have completed field tested following TARP Tier II protocol requirements

4.0 EXECUTION

4.1 The contractor shall exercise care in the storage and handling of the SWTD components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the contractor.

4.2 The SWTD shall be installed in accordance with the manufacturer's recommendations and related sections of the contract documents. The manufacturer shall provide the contractor installation instructions and offer on-site guidance during the important stages of the installation as identified by the manufacturer at no additional expense. A minimum of 72 hours notice shall be provided to the manufacturer prior to their performance of the services included under this subsection.

4.3 The contractor shall fill all voids associated with lifting provisions provided by the manufacturer. These voids shall be filled with non-shrinking grout providing a finished surface consistent with adjacent surfaces. The contractor shall trim all protruding lifting provisions flush with the adjacent concrete surface in a manner, which leaves no sharp points or edges.

4.4 The contractor shall removal all loose material and pooling water from the SWTD prior to the transfer of operational responsibility to the Owner.

TABLE 1
Storm Water Treatment Device
Storage Capacities

CDS Model	Minimum Sump Storage Capacity $(yd^3)/(m^3)$	Minimum Oil Storage Capacity (gal)/(L)
CDS2015-4	0.9(0.7)	61(232)
CDS2015-5	1.5(1.1)	83(313)
CDS2020-5	1.5(1.1)	99(376)
CDS2025-5	1.5(1.1)	116(439)
CDS3020-6	2.1 (1.6)	184(696)
CDS3025-6	2.1(1.6)	210(795)
CDS3030-6	2.1 (1.6)	236(895)
CDS3035-6	2.1 (1.6)	263(994)
CDS3535-7	2.9(2.2)	377(1426)
CDS4030-8	5.6(4.3)	426(1612)
CDS4040-8	5.6 (4.3)	520(1970)
CDS4045-8	5.6 (4.3)	568(2149)
CDS5640-10	8.7(6.7)	758(2869)
CDS5653-10	8.7(6.7)	965(3652)
CDS5668-10	8.7(6.7)	1172(4435)
CDS5678-10	8.7(6.7)	1309(4956)
CDS10060-DV	5.0 (3.8)	792 (2997)
CDS10080-DV	5.0 (3.8)	1057 (4000)
CDS100100-DV	5.0 (3.8)	1320 (4996)

END OF SECTION

CONTECH®
ENGINEERED SOLUTIONS

CDS Guide
Operation, Design, Performance and Maintenance

CDS®

Using patented continuous deflective separation technology, the CDS system screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls physically separate captured solids, and minimize the re-suspension and release of previously trapped pollutants. Inline units can treat up to 6 cfs, and internally bypass flows in excess of 50 cfs (1416 L/s). Available precast or cast-in-place, offline units can treat flows from 1 to 300 cfs (28.3 to 8495 L/s). The pollutant removal capacity of the CDS system has been proven in lab and field testing.

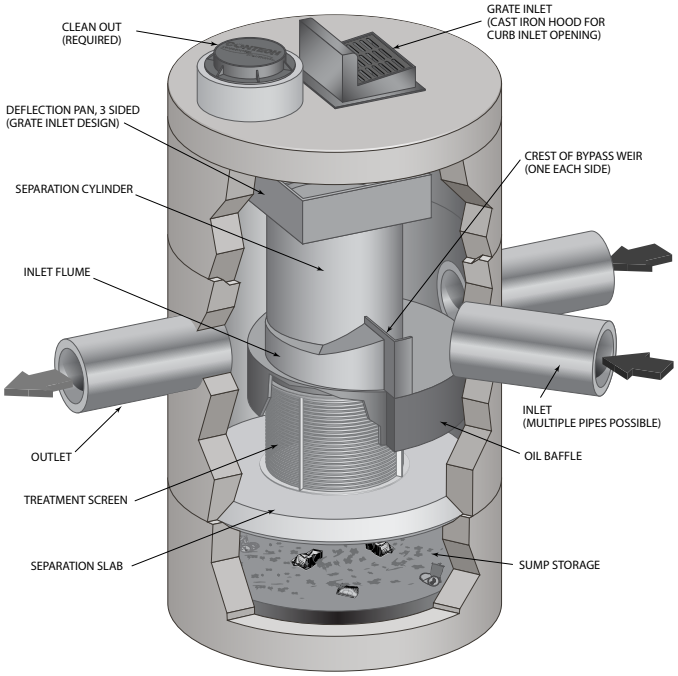
Operation Overview

Stormwater enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the system's treatment design capacity enter the separation chamber and are treated.

Swirl concentration and screen deflection force floatables and solids to the center of the separation chamber where 100% of floatables and neutrally buoyant debris larger than the screen apertures are trapped.

