STORMWATER MANAGEMENT REPORT

Definitive Subdivision Plan
Warwick Road Extension
Walpole, Massachusetts

August 22, 2022
Revised: January 19, 2023
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Prepared for:

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Project Introduction:

The applicant, Wall Street Development Corp., is proposing to develop the existing property located off the end of Warwick Road in Walpole, Massachusetts. The property is identified as Assessor Map 56, Parcels 89 and 90. The property consists of approximately 4.76 +/- acres and is serviced by municipal sewer and water. The proposed development was submitted for review to the Walpole Planning Board for review and approval.

The proposal is to subdivide the existing property to create two (2) single family house lots. The site will be accessed from Warwick Road. The proposed dwellings will be service by Town Water and Sewer.

The purpose of these calculations is to demonstrate design compliance of the Project's stormwater management system for water quantity and quality objectives of the Town of Walpole's Stormwater Management and Erosion Control Bylaws. As designed, the system will mitigate peak rates and volumes of runoff for storms up to and including the 100-year event under post-construction conditions.

Methodology/Sources of Data:

The pre- and post-development drainage calculations were prepared using the U.S. Soil Conservation Service Technical Release 20 - Urban Hydrology for storm Small Watersheds. Rainfall calculations for Stormwater management BMP's shall be as per the National Resources Conservation Service Precipitation Frequency Analysis for New York and the New England States.

The overall storm water management plan for the project is designed to maintain the peak rate of storm water runoff and runoff volumes from the site after development. The Soil Conservation Service Modified Soil Cover Complex Method, the computer program "HydroCAD" by Applied Microcomputer Systems, and the procedures specified in Urban Hydrology for storm Small Watersheds were used to determine pre-and post-developed peak flow rates of runoff from the site. The 2-year, 10-year, 25-year and 100-year storm events have been utilized for hydrology calculations. The rainfall data for the Type III, 24-hour storm events follow:

24-Hour Storm	Rainfall (inches)
2	3.27
10	4.94
25	6.26
100	8.99

The storm water runoff will be controlled using "Best Management Practices" and in conformance with the MADEP Stormwater Management Policy. The proposed Project will mitigate peak rates of flow, by constructing a storm water management.

The project is subject to the MADEP Stormwater Management Standards to the maximum extent practicable as a small residential project 2-4 single family houses in a development.

The piped drainage system has been designed utilizing the Rational Method for the 100-year storm event to size street drains.

Soils:

The Natural Resources Conservation Service (NRCS), Hydrologic Soils Group Map for Norfolk county, Massachusetts indicates that the on-site soils primarily consist of Ridgebury, fine sandy loam-71B. NRCS assigned a hydrologic soil rating D for these soil classifications.

The entire developable area is comprised of Hydrologic soil group 'D". When designing BMP's for sites comprised of D soils and rock outcrops at the surface, then the required recharge volume only to the maximum extend practicable. Infiltration systems should not be installed in D soils.

On-site soil testing was performed to determine groundwater elevations and confirm soil classifications. The soil testing confirmed the soil rating and groundwater was encountered during the testing. (See Appendix D) Based on site area limitations and economic factors the "Simple Dynamic" method was used in the design analysis for the stormwater drainage basins.

Existing Conditions Overview:

The property is identified as Assessor Map 56, Parcels 89 and 90. The property consists of approximately 4.76 +/- acres and is serviced by municipal sewer and water. The site is currently undeveloped woodlands and lawn area with a bordering vegetated wetland located within the project site. The site drains via overland flow to the existing wetland areas.

The existing site is divided into two (2) existing watershed subcatchment areas to provide a comprehensive review of surface flows to the surrounding area. The surface water runoff flows via overland to the northerly portion of the site. The flows have been combined with Link L1 (Design Point #1) for comparison with post developed flows. See the attached Pre-Development Subcatchment Area Plan for delineations with associated design points (link).

Proposed Conditions Overview:

The proposal is to subdivide the existing property to create two (2) single family house lots. The site will be accessed from Warwick Road.

The Runoff generated from the Project will be collected via deep sump catch basins where it will be conveyed to stormwater drainage basin to provide mitigation. The system will mitigate the peak rate and volume of runoff through the 100-year storm event. The proposed system will reduce or match all post-development peak flows for design storms up to and including the 100-year storm event.

The proposed runoff areas have been divided into three (3) subcatchments. Subcatchment area #2 discharges to the proposed drainage basin. Subcatchments #1 and #3 flow via overland to design point #1. The flows have been combined with link L2 (Design Point #1) for comparison purposes with pre-development conditions.

The following is summary comparison of Pre- and Post-Developed Rates of Runoff:

Summary of Peak Stormwater Runoff Rates:								
Design Point	**2-Yr Peak Flow (cfs)**		**10-Yr Peak Flow (cfs)**		**25-Yr Peak Flow (cfs)**		**100-Yr Peak Flow (cfs)**	
	Existing Link 1L	***Proposed Link 2L***	***Existing Link 1L***	***Proposed Link 2L***	***Existing Lind 1L***	***Proposed Link 2L***	***Existing Link 1L***	***Proposed Link 2L***
DP #1	7.59	7.35	17.09	16.38	25.35	25.03	43.26	43.25

Summary of Peak Stormwater Runoff Volumes:								
Design Point	**2-Yr Peak Volume (ac.ft.)**		**10-Yr Peak Volume (ac.ft.)**		**25-Yr Peak Volume (ac.ft.)**		**100-Yr PeakVolume (ac.ft.)**	
	Existing Link 1L	***Proposed Link 2L***	***Existing Link 1L***	***Proposed Link 2L***	***Existing Lind 1L***	***Proposed Link 2L***	***Existing Link 1L***	***Proposed Link 2L***
DP #1	0.79	0.84	1.69	1.76	2.49	2.57	4.26	4.35

Summary of Recharge Basins				
	100-Yr Storm Frequency			
Drainage Basin	***Peak Flood Elevation (feet)***	***Bottom Storage Elevation (feet)***	***Top Storage Elevation (feet)***	***Emergency Overflow Elev. (feet)***
1P	217.28	214.00	218.30	217.30

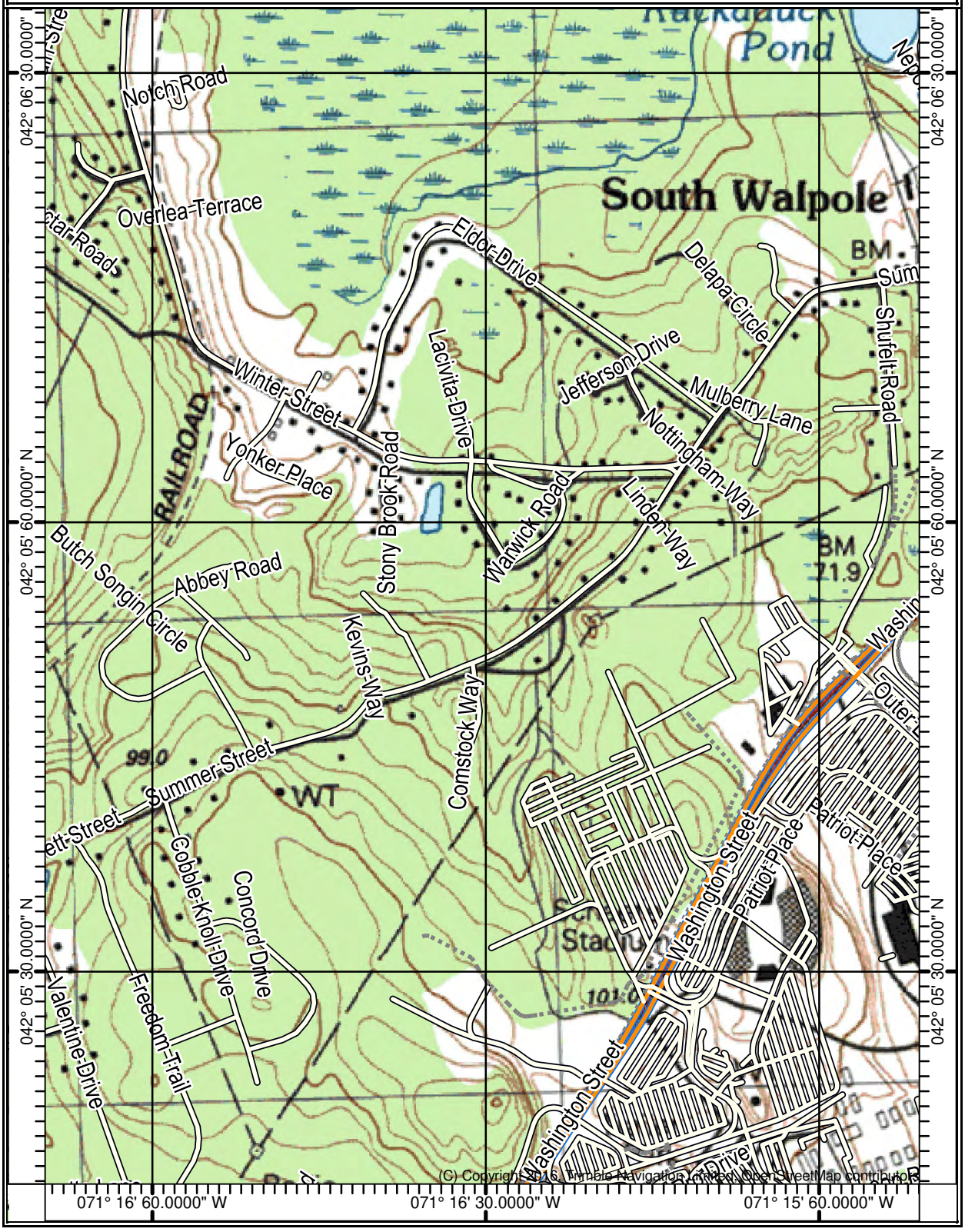
Summary:

The calculations performed for all design storm events indicate that the total peak rates of runoff for the Project as proposed will not exceed those of existing conditions with the implementation of the stormwater management system. With the implementation of the stormwater management system as designed, along with the Operation and Maintenance plan contained herein, all the objectives of the DEP's Stormwater Management Regulations are satisfied.

Map Name: FRANKLIN
Print Date: 08/22/22

Scale: 1 inch = 1,000 ft.
Map Center: 042° 05' 56.0908" N,

Horizontal Datum: NAD27

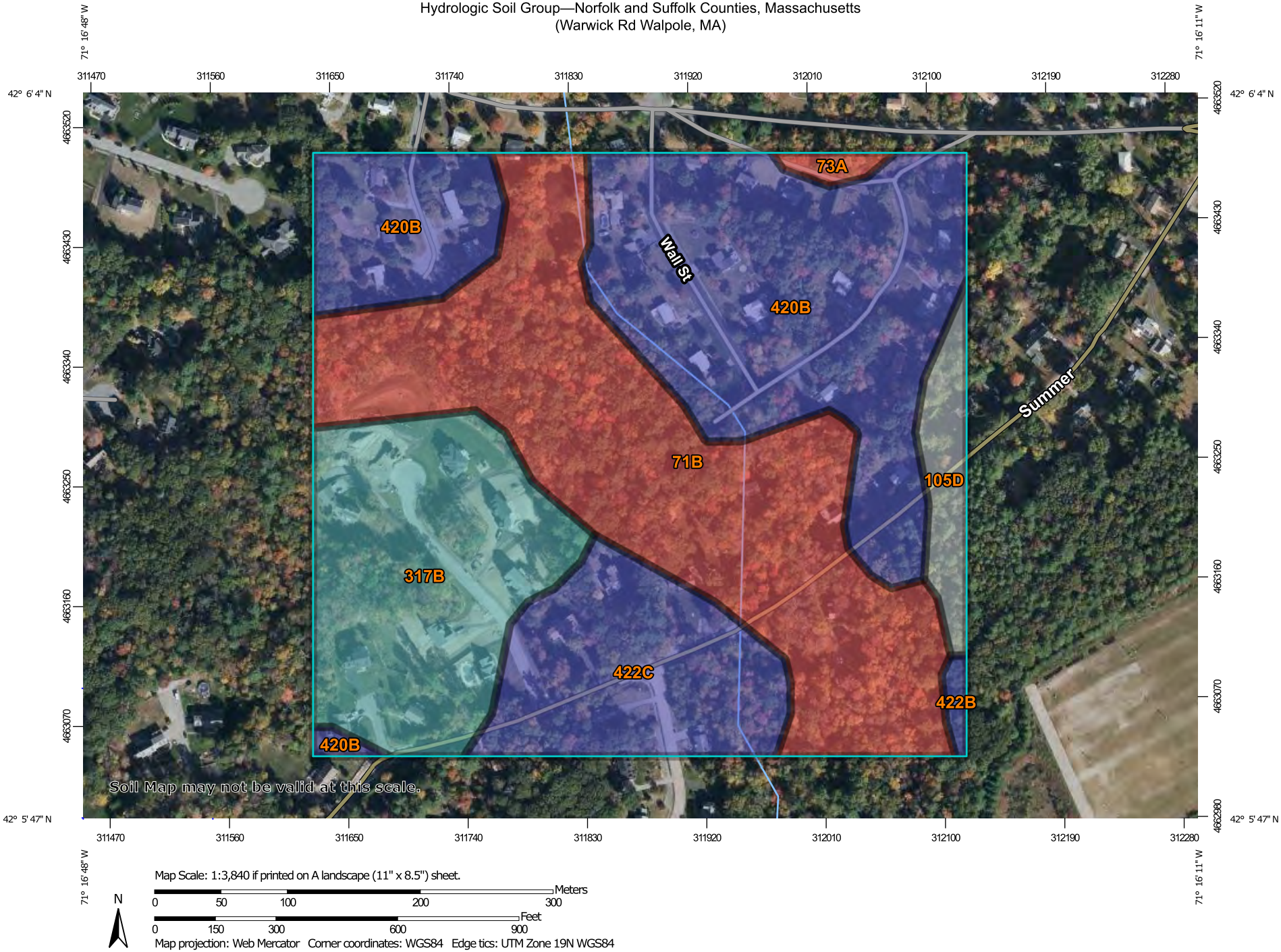


SCALE 1:12000

0 1000 2000 3000

Feet

Hydrologic Soil Group—Norfolk and Suffolk Counties, Massachusetts
(Warwick Rd Walpole, MA)



Map Scale: 1:3,840 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 150 300 600 900

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 17, Sep 3, 2021

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

Date(s) aerial images were photographed: Oct 4, 2020—Oct 19, 2020

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	D	18.1	32.7%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D	0.4	0.7%
105D	Rock outcrop-Hollis complex, 3 to 25 percent slopes		1.8	3.3%
317B	Scituate fine sandy loam, 3 to 8 percent slopes, extremely stony	C	9.9	17.8%
420B	Canton fine sandy loam, 3 to 8 percent slopes	B	18.2	32.8%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	B	0.3	0.5%
422C	Canton fine sandy loam, 8 to 15 percent slopes, extremely stony	B	6.8	12.2%
Totals for Area of Interest			**55.5**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

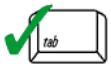
Tie-break Rule: Higher

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

- ☐ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☒ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

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;

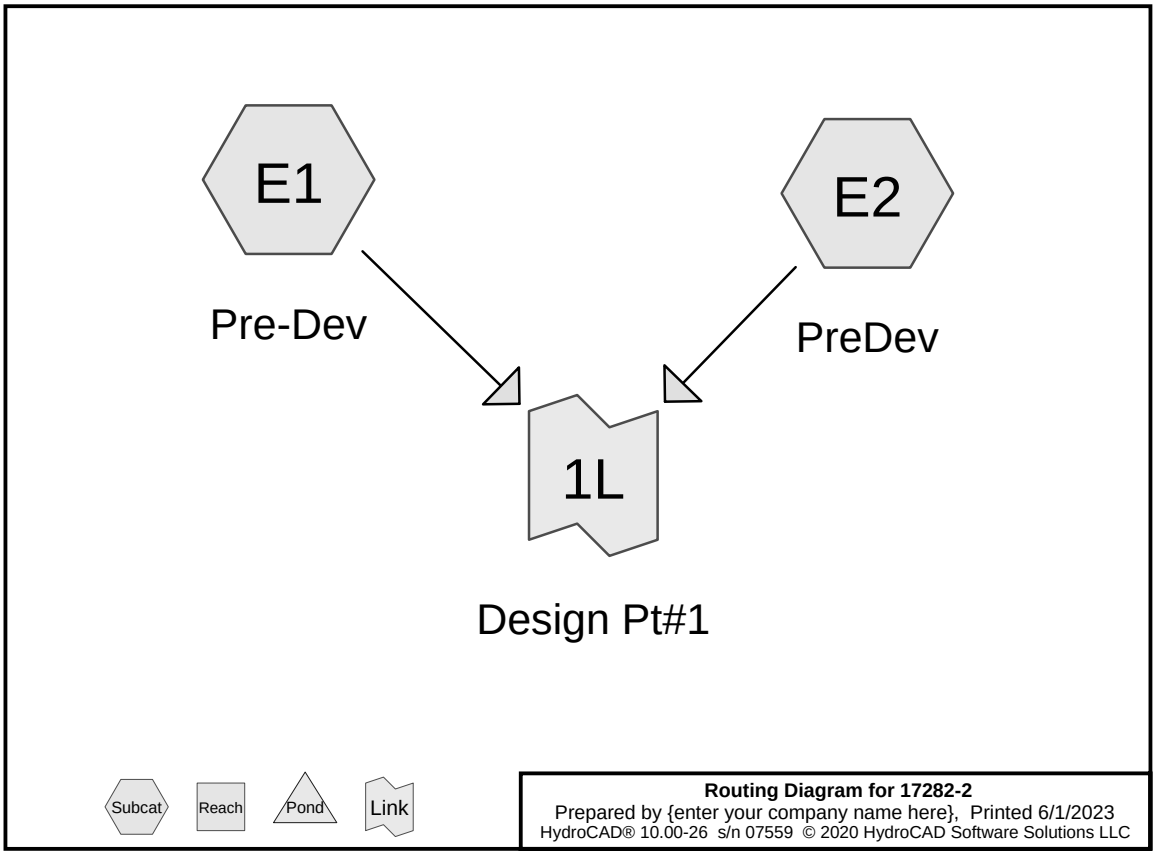
☒ An Illicit Discharge Compliance Statement is attached;

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

APPENDIX – A1

Hydrogeological Calculations for Pre-Development Hydro-Cad Computations

Standard 2



Summary for Subcatchment E1: Pre-Dev

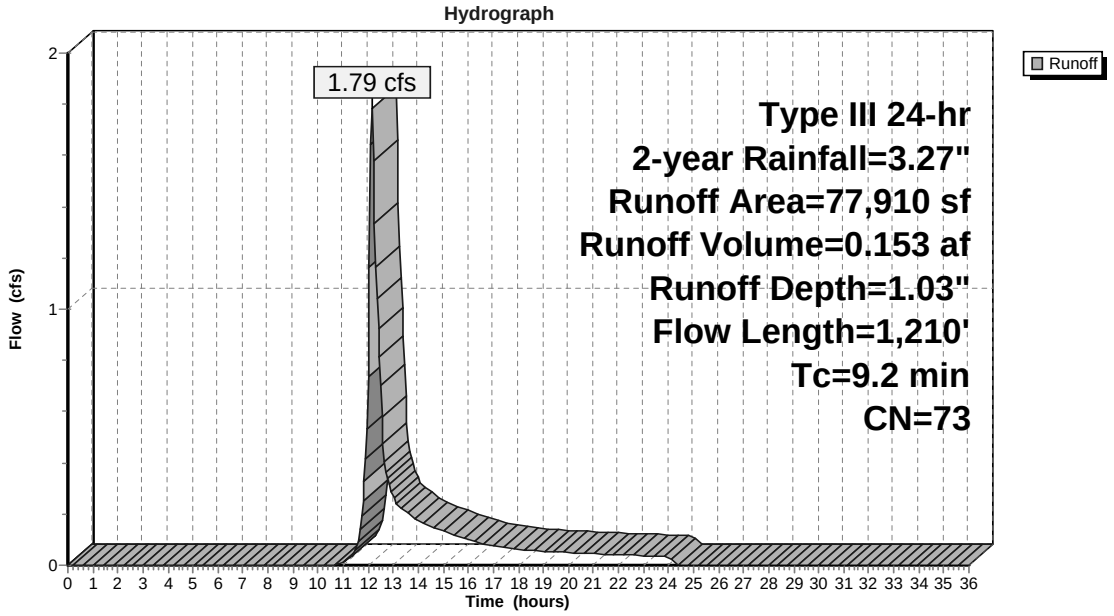
Runoff = 1.79 cfs @ 12.15 hrs, Volume= 0.153 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.27"

	Area (sf)	CN	Description
*	8,926	98	Imp, roofs, drives
	3,040	55	Woods, Good, HSG B
	30,546	61	>75% Grass cover, Good, HSG B
	11,620	77	Woods, Good, HSG D
	18,004	80	>75% Grass cover, Good, HSG D
*	5,774	78	Wetlands
	77,910	73	Weighted Average
	68,984		88.54% Pervious Area
	8,926		11.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
1.0	300	0.0900	4.83		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
2.0	860	0.0370	7.27	29.08	**Channel Flow, Brook** Area= 4.0 sf Perim= 6.0' r= 0.67' n= 0.030 Stream, clean & straight
9.2	1,210	Total			

Subcatchment E1: Pre-Dev



Summary for Subcatchment E2: PreDev

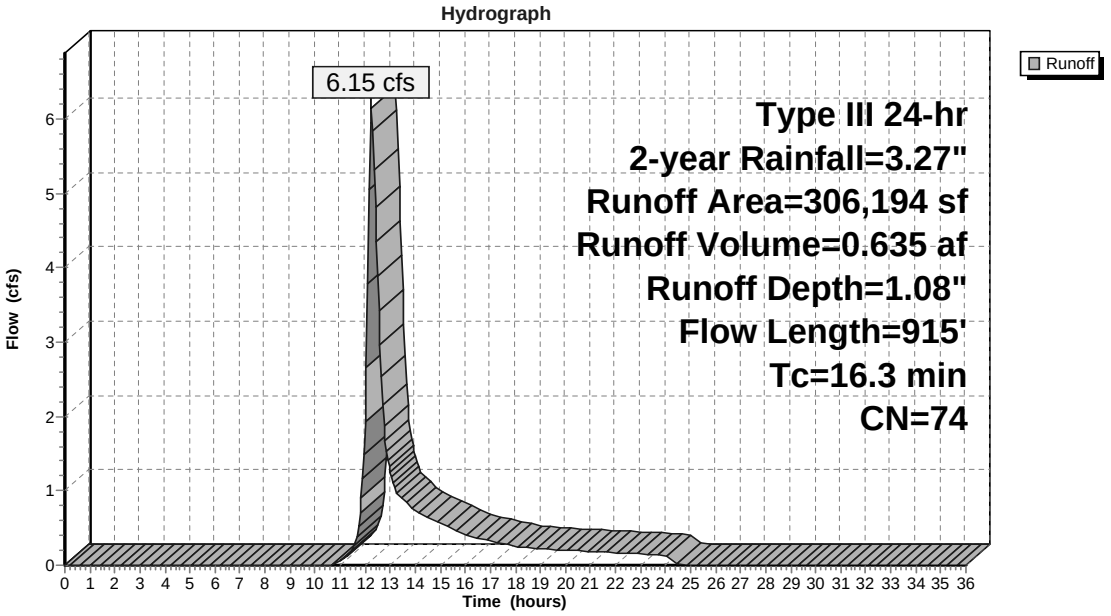
Runoff = 6.15 cfs @ 12.24 hrs, Volume= 0.635 af, Depth= 1.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.27"

	Area (sf)	CN	Description
*	12,455	98	Imp, roof, drives
	50,263	61	>75% Grass cover, Good, HSG B
	15,828	74	>75% Grass cover, Good, HSG C
	19,740	80	>75% Grass cover, Good, HSG D
	8,682	55	Woods, Good, HSG B
	15,813	70	Woods, Good, HSG C
	121,693	77	Woods, Good, HSG D
*	61,720	78	Wetlands HSG D
	306,194	74	Weighted Average
	293,739		95.93% Pervious Area
	12,455		4.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.5	170	0.1200	5.20		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
2.3	255	0.1400	1.87		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
7.3	440	0.0400	1.00		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
16.3	915	Total			

Subcatchment E2: PreDev

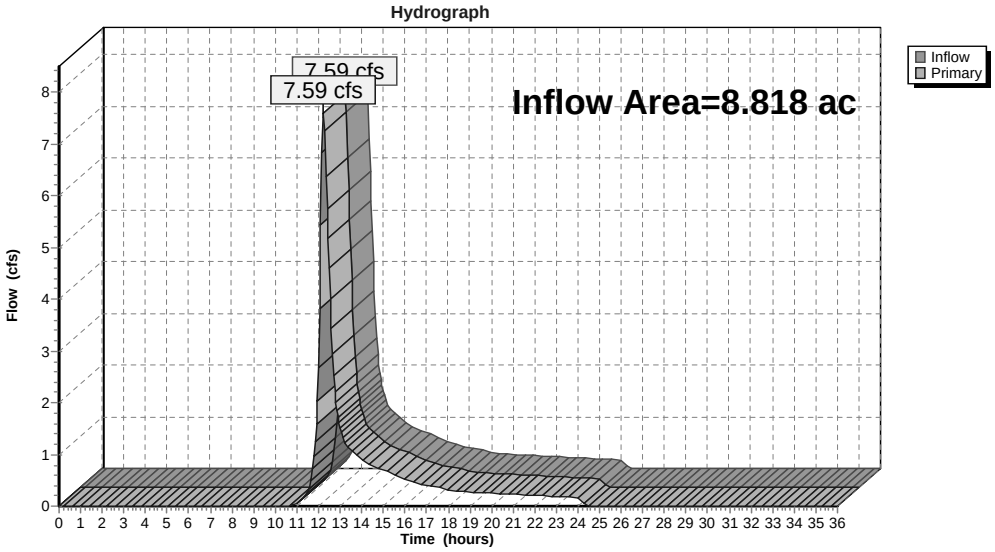


Summary for Link 1L: Design Pt#1

Inflow Area = 8.818 ac, 5.57% Impervious, Inflow Depth = 1.07" for 2-year event
Inflow = 7.59 cfs @ 12.22 hrs, Volume= 0.788 af
Primary = 7.59 cfs @ 12.22 hrs, Volume= 0.788 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: Design Pt#1



Summary for Subcatchment E1: Pre-Dev

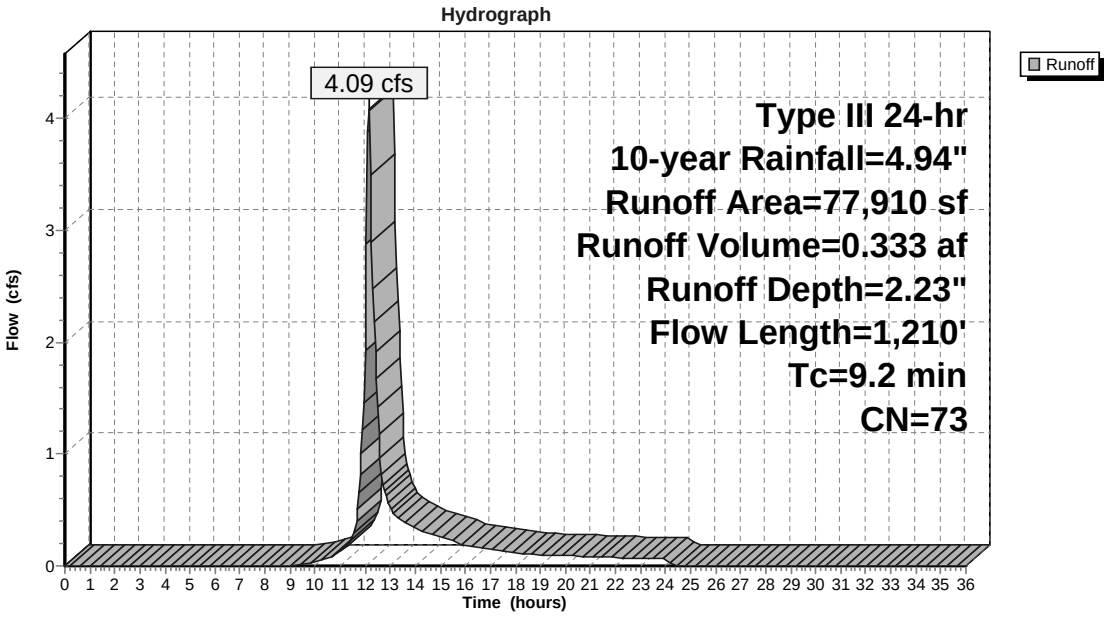
Runoff = 4.09 cfs @ 12.14 hrs, Volume= 0.333 af, Depth= 2.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.94"

	Area (sf)	CN	Description
*	8,926	98	Imp, roofs, drives
	3,040	55	Woods, Good, HSG B
	30,546	61	>75% Grass cover, Good, HSG B
	11,620	77	Woods, Good, HSG D
	18,004	80	>75% Grass cover, Good, HSG D
*	5,774	78	Wetlands
	77,910	73	Weighted Average
	68,984		88.54% Pervious Area
	8,926		11.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
1.0	300	0.0900	4.83		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
2.0	860	0.0370	7.27	29.08	**Channel Flow, Brook** Area= 4.0 sf Perim= 6.0' r= 0.67' n= 0.030 Stream, clean & straight
9.2	1,210	Total			