Stormwater then moves through the separation screen, under the oil baffle and exits the system. The separation screen remains clog free due to continuous deflection.

During the flow events exceeding the treatment design capacity, the diversion weir bypasses excessive flows around the separation chamber, so captured pollutants are retained in the separation cylinder.



Design Basics

There are three primary methods of sizing a CDS system. The Water Quality Flow Rate Method determines which model size provides the desired removal efficiency at a given flow rate for a defined particle size. The Rational Rainfall Method™ or the and Probabilistic Method is used when a specific removal efficiency of the net annual sediment load is required.

Typically in the Unites States, CDS systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a gradation with an average particle size (d50) of 125 microns (μm). For some regulatory environments, CDS systems can also be designed to achieve an 80% annual solids load reduction based on an average particle size (d50) of 75 microns (μm) or 50 microns (μm).

Water Quality Flow Rate Method

In some cases, regulations require that a specific treatment rate, often referred to as the water quality design flow (WQQ), be treated. This WQQ represents the peak flow rate from either an event with a specific recurrence interval, e.g. the six-month storm, or a water quality depth, e.g. 1/2-inch (13 mm) of rainfall.

The CDS is designed to treat all flows up to the WQQ. At influent rates higher than the WQQ, the diversion weir will direct most flow exceeding the WQQ around the separation chamber. This allows removal efficiency to remain relatively constant in the separation chamber and eliminates the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as the rate at which the CDS will remove a specific gradation of sediment at a specific removal efficiency. Therefore the treatment flow rate is variable, based on the gradation and removal efficiency specified by the design engineer.

Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. It is important to take these factors into consideration when estimating the long-term performance of any stormwater treatment system. The Rational Rainfall Method combines site-specific information with laboratory generated performance data, and local historical precipitation records to estimate removal efficiencies as accurately as possible.

Short duration rain gauge records from across the United States and Canada were analyzed to determine the percent of the total annual rainfall that fell at a range of intensities. US stations' depths were totaled every 15 minutes, or hourly, and recorded in 0.01-inch increments. Depths were recorded hourly with 1-mm resolution at Canadian stations. One trend was consistent at all sites; the vast majority of precipitation fell at low intensities and high intensity storms contributed relatively little to the total annual depth.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Rainfall Method. Since most sites are relatively small and highly impervious, the Rational Rainfall Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS system are

determined. Performance efficiency curve determined from full scale laboratory tests on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Probabilistic Rational Method

The Probabilistic Rational Method is a sizing program Contech developed to estimate a net annual sediment load reduction for a particular CDS model based on site size, site runoff coefficient, regional rainfall intensity distribution, and anticipated pollutant characteristics.

The Probabilistic Method is an extension of the Rational Method used to estimate peak discharge rates generated by storm events of varying statistical return frequencies (e.g. 2-year storm event). Under the Rational Method, an adjustment factor is used to adjust the runoff coefficient estimated for the 10-year event, correlating a known hydrologic parameter with the target storm event. The rainfall intensities vary depending on the return frequency of the storm event under consideration. In general, these two frequency dependent parameters (rainfall intensity and runoff coefficient) increase as the return frequency increases while the drainage area remains constant.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Method. Since most sites are relatively small and highly impervious, the Rational Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS are determined. Performance efficiency curve on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Treatment Flow Rate

The inlet throat area is sized to ensure that the WQQ passes through the separation chamber at a water surface elevation equal to the crest of the diversion weir. The diversion weir bypasses excessive flows around the separation chamber, thus preventing re-suspension or re-entrainment of previously captured particles.

Hydraulic Capacity

The hydraulic capacity of a CDS system is determined by the length and height of the diversion weir and by the maximum allowable head in the system. Typical configurations allow hydraulic capacities of up to ten times the treatment flow rate. The crest of the diversion weir may be lowered and the inlet throat may be widened to increase the capacity of the system at a given water surface elevation. The unit is designed to meet project specific hydraulic requirements.

Performance

Full-Scale Laboratory Test Results

A full-scale CDS system (Model CDS2020-5B) was tested at the facility of University of Florida, Gainesville, FL. This CDS unit was evaluated under controlled laboratory conditions of influent flow rate and addition of sediment.

Two different gradations of silica sand material (UF Sediment & OK-110) were used in the CDS performance evaluation. The particle size distributions (PSDs) of the test materials were analyzed using standard method "Gradation ASTM D-422 "Standard Test Method for Particle-Size Analysis of Soils" by a certified laboratory.