Subcatchment E1: Pre-Dev



Summary for Subcatchment E2: PreDev

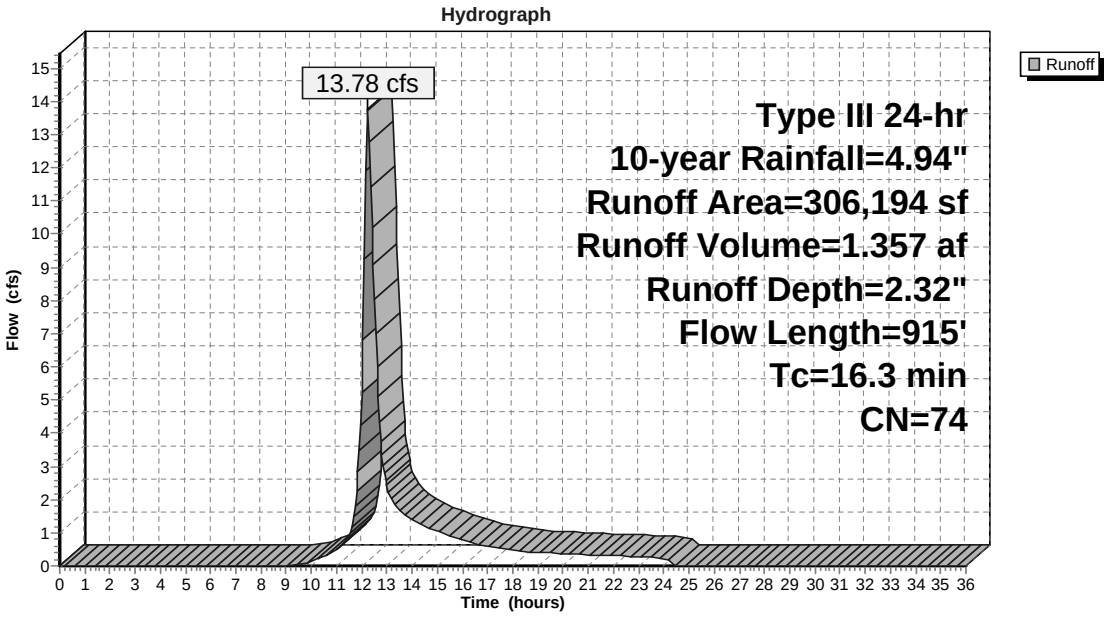
Runoff = 13.78 cfs @ 12.23 hrs, Volume= 1.357 af, Depth= 2.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.94"

	Area (sf)	CN	Description
*	12,455	98	Imp, roof, drives
	50,263	61	>75% Grass cover, Good, HSG B
	15,828	74	>75% Grass cover, Good, HSG C
	19,740	80	>75% Grass cover, Good, HSG D
	8,682	55	Woods, Good, HSG B
	15,813	70	Woods, Good, HSG C
	121,693	77	Woods, Good, HSG D
*	61,720	78	Wetlands HSG D
	306,194	74	Weighted Average
	293,739		95.93% Pervious Area
	12,455		4.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.5	170	0.1200	5.20		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
2.3	255	0.1400	1.87		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
7.3	440	0.0400	1.00		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
16.3	915	Total			

Subcatchment E2: PreDev

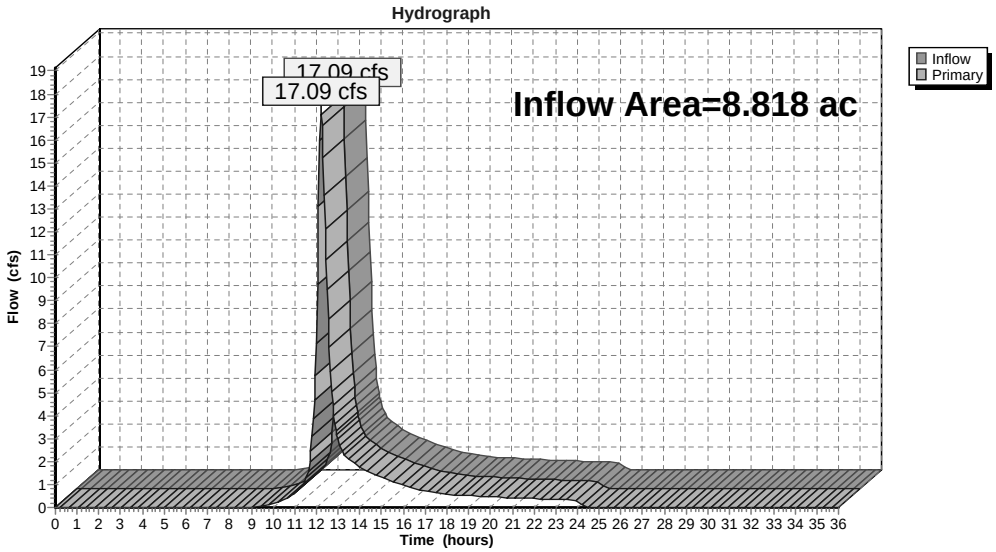


Summary for Link 1L: Design Pt#1

Inflow Area = 8.818 ac, 5.57% Impervious, Inflow Depth = 2.30" for 10-year event
Inflow = 17.09 cfs @ 12.21 hrs, Volume= 1.690 af
Primary = 17.09 cfs @ 12.21 hrs, Volume= 1.690 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: Design Pt#1



Summary for Subcatchment E1: Pre-Dev

Runoff = 6.10 cfs @ 12.13 hrs, Volume= 0.493 af, Depth= 3.31"

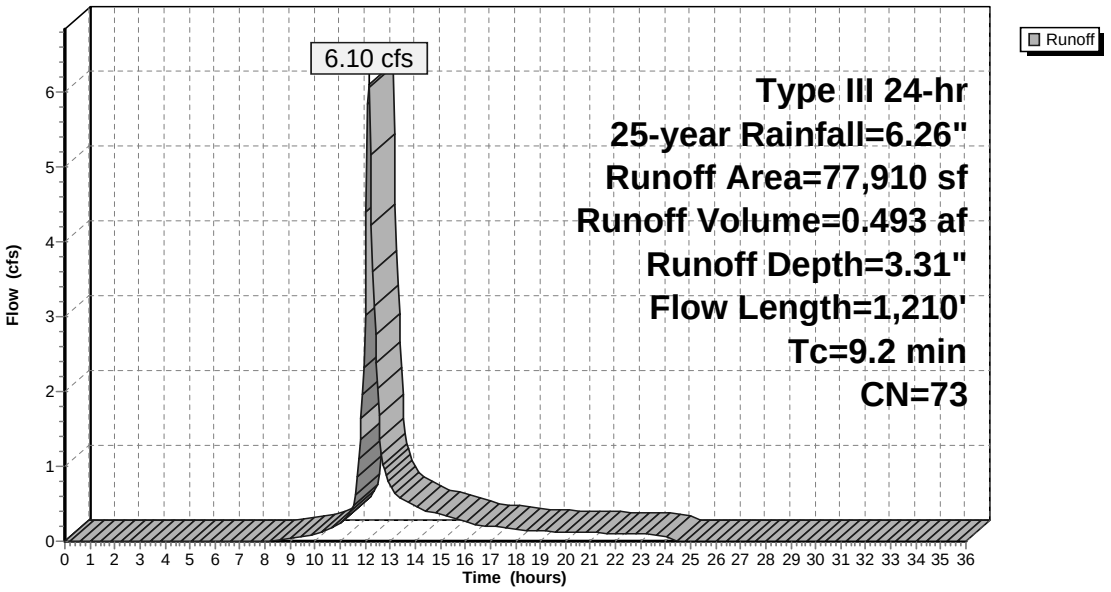
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.26"

	Area (sf)	CN	Description
*	8,926	98	Imp, roofs, drives
	3,040	55	Woods, Good, HSG B
	30,546	61	>75% Grass cover, Good, HSG B
	11,620	77	Woods, Good, HSG D
	18,004	80	>75% Grass cover, Good, HSG D
*	5,774	78	Wetlands
	77,910	73	Weighted Average
	68,984		88.54% Pervious Area
	8,926		11.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
1.0	300	0.0900	4.83		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
2.0	860	0.0370	7.27	29.08	**Channel Flow, Brook** Area= 4.0 sf Perim= 6.0' r= 0.67' n= 0.030 Stream, clean & straight
9.2	1,210	Total			

Subcatchment E1: Pre-Dev

Hydrograph



Summary for Subcatchment E2: PreDev

Runoff = 20.40 cfs @ 12.23 hrs, Volume= 1.994 af, Depth= 3.40"

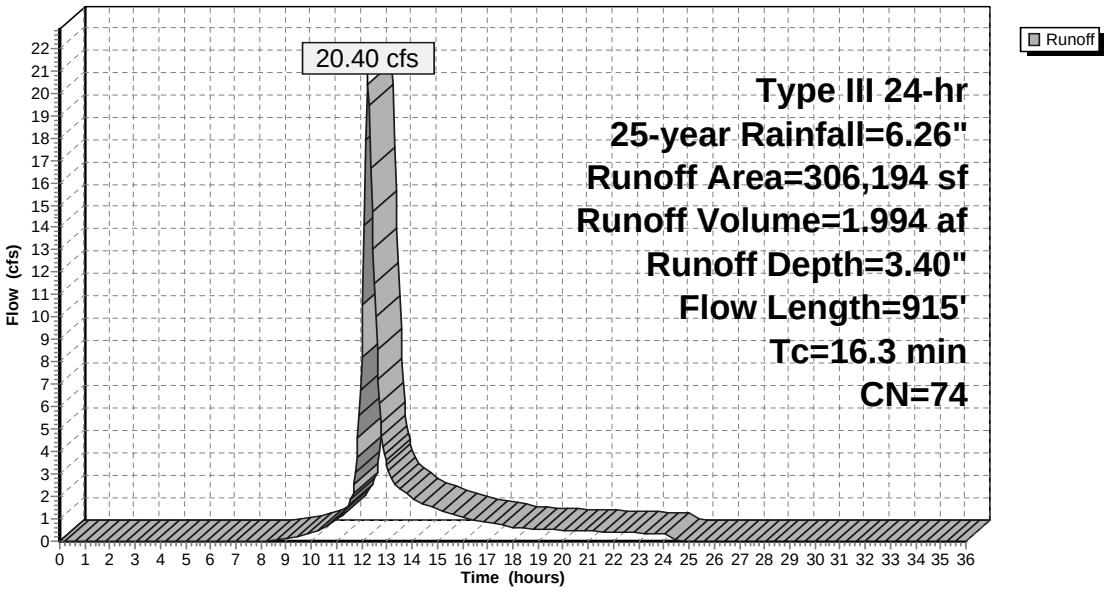
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.26"

	Area (sf)	CN	Description
*	12,455	98	Imp, roof, drives
	50,263	61	>75% Grass cover, Good, HSG B
	15,828	74	>75% Grass cover, Good, HSG C
	19,740	80	>75% Grass cover, Good, HSG D
	8,682	55	Woods, Good, HSG B
	15,813	70	Woods, Good, HSG C
	121,693	77	Woods, Good, HSG D
*	61,720	78	Wetlands HSG D
	306,194	74	Weighted Average
	293,739		95.93% Pervious Area
	12,455		4.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.5	170	0.1200	5.20		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
2.3	255	0.1400	1.87		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
7.3	440	0.0400	1.00		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
16.3	915	Total			

Subcatchment E2: PreDev

Hydrograph



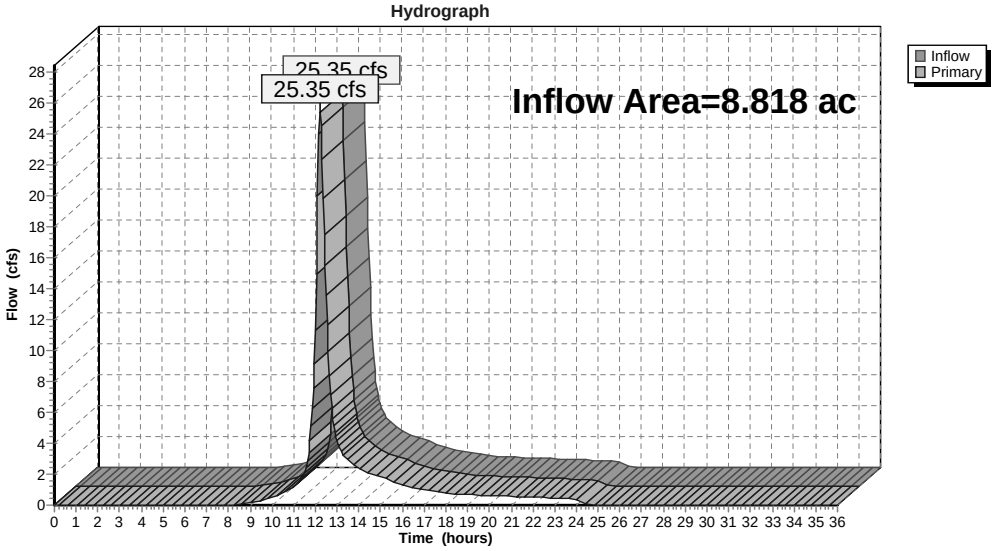
Summary for Link 1L: Design Pt#1

Inflow Area = 8.818 ac, 5.57% Impervious, Inflow Depth = 3.38" for 25-year event
Inflow = 25.35 cfs @ 12.21 hrs, Volume= 2.487 af
Primary = 25.35 cfs @ 12.21 hrs, Volume= 2.487 af, Atten= 0%, Lag= 0.0 min

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

Link 1L: Design Pt#1

Hydrograph



Summary for Subcatchment E1: Pre-Dev

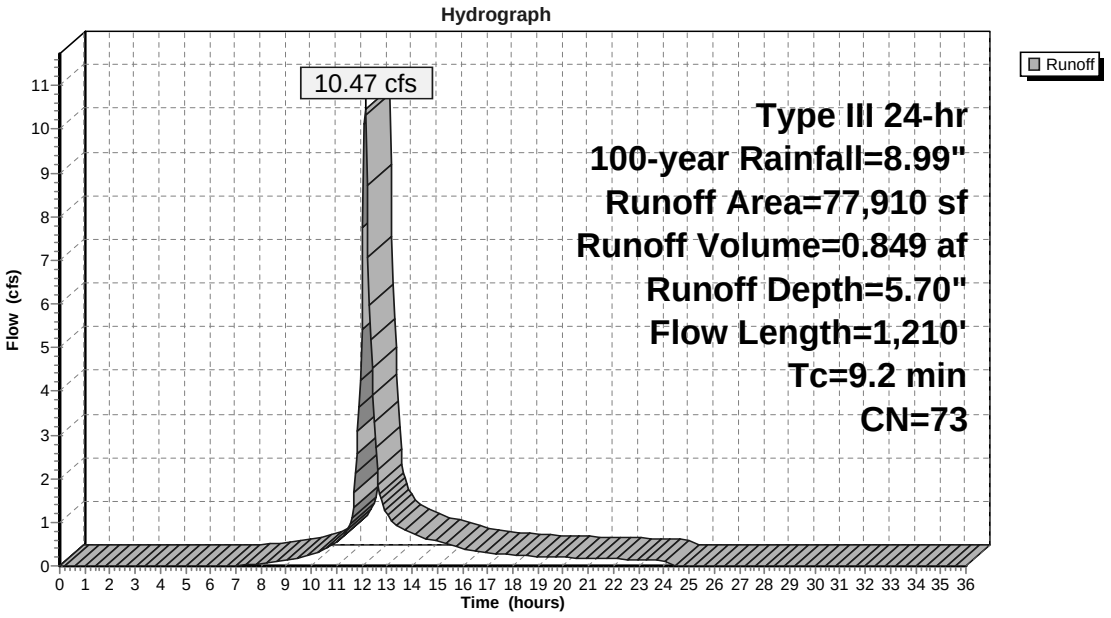
Runoff = 10.47 cfs @ 12.13 hrs, Volume= 0.849 af, Depth= 5.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.99"

	Area (sf)	CN	Description
*	8,926	98	Imp, roofs, drives
	3,040	55	Woods, Good, HSG B
	30,546	61	>75% Grass cover, Good, HSG B
	11,620	77	Woods, Good, HSG D
	18,004	80	>75% Grass cover, Good, HSG D
*	5,774	78	Wetlands
	77,910	73	Weighted Average
	68,984		88.54% Pervious Area
	8,926		11.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
1.0	300	0.0900	4.83		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
2.0	860	0.0370	7.27	29.08	**Channel Flow, Brook** Area= 4.0 sf Perim= 6.0' r= 0.67' n= 0.030 Stream, clean & straight
9.2	1,210	Total			

Subcatchment E1: Pre-Dev



Summary for Subcatchment E2: PreDev

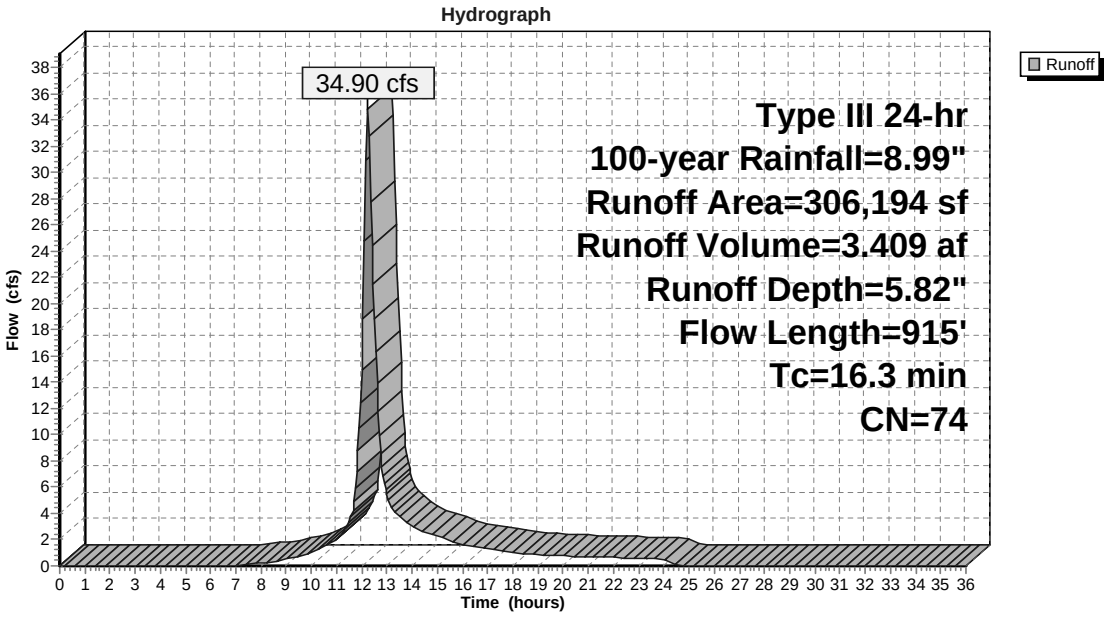
Runoff = 34.90 cfs @ 12.22 hrs, Volume= 3.409 af, Depth= 5.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.99"

	Area (sf)	CN	Description
*	12,455	98	Imp, roof, drives
	50,263	61	>75% Grass cover, Good, HSG B
	15,828	74	>75% Grass cover, Good, HSG C
	19,740	80	>75% Grass cover, Good, HSG D
	8,682	55	Woods, Good, HSG B
	15,813	70	Woods, Good, HSG C
	121,693	77	Woods, Good, HSG D
*	61,720	78	Wetlands HSG D
	306,194	74	Weighted Average
	293,739		95.93% Pervious Area
	12,455		4.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.5	170	0.1200	5.20		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
2.3	255	0.1400	1.87		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
7.3	440	0.0400	1.00		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
16.3	915	Total			

Subcatchment E2: PreDev

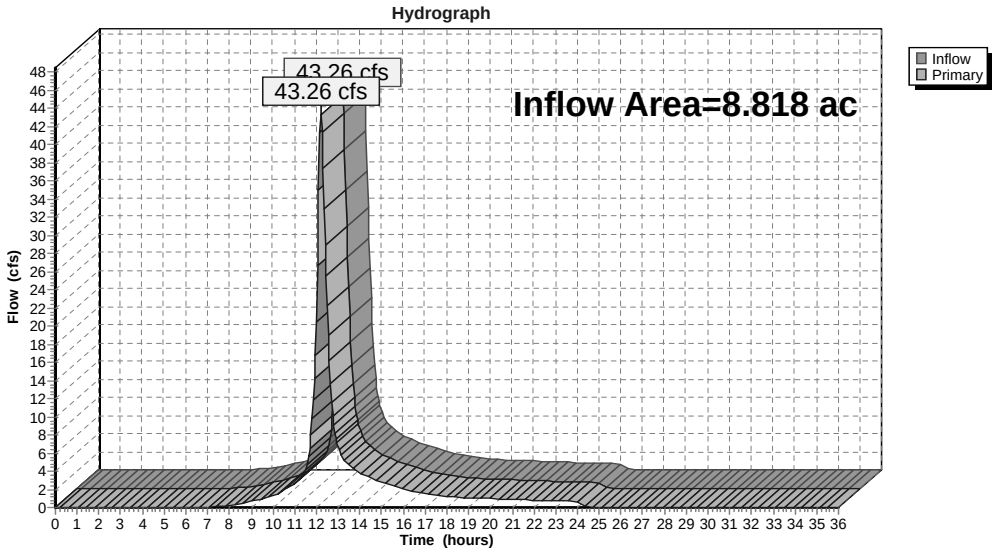


Summary for Link 1L: Design Pt#1

Inflow Area = 8.818 ac, 5.57% Impervious, Inflow Depth = 5.79" for 100-year event
Inflow = 43.26 cfs @ 12.20 hrs, Volume= 4.258 af
Primary = 43.26 cfs @ 12.20 hrs, Volume= 4.258 af, Atten= 0%, Lag= 0.0 min

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

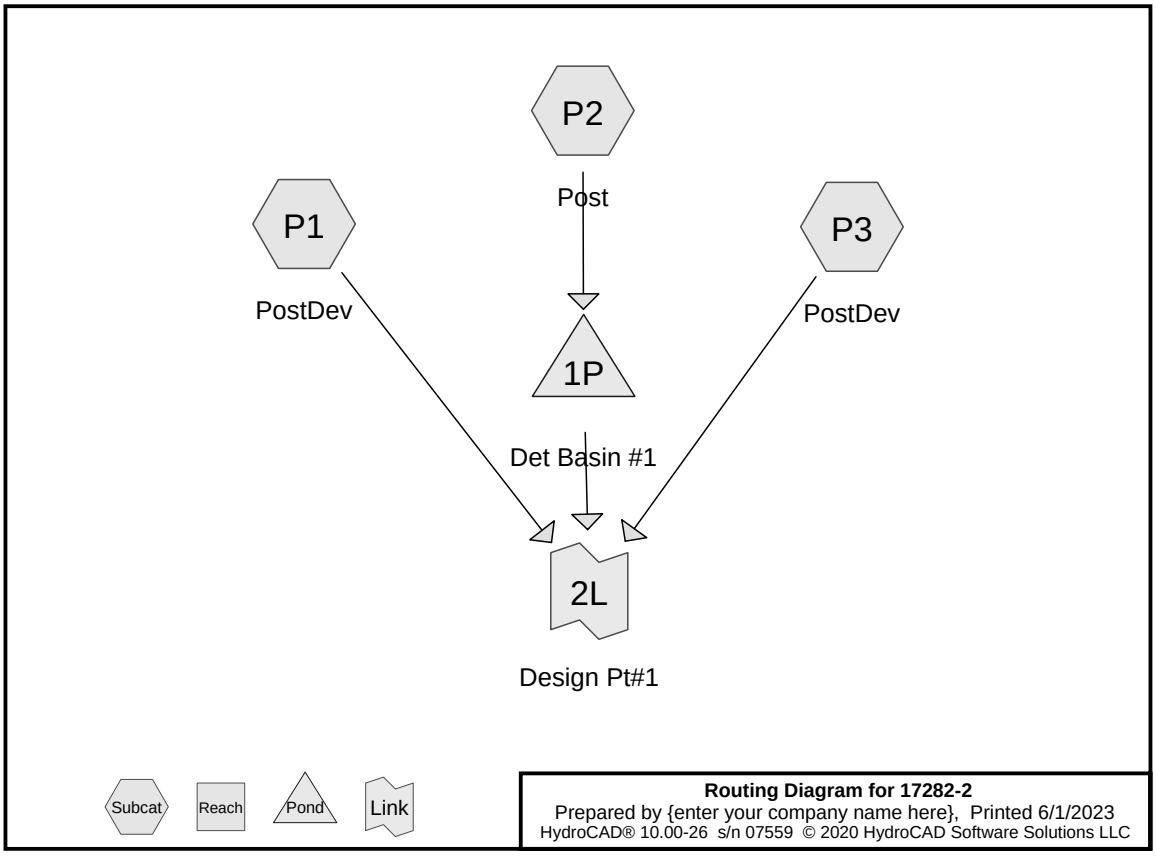
Link 1L: Design Pt#1



APPENDIX – A2

Hydrogeological Calculations for Post-Development Hydro-Cad Computations

Standard 2



Summary for Subcatchment P1: PostDev

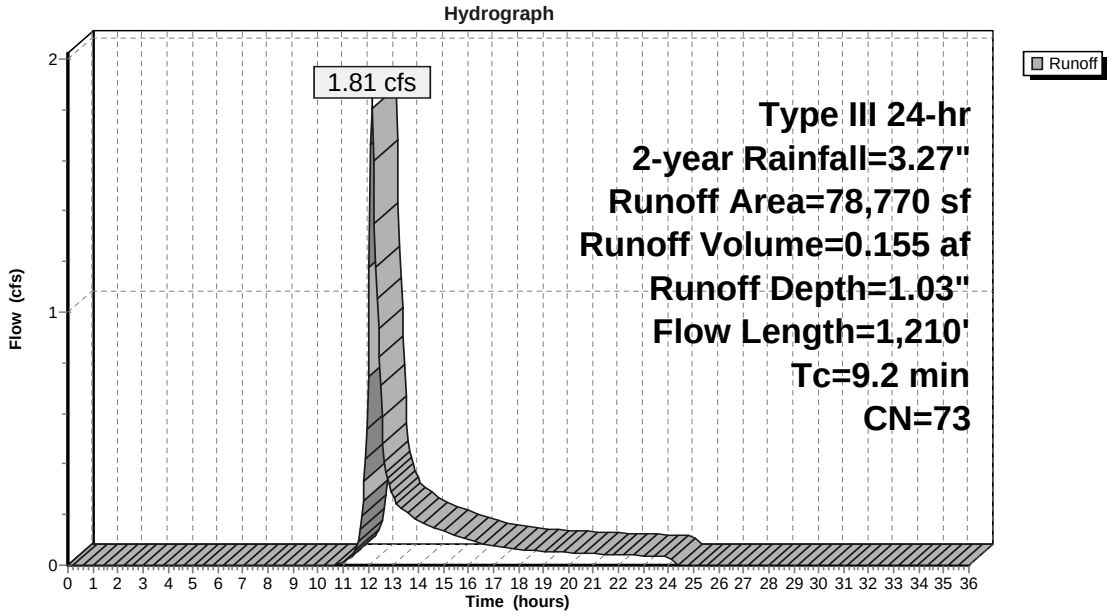
Runoff = 1.81 cfs @ 12.15 hrs, Volume= 0.155 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.27"

	Area (sf)	CN	Description
*	8,926	98	Imp, roofs, drives
	3,040	55	Woods, Good, HSG B
	31,924	61	>75% Grass cover, Good, HSG B
	8,396	77	Woods, Good, HSG D
	20,710	80	>75% Grass cover, Good, HSG D
*	5,774	78	Wetlands
	78,770	73	Weighted Average
	69,844		88.67% Pervious Area
	8,926		11.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
1.0	300	0.0900	4.83		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
2.0	860	0.0370	7.27	29.08	**Channel Flow, Brook** Area= 4.0 sf Perim= 6.0' r= 0.67' n= 0.030 Stream, clean & straight
9.2	1,210	Total			