UF Sediment is a mixture of three different products produced by the U.S. Silica Company: "Sil-Co-Sil 106", "#1 DRY" and "20/40 Oil Frac". Particle size distribution analysis shows that the UF Sediment has a very fine gradation (d50 = 20 to 30 μm) covering a wide size range (Coefficient of Uniformity, C averaged at 10.6). In comparison with the hypothetical TSS gradation specified in the NJDEP (New Jersey Department of Environmental Protection) and NJCAT (New Jersey Corporation for Advanced Technology) protocol for lab testing, the UF Sediment covers a similar range of particle size but with a finer d50 (d50 for NJDEP is approximately 50 μm) (NJDEP, 2003).

The OK-110 silica sand is a commercial product of U.S. Silica Sand. The particle size distribution analysis of this material, also included in Figure 1, shows that 99.9% of the OK-110 sand is finer than 250 microns, with a mean particle size (d50) of 106 microns. The PSDs for the test material are shown in Figure 1.

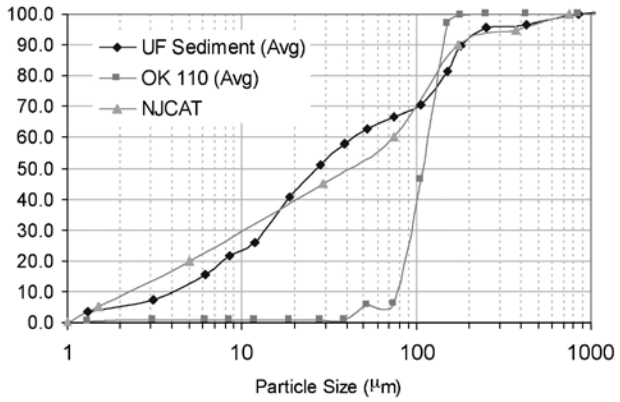


Figure 1. Particle size distributions

Tests were conducted to quantify the performance of a specific CDS unit (1.1 cfs (31.3-L/s) design capacity) at various flow rates, ranging from 1% up to 125% of the treatment design capacity of the unit, using the 2400 micron screen. All tests were conducted with controlled influent concentrations of approximately 200 mg/L. Effluent samples were taken at equal time intervals across the entire duration of each test run. These samples were then processed with a Dekaport Cone sample splitter to obtain representative sub-samples for Suspended Sediment Concentration (SSC) testing using ASTM D3977-97 "Standard Test Methods for Determining Sediment Concentration in Water Samples", and particle size distribution analysis.

Results and Modeling

Based on the data from the University of Florida, a performance model was developed for the CDS system. A regression analysis was used to develop a fitting curve representative of the scattered data points at various design flow rates. This model, which demonstrated good agreement with the laboratory data, can then be used to predict CDS system performance with respect

to SSC removal for any particle size gradation, assuming the particles are inorganic sandy-silt. Figure 2 shows CDS predictive performance for two typical particle size gradations (NJCAT gradation and OK-110 sand) as a function of operating rate.

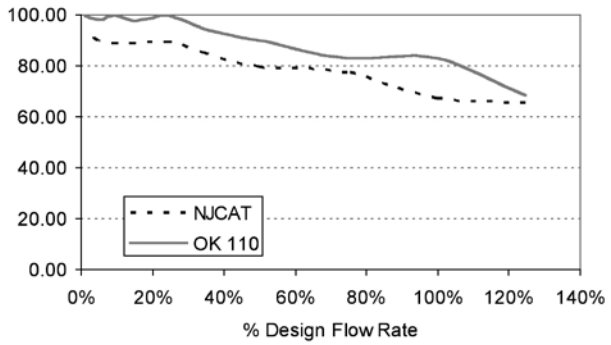


Figure 2. CDS stormwater treatment predictive performance for various particle gradations as a function of operating rate.

Many regulatory jurisdictions set a performance standard for hydrodynamic devices by stating that the devices shall be capable of achieving an 80% removal efficiency for particles having a mean particle size (d50) of 125 microns (e.g. Washington State Department of Ecology — WASDOE - 2008). The model can be used to calculate the expected performance of such a PSD (shown in Figure 3). The model indicates (Figure 4) that the CDS system with 2400 micron screen achieves approximately 80% removal at the design (100%) flow rate, for this particle size distribution (d50 = 125 μm).