Subcatchment P1: PostDev



Summary for Subcatchment P2: Post

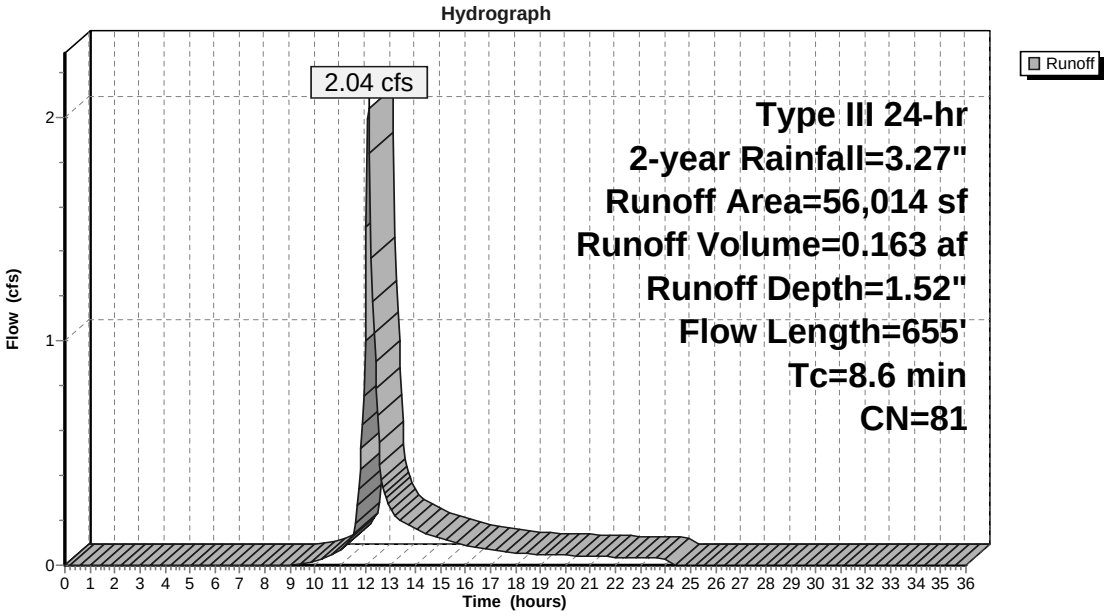
Runoff = 2.04 cfs @ 12.13 hrs, Volume= 0.163 af, Depth= 1.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.27"

	Area (sf)	CN	Description
*	2,650	98	Det Basin
	3,870	55	Woods, Good, HSG B
*	7,194	98	Imp, roof, drives
	10,222	61	>75% Grass cover, Good, HSG B
*	10,737	98	Imp, roof, drives
	3,480	77	Woods, Good, HSG D
	17,861	80	>75% Grass cover, Good, HSG D
	56,014	81	Weighted Average
	35,433		63.26% Pervious Area
	20,581		36.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
1.0	300	0.0900	4.83		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.2	50	0.0500	3.35		**Shallow Concentrated Flow, C-D** Grassed Waterway Kv= 15.0 fps
0.3	105	0.1000	6.42		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
0.9	150	0.0200	2.87		**Shallow Concentrated Flow, E-F** Paved Kv= 20.3 fps
8.6	655	Total			

Subcatchment P2: Post



Summary for Subcatchment P3: PostDev

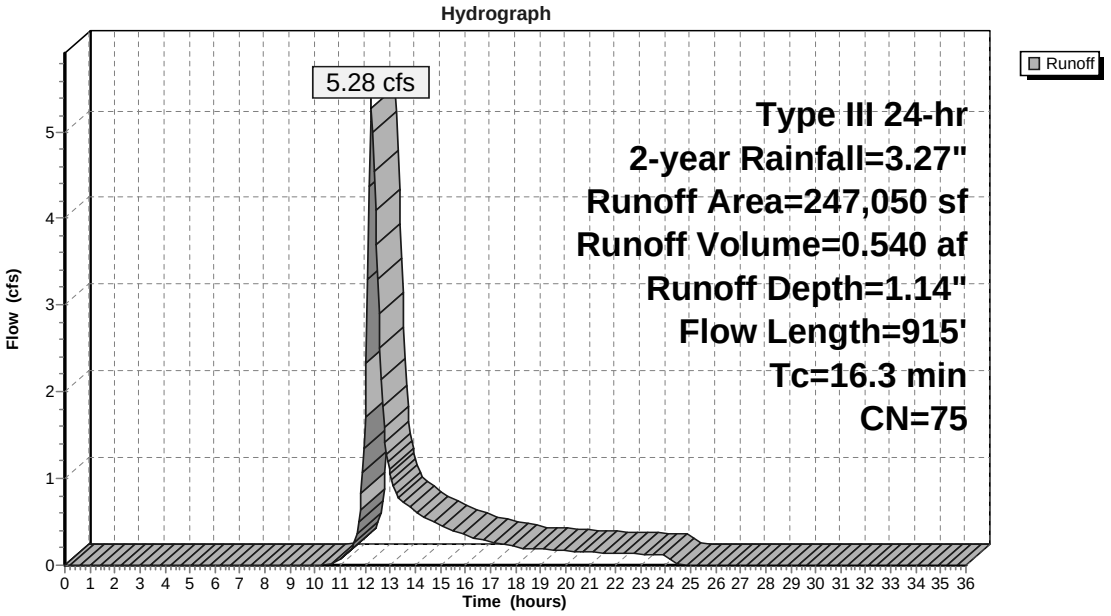
Runoff = 5.28 cfs @ 12.24 hrs, Volume= 0.540 af, Depth= 1.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.27"

	Area (sf)	CN	Description
*	6,237	98	Imp, roof, drives
	40,377	61	>75% Grass cover, Good, HSG B
	15,828	74	>75% Grass cover, Good, HSG C
	36,369	80	>75% Grass cover, Good, HSG D
	4,812	55	Woods, Good, HSG B
	15,813	70	Woods, Good, HSG C
	60,549	77	Woods, Good, HSG D
*	61,720	78	Wetlands HSG D
*	5,345	98	Imp, roof drives
	247,050	75	Weighted Average
	235,468		95.31% Pervious Area
	11,582		4.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.5	170	0.1200	5.20		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
2.3	255	0.1400	1.87		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
7.3	440	0.0400	1.00		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
16.3	915	Total			

Subcatchment P3: PostDev



Summary for Pond 1P: Det Basin #1

Inflow Area = 1.286 ac, 36.74% Impervious, Inflow Depth = 1.52" for 2-year event
Inflow = 2.04 cfs @ 12.13 hrs, Volume= 0.163 af
Outflow = 0.69 cfs @ 12.49 hrs, Volume= 0.160 af, Atten= 66%, Lag= 22.0 min
Discarded = 0.02 cfs @ 12.49 hrs, Volume= 0.016 af
Primary = 0.67 cfs @ 12.49 hrs, Volume= 0.144 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 215.74' @ 12.49 hrs Surf.Area= 2,111 sf Storage= 2,196 cf

Plug-Flow detention time= 86.7 min calculated for 0.160 af (98% of inflow)
Center-of-Mass det. time= 74.0 min (914.9 - 840.9)

Volume	Invert	Avail.Storage	Storage Description
#1	214.00'	8,810 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

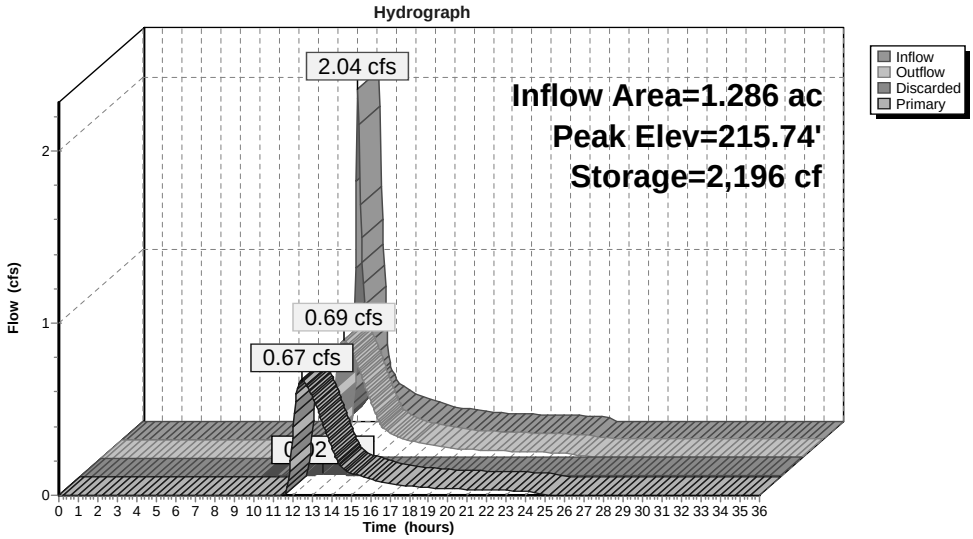
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
214.00	570	93.0	0	0	570
216.00	2,420	219.0	2,776	2,776	3,714
217.00	2,995	228.0	2,702	5,479	4,104
218.00	3,680	247.0	3,332	8,810	4,861

Device	Routing	Invert	Outlet Devices
#1	Primary	214.00'	**18.0" Round Culvert** L= 20.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.00' / 213.00' S= 0.0500 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.77 sf
#2	Device 1	214.50'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	216.00'	**1.2' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.3' Crest Height
#4	Discarded	214.00'	**0.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 212.00'

Discarded OutFlow Max=0.02 cfs @ 12.49 hrs HW=215.74' (Free Discharge)
└**4=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.67 cfs @ 12.49 hrs HW=215.74' (Free Discharge)
└**1=Culvert** (Passes 0.67 cfs of 8.48 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.67 cfs @ 4.90 fps)
└**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Det Basin #1

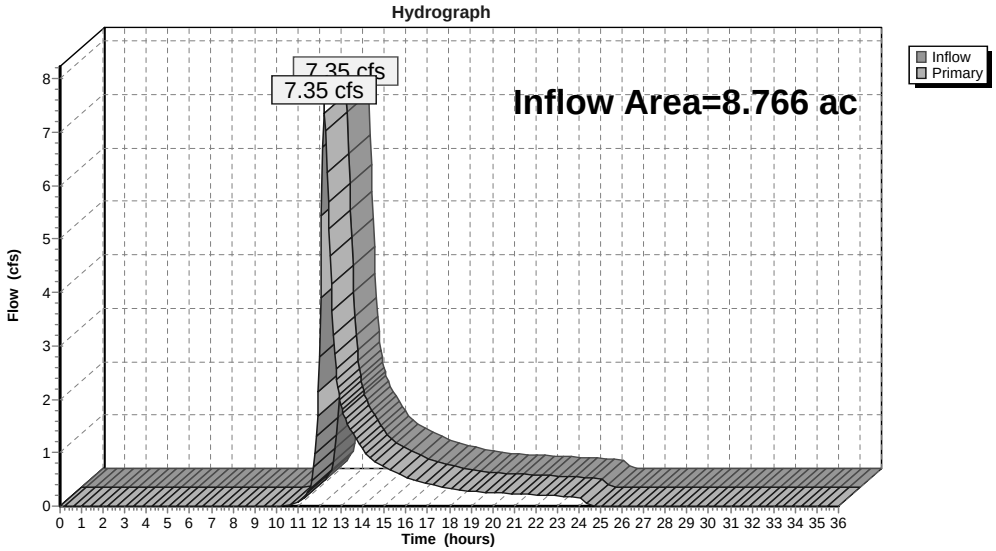


Summary for Link 2L: Design Pt#1

Inflow Area = 8.766 ac, 10.76% Impervious, Inflow Depth = 1.15" for 2-year event
Inflow = 7.35 cfs @ 12.22 hrs, Volume= 0.838 af
Primary = 7.35 cfs @ 12.22 hrs, Volume= 0.838 af, Atten= 0%, Lag= 0.0 min

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

Link 2L: Design Pt#1



Summary for Subcatchment P1: PostDev

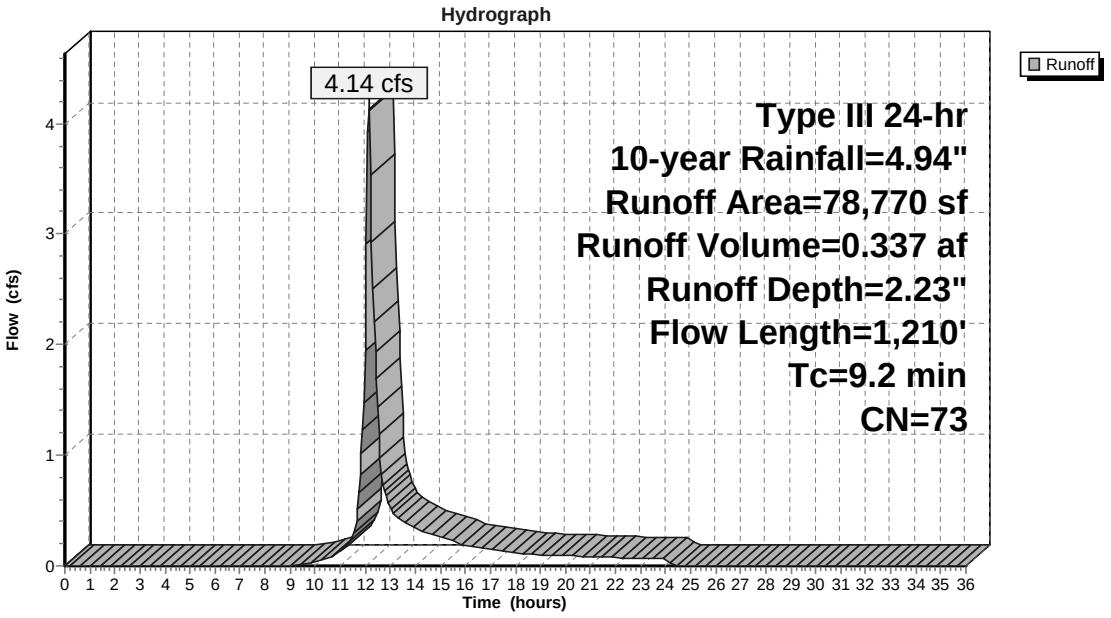
Runoff = 4.14 cfs @ 12.14 hrs, Volume= 0.337 af, Depth= 2.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.94"

	Area (sf)	CN	Description
*	8,926	98	Imp, roofs, drives
	3,040	55	Woods, Good, HSG B
	31,924	61	>75% Grass cover, Good, HSG B
	8,396	77	Woods, Good, HSG D
	20,710	80	>75% Grass cover, Good, HSG D
*	5,774	78	Wetlands
	78,770	73	Weighted Average
	69,844		88.67% Pervious Area
	8,926		11.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
1.0	300	0.0900	4.83		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
2.0	860	0.0370	7.27	29.08	**Channel Flow, Brook** Area= 4.0 sf Perim= 6.0' r= 0.67' n= 0.030 Stream, clean & straight
9.2	1,210	Total			

Subcatchment P1: PostDev



Summary for Subcatchment P2: Post

Runoff = 3.98 cfs @ 12.12 hrs, Volume= 0.314 af, Depth= 2.93"

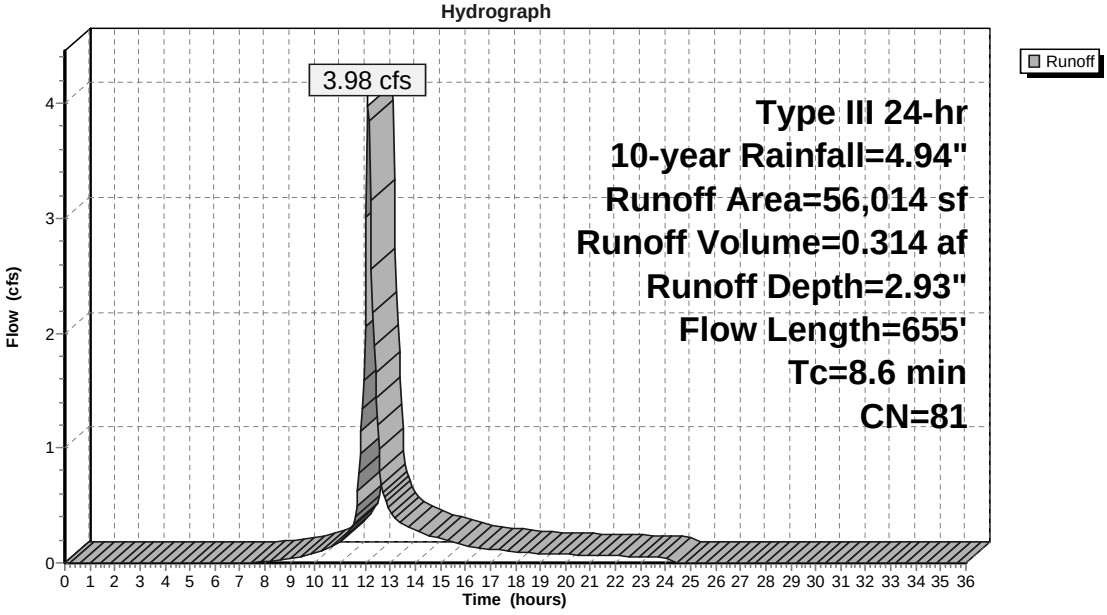
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.94"

	Area (sf)	CN	Description
*	2,650	98	Det Basin
	3,870	55	Woods, Good, HSG B
*	7,194	98	Imp, roof, drives
	10,222	61	>75% Grass cover, Good, HSG B
*	10,737	98	Imp, roof, drives
	3,480	77	Woods, Good, HSG D
	17,861	80	>75% Grass cover, Good, HSG D
	56,014	81	Weighted Average
	35,433		63.26% Pervious Area
	20,581		36.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
1.0	300	0.0900	4.83		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.2	50	0.0500	3.35		**Shallow Concentrated Flow, C-D** Grassed Waterway Kv= 15.0 fps
0.3	105	0.1000	6.42		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
0.9	150	0.0200	2.87		**Shallow Concentrated Flow, E-F** Paved Kv= 20.3 fps
8.6	655	Total			

Subcatchment P2: Post

Hydrograph



Summary for Subcatchment P3: PostDev

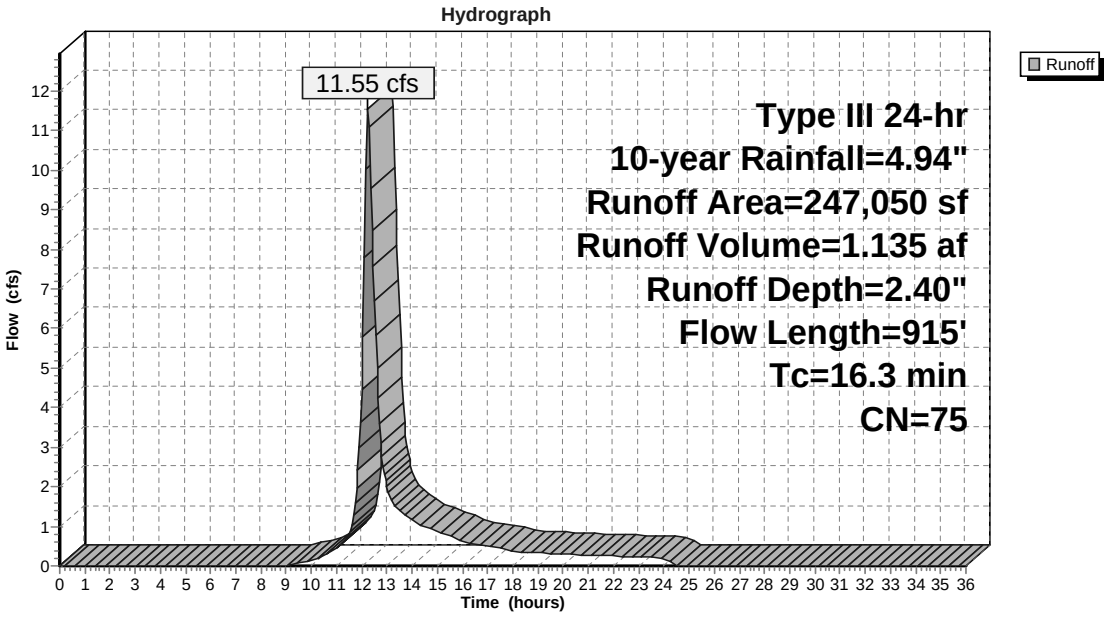
Runoff = 11.55 cfs @ 12.23 hrs, Volume= 1.135 af, Depth= 2.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.94"

	Area (sf)	CN	Description
*	6,237	98	Imp, roof, drives
	40,377	61	>75% Grass cover, Good, HSG B
	15,828	74	>75% Grass cover, Good, HSG C
	36,369	80	>75% Grass cover, Good, HSG D
	4,812	55	Woods, Good, HSG B
	15,813	70	Woods, Good, HSG C
	60,549	77	Woods, Good, HSG D
*	61,720	78	Wetlands HSG D
*	5,345	98	Imp, roof drives
	247,050	75	Weighted Average
	235,468		95.31% Pervious Area
	11,582		4.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.5	170	0.1200	5.20		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
2.3	255	0.1400	1.87		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
7.3	440	0.0400	1.00		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
16.3	915	Total			

Subcatchment P3: PostDev



Summary for Pond 1P: Det Basin #1

Inflow Area = 1.286 ac, 36.74% Impervious, Inflow Depth = 2.93" for 10-year event
Inflow = 3.98 cfs @ 12.12 hrs, Volume= 0.314 af
Outflow = 1.90 cfs @ 12.36 hrs, Volume= 0.311 af, Atten= 52%, Lag= 14.0 min
Discarded = 0.03 cfs @ 12.36 hrs, Volume= 0.019 af
Primary = 1.87 cfs @ 12.36 hrs, Volume= 0.291 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 216.41' @ 12.36 hrs Surf.Area= 2,651 sf Storage= 3,826 cf

Plug-Flow detention time= 63.7 min calculated for 0.310 af (99% of inflow)
Center-of-Mass det. time= 57.5 min (879.5 - 822.0)

Volume	Invert	Avail.Storage	Storage Description
#1	214.00'	8,810 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

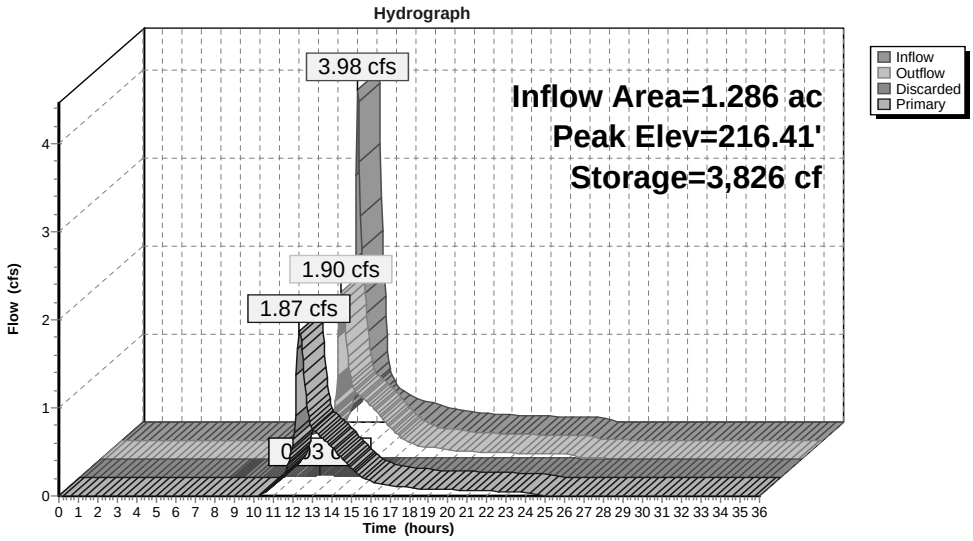
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
214.00	570	93.0	0	0	570
216.00	2,420	219.0	2,776	2,776	3,714
217.00	2,995	228.0	2,702	5,479	4,104
218.00	3,680	247.0	3,332	8,810	4,861

Device	Routing	Invert	Outlet Devices
#1	Primary	214.00'	**18.0" Round Culvert** L= 20.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.00' / 213.00' S= 0.0500 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.77 sf
#2	Device 1	214.50'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	216.00'	**1.2' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.3' Crest Height
#4	Discarded	214.00'	**0.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 212.00'

Discarded OutFlow Max=0.03 cfs @ 12.36 hrs HW=216.41' (Free Discharge)
└**4=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=1.87 cfs @ 12.36 hrs HW=216.41' (Free Discharge)
└**1=Culvert** (Passes 1.87 cfs of 10.97 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.86 cfs @ 6.29 fps)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 1.01 cfs @ 2.18 fps)

Pond 1P: Det Basin #1

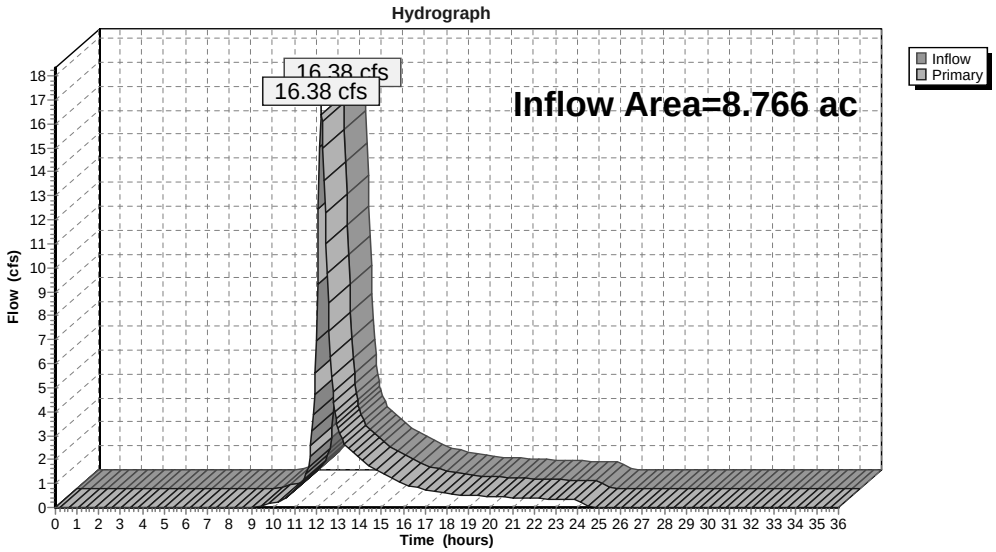


Summary for Link 2L: Design Pt#1

Inflow Area = 8.766 ac, 10.76% Impervious, Inflow Depth = 2.41" for 10-year event
Inflow = 16.38 cfs @ 12.22 hrs, Volume= 1.763 af
Primary = 16.38 cfs @ 12.22 hrs, Volume= 1.763 af, Atten= 0%, Lag= 0.0 min

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

Link 2L: Design Pt#1



Summary for Subcatchment P1: PostDev

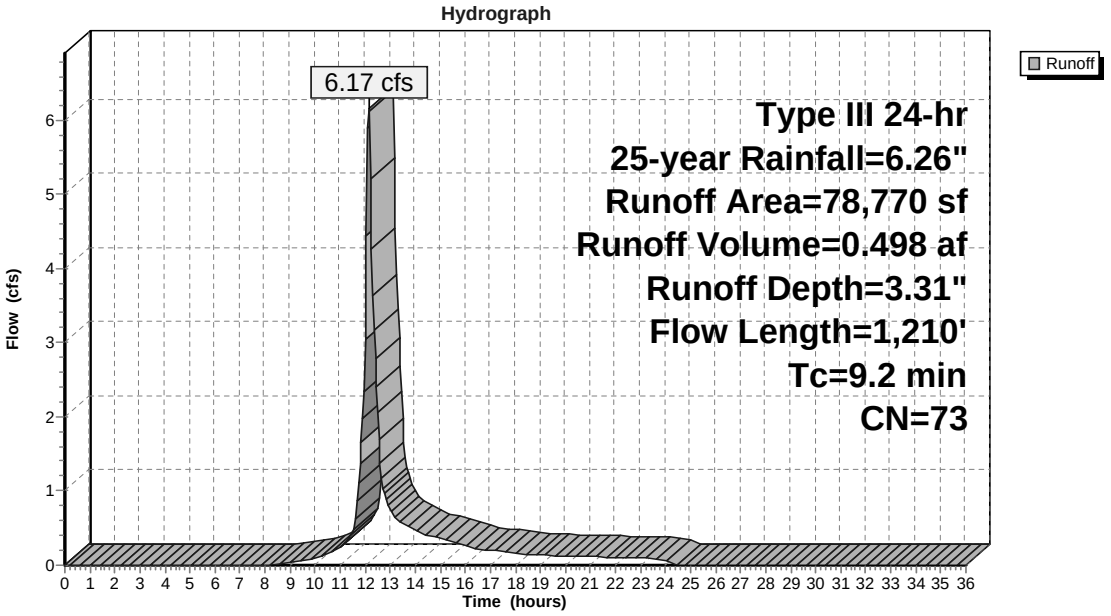
Runoff = 6.17 cfs @ 12.13 hrs, Volume= 0.498 af, Depth= 3.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.26"

	Area (sf)	CN	Description
*	8,926	98	Imp, roofs, drives
	3,040	55	Woods, Good, HSG B
	31,924	61	>75% Grass cover, Good, HSG B
	8,396	77	Woods, Good, HSG D
	20,710	80	>75% Grass cover, Good, HSG D
*	5,774	78	Wetlands
	78,770	73	Weighted Average
	69,844		88.67% Pervious Area
	8,926		11.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
1.0	300	0.0900	4.83		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
2.0	860	0.0370	7.27	29.08	**Channel Flow, Brook** Area= 4.0 sf Perim= 6.0' r= 0.67' n= 0.030 Stream, clean & straight
9.2	1,210	Total			

Subcatchment P1: PostDev



Summary for Subcatchment P2: Post

Runoff = 5.56 cfs @ 12.12 hrs, Volume= 0.442 af, Depth= 4.12"