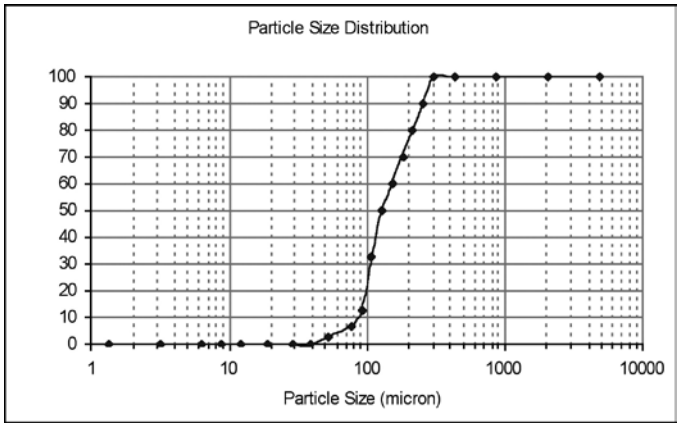


Figure 3. WASDOE PSD

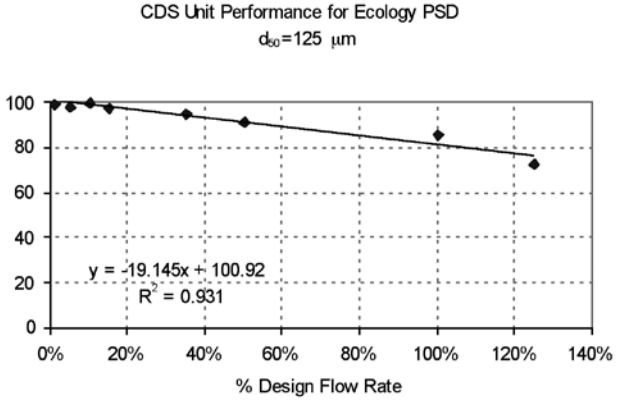


Figure 4. Modeled performance for WASDOE PSD.

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

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

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified

during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

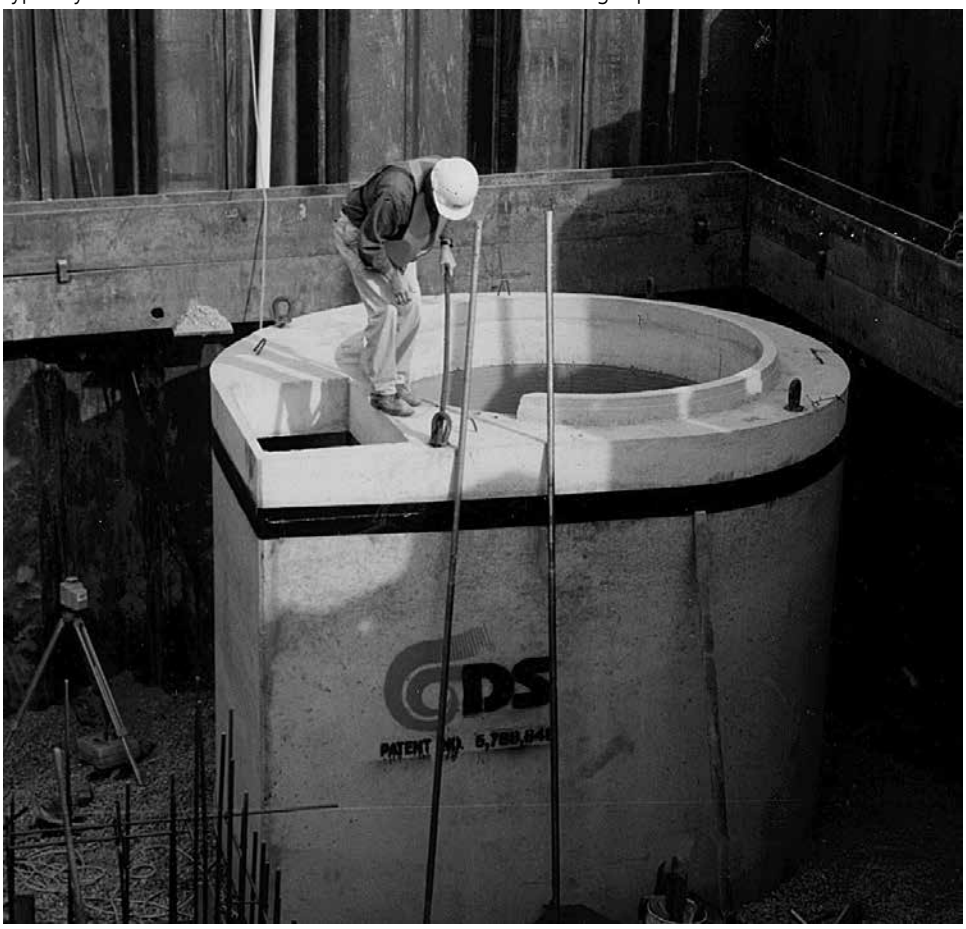
In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be cleaned to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Note: To avoid underestimating the volume of sediment in the chamber, carefully lower the measuring device to the top of the sediment pile. Finer silty particles at the top of the pile may be more difficult to feel with a measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.



CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile**.

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
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