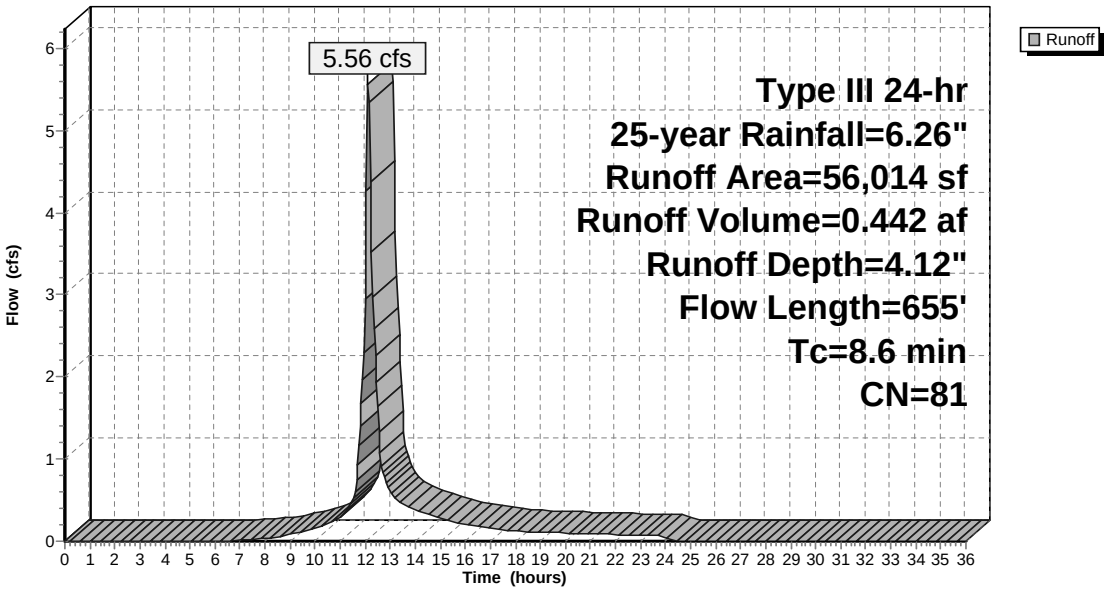
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.26"

	Area (sf)	CN	Description
*	2,650	98	Det Basin
	3,870	55	Woods, Good, HSG B
*	7,194	98	Imp, roof, drives
	10,222	61	>75% Grass cover, Good, HSG B
*	10,737	98	Imp, roof, drives
	3,480	77	Woods, Good, HSG D
	17,861	80	>75% Grass cover, Good, HSG D
	56,014	81	Weighted Average
	35,433		63.26% Pervious Area
	20,581		36.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
1.0	300	0.0900	4.83		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.2	50	0.0500	3.35		**Shallow Concentrated Flow, C-D** Grassed Waterway Kv= 15.0 fps
0.3	105	0.1000	6.42		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
0.9	150	0.0200	2.87		**Shallow Concentrated Flow, E-F** Paved Kv= 20.3 fps
8.6	655	Total			

Subcatchment P2: Post

Hydrograph



Summary for Subcatchment P3: PostDev

Runoff = 16.95 cfs @ 12.23 hrs, Volume= 1.656 af, Depth= 3.50"

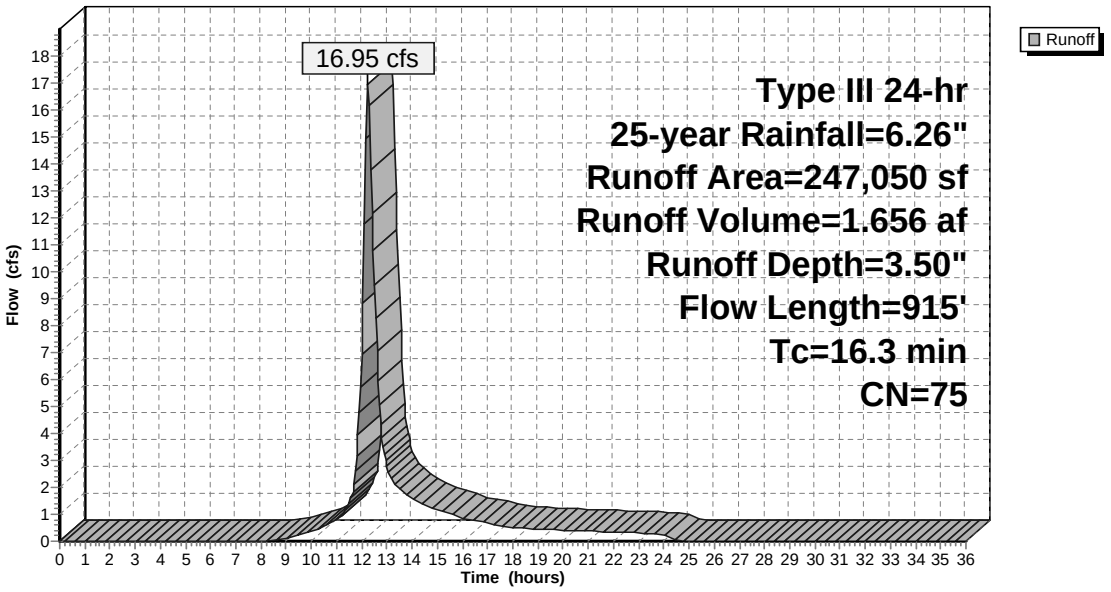
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.26"

	Area (sf)	CN	Description
*	6,237	98	Imp, roof, drives
	40,377	61	>75% Grass cover, Good, HSG B
	15,828	74	>75% Grass cover, Good, HSG C
	36,369	80	>75% Grass cover, Good, HSG D
	4,812	55	Woods, Good, HSG B
	15,813	70	Woods, Good, HSG C
	60,549	77	Woods, Good, HSG D
*	61,720	78	Wetlands HSG D
*	5,345	98	Imp, roof drives
	247,050	75	Weighted Average
	235,468		95.31% Pervious Area
	11,582		4.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.5	170	0.1200	5.20		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
2.3	255	0.1400	1.87		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
7.3	440	0.0400	1.00		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
16.3	915	Total			

Subcatchment P3: PostDev

Hydrograph



Summary for Pond 1P: Det Basin #1

Inflow Area = 1.286 ac, 36.74% Impervious, Inflow Depth = 4.12" for 25-year event
Inflow = 5.56 cfs @ 12.12 hrs, Volume= 0.442 af
Outflow = 3.29 cfs @ 12.27 hrs, Volume= 0.438 af, Atten= 41%, Lag= 9.2 min
Discarded = 0.03 cfs @ 12.27 hrs, Volume= 0.021 af
Primary = 3.26 cfs @ 12.27 hrs, Volume= 0.417 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 216.74' @ 12.27 hrs Surf.Area= 2,837 sf Storage= 4,710 cf

Plug-Flow detention time= 54.3 min calculated for 0.438 af (99% of inflow)
Center-of-Mass det. time= 49.0 min (861.3 - 812.3)

Volume	Invert	Avail.Storage	Storage Description
#1	214.00'	8,810 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

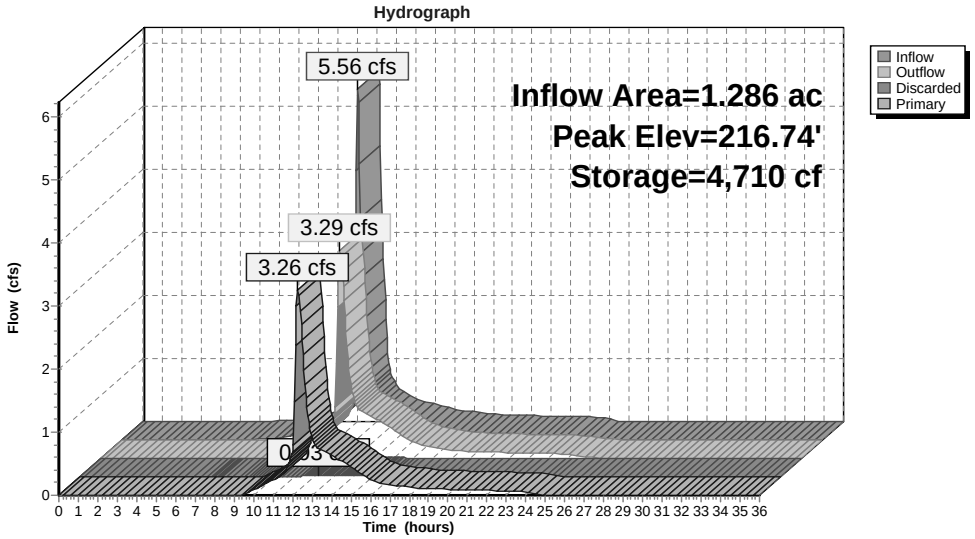
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
214.00	570	93.0	0	0	570
216.00	2,420	219.0	2,776	2,776	3,714
217.00	2,995	228.0	2,702	5,479	4,104
218.00	3,680	247.0	3,332	8,810	4,861

Device	Routing	Invert	Outlet Devices
#1	Primary	214.00'	**18.0" Round Culvert** L= 20.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.00' / 213.00' S= 0.0500 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.77 sf
#2	Device 1	214.50'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	216.00'	**1.2' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.3' Crest Height
#4	Discarded	214.00'	**0.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 212.00'

Discarded OutFlow Max=0.03 cfs @ 12.27 hrs HW=216.73' (Free Discharge)
└**4=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=3.23 cfs @ 12.27 hrs HW=216.73' (Free Discharge)
└**1=Culvert** (Passes 3.23 cfs of 11.97 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.93 cfs @ 6.85 fps)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 2.30 cfs @ 2.99 fps)

Pond 1P: Det Basin #1

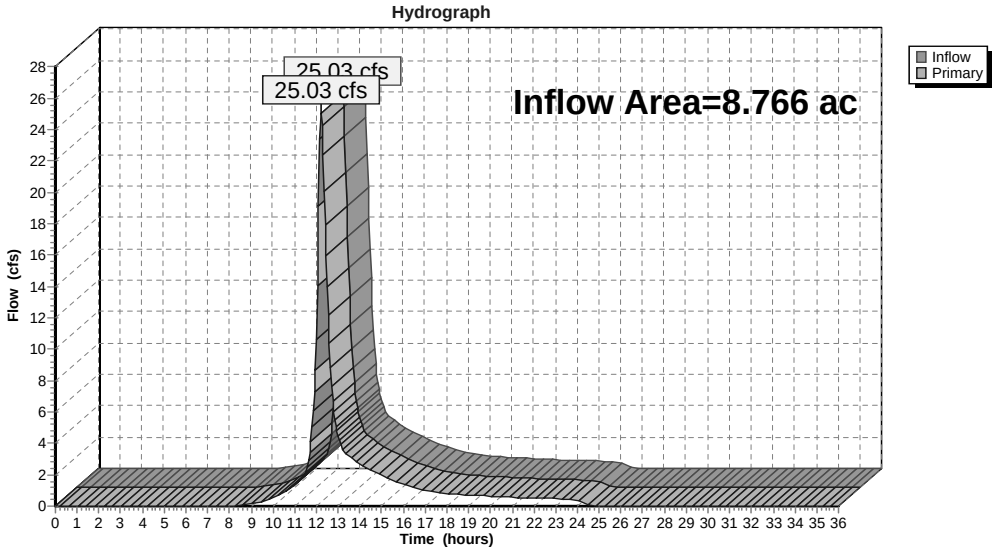


Summary for Link 2L: Design Pt#1

Inflow Area = 8.766 ac, 10.76% Impervious, Inflow Depth = 3.52" for 25-year event
Inflow = 25.03 cfs @ 12.21 hrs, Volume= 2.572 af
Primary = 25.03 cfs @ 12.21 hrs, Volume= 2.572 af, Atten= 0%, Lag= 0.0 min

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

Link 2L: Design Pt#1



Summary for Subcatchment P1: PostDev

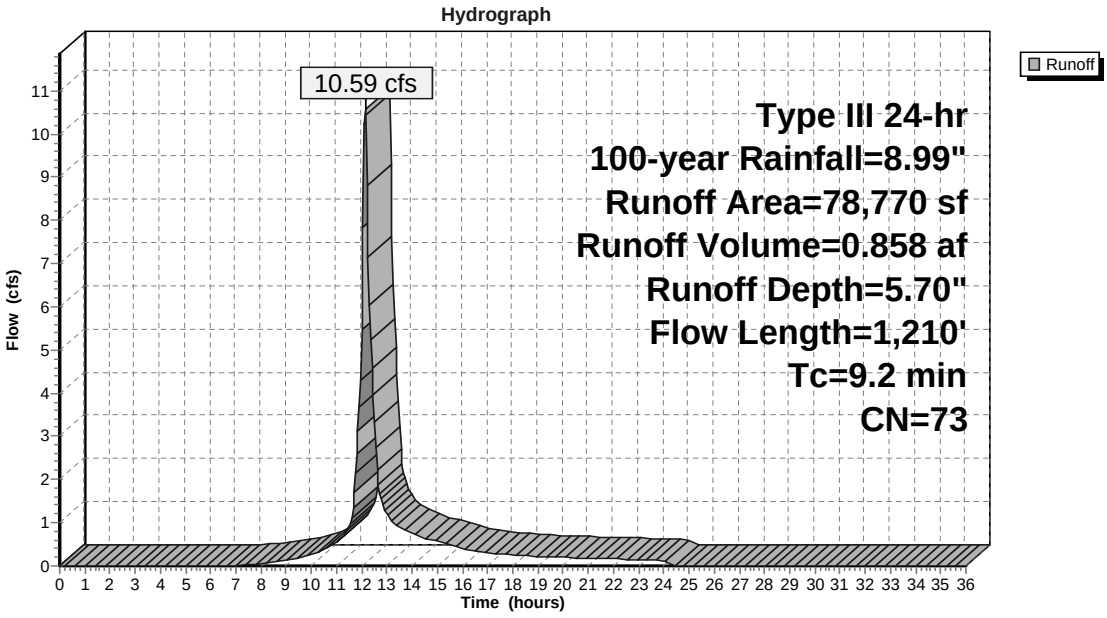
Runoff = 10.59 cfs @ 12.13 hrs, Volume= 0.858 af, Depth= 5.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.99"

	Area (sf)	CN	Description
*	8,926	98	Imp, roofs, drives
	3,040	55	Woods, Good, HSG B
	31,924	61	>75% Grass cover, Good, HSG B
	8,396	77	Woods, Good, HSG D
	20,710	80	>75% Grass cover, Good, HSG D
*	5,774	78	Wetlands
	78,770	73	Weighted Average
	69,844		88.67% Pervious Area
	8,926		11.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
1.0	300	0.0900	4.83		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
2.0	860	0.0370	7.27	29.08	**Channel Flow, Brook** Area= 4.0 sf Perim= 6.0' r= 0.67' n= 0.030 Stream, clean & straight
9.2	1,210	Total			

Subcatchment P1: PostDev



Summary for Subcatchment P2: Post

Runoff = 8.87 cfs @ 12.12 hrs, Volume= 0.716 af, Depth= 6.68"

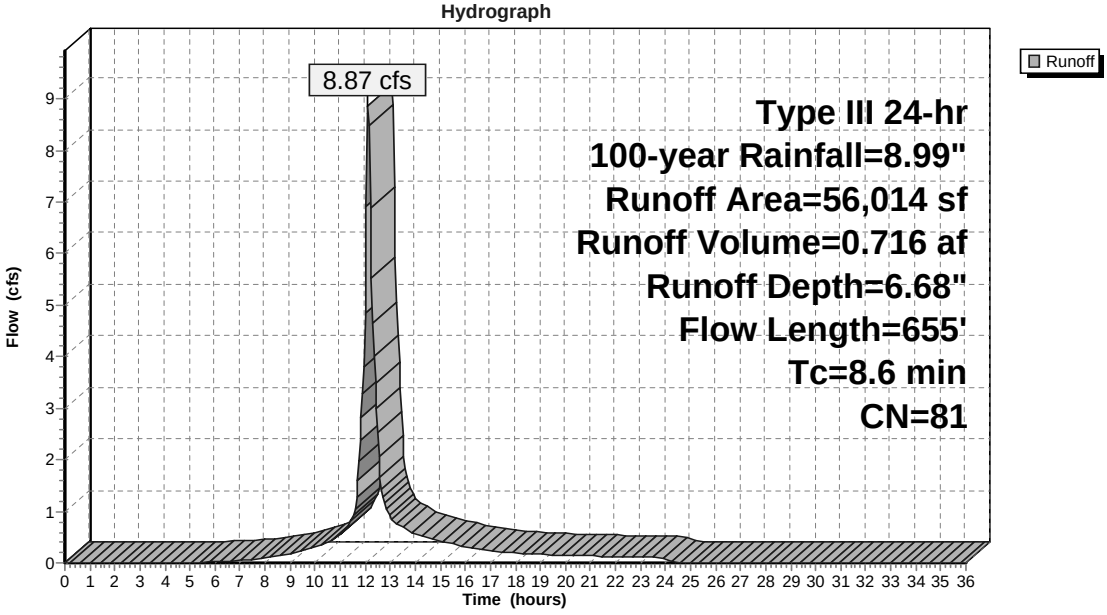
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.99"

	Area (sf)	CN	Description
*	2,650	98	Det Basin
	3,870	55	Woods, Good, HSG B
*	7,194	98	Imp, roof, drives
	10,222	61	>75% Grass cover, Good, HSG B
*	10,737	98	Imp, roof, drives
	3,480	77	Woods, Good, HSG D
	17,861	80	>75% Grass cover, Good, HSG D
	56,014	81	Weighted Average
	35,433		63.26% Pervious Area
	20,581		36.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
1.0	300	0.0900	4.83		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.2	50	0.0500	3.35		**Shallow Concentrated Flow, C-D** Grassed Waterway Kv= 15.0 fps
0.3	105	0.1000	6.42		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
0.9	150	0.0200	2.87		**Shallow Concentrated Flow, E-F** Paved Kv= 20.3 fps
8.6	655	Total			

Subcatchment P2: Post

Hydrograph



Summary for Subcatchment P3: PostDev

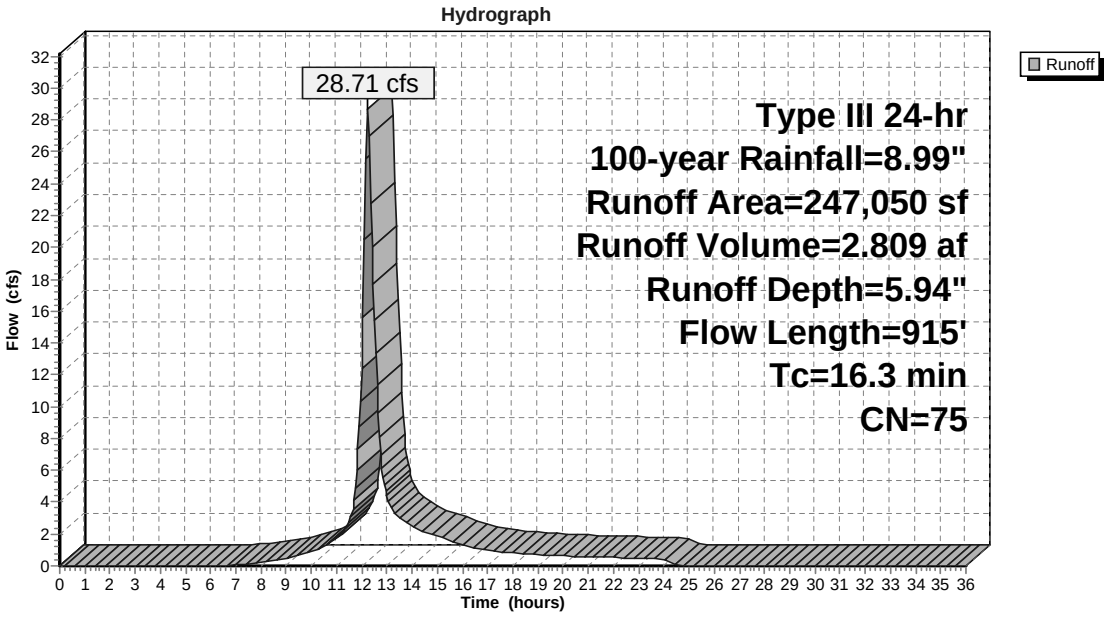
Runoff = 28.71 cfs @ 12.22 hrs, Volume= 2.809 af, Depth= 5.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.99"

	Area (sf)	CN	Description
*	6,237	98	Imp, roof, drives
	40,377	61	>75% Grass cover, Good, HSG B
	15,828	74	>75% Grass cover, Good, HSG C
	36,369	80	>75% Grass cover, Good, HSG D
	4,812	55	Woods, Good, HSG B
	15,813	70	Woods, Good, HSG C
	60,549	77	Woods, Good, HSG D
*	61,720	78	Wetlands HSG D
*	5,345	98	Imp, roof drives
	247,050	75	Weighted Average
	235,468		95.31% Pervious Area
	11,582		4.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.5	170	0.1200	5.20		**Shallow Concentrated Flow, B-C** Grassed Waterway Kv= 15.0 fps
2.3	255	0.1400	1.87		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
7.3	440	0.0400	1.00		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
16.3	915	Total			

Subcatchment P3: PostDev



Summary for Pond 1P: Det Basin #1

Inflow Area = 1.286 ac, 36.74% Impervious, Inflow Depth = 6.68" for 100-year event
Inflow = 8.87 cfs @ 12.12 hrs, Volume= 0.716 af
Outflow = 6.10 cfs @ 12.23 hrs, Volume= 0.712 af, Atten= 31%, Lag= 6.7 min
Discarded = 0.03 cfs @ 12.23 hrs, Volume= 0.024 af
Primary = 6.07 cfs @ 12.23 hrs, Volume= 0.688 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 217.28' @ 12.23 hrs Surf.Area= 3,181 sf Storage= 6,347 cf

Plug-Flow detention time= 43.9 min calculated for 0.712 af (99% of inflow)
Center-of-Mass det. time= 40.5 min (839.2 - 798.7)

Volume	Invert	Avail.Storage	Storage Description
#1	214.00'	8,810 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

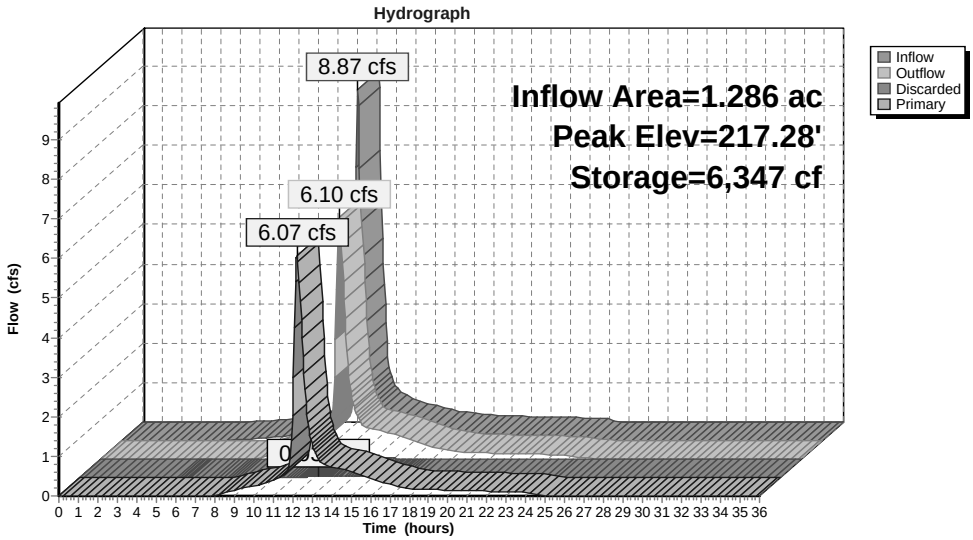
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
214.00	570	93.0	0	0	570
216.00	2,420	219.0	2,776	2,776	3,714
217.00	2,995	228.0	2,702	5,479	4,104
218.00	3,680	247.0	3,332	8,810	4,861

Device	Routing	Invert	Outlet Devices
#1	Primary	214.00'	**18.0" Round Culvert** L= 20.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 214.00' / 213.00' S= 0.0500 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.77 sf
#2	Device 1	214.50'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	216.00'	**1.2' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.3' Crest Height
#4	Discarded	214.00'	**0.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 212.00'

Discarded OutFlow Max=0.03 cfs @ 12.23 hrs HW=217.27' (Free Discharge)
└**4=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=6.03 cfs @ 12.23 hrs HW=217.27' (Free Discharge)
└**1=Culvert** (Passes 6.03 cfs of 13.52 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 1.05 cfs @ 7.71 fps)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 4.98 cfs @ 4.13 fps)

Pond 1P: Det Basin #1

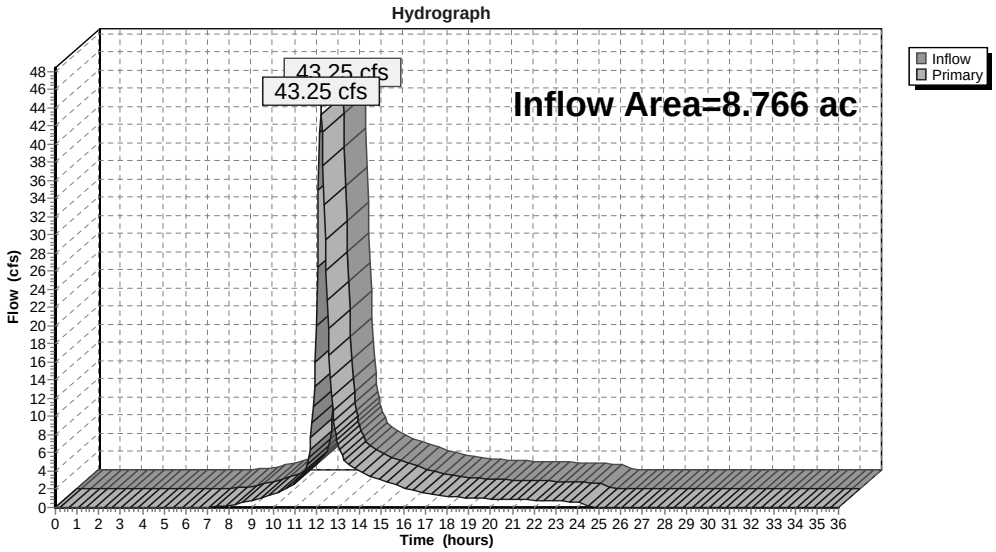


Summary for Link 2L: Design Pt#1

Inflow Area = 8.766 ac, 10.76% Impervious, Inflow Depth = 5.96" for 100-year event
Inflow = 43.25 cfs @ 12.20 hrs, Volume= 4.355 af
Primary = 43.25 cfs @ 12.20 hrs, Volume= 4.355 af, Atten= 0%, Lag= 0.0 min

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

Link 2L: Design Pt#1



APPENDIX – B

Hydraulic Calculations and Pipe Design (Manning's Equation)
Time of flow
Average CN Values

STORM DRAINAGE CALCULATIONS

Pipe Flow Calculations - Manning's Equation

i = Rainfall Intensity at 100 Year Storm

Date: 1/19/23
Revised:
Job No: 17,282
Calc. by: rst

Project: Warwick Road
Town: Walpole, MA

Line		Length	Drain Area	Total Area	Runoff	Time of Concentration (min.)			Rainfall i	Required Capacity Q(cfs)		Pipe Diameter	Slope	Design Conditions		Invert Elevation		Rim Elev.	
From	To	(Feet)	(Ac)	(Ac)	"C"	Upper End	In Pipe	Total	(in./hr.)	Inlet	Pipe	(in.)	(ft./ft.)	Depth (in.)	Velocity (f.p.s.)	Upper	Lower	Upper	n
CB 1	DMH 3	17	1.17		0.47	21.29	0.03	21.32	4.73	2.61		12	0.053	4.60	9.30	220.00	219.10	223.64	0.013
CB 2	DMH 3	17	0.12		0.70	12.83	0.05	12.88	5.79	0.48		12	0.053	2.00	5.70	220.00	219.10	223.64	0.013
DMH 3	CDS	10		1.29	0.49	21.32	0.02	21.35	4.73		3.01	12	0.020	6.80	6.70	219.00	218.80	224.29	0.013
CDS	DMH 4	135		1.29	0.49	21.35	0.36	21.71	4.72		3.01	12	0.017	7.20	6.30	218.80	216.55	224.50	0.013
DMH 4	OUTLET	30		1.29	0.49	21.71	0.08	21.79	4.69		2.98	12	0.015	7.30	6.00	216.45	216.00	219.70	0.013

OVERLAND FLOW TRAVEL TIME

STORM RUNOFF DATA

Date: **1/19/23**
Revised:

Project: **Warwick Road**
Town: **Walpole, MA**

Job No: **17,282**
Calc. by: **rst**

Structure	Impervious			Lawn			Wooded			Total
	Length (ft)	Slope ('/')	Time (min.)	Length (ft)	Slope ('/')	Time (min.)	Length (ft)	Slope ('/')	Time (min.)	Travel Time (min.)
1	**160**	**0.017**	**1.86**	**320**	**0.090**	**19.43**				21.29
2	**160**	**0.017**	**1.86**	**70**	**0.050**	**10.97**				12.83

AVERAGE 'c' VALUE FOR STRUCTURES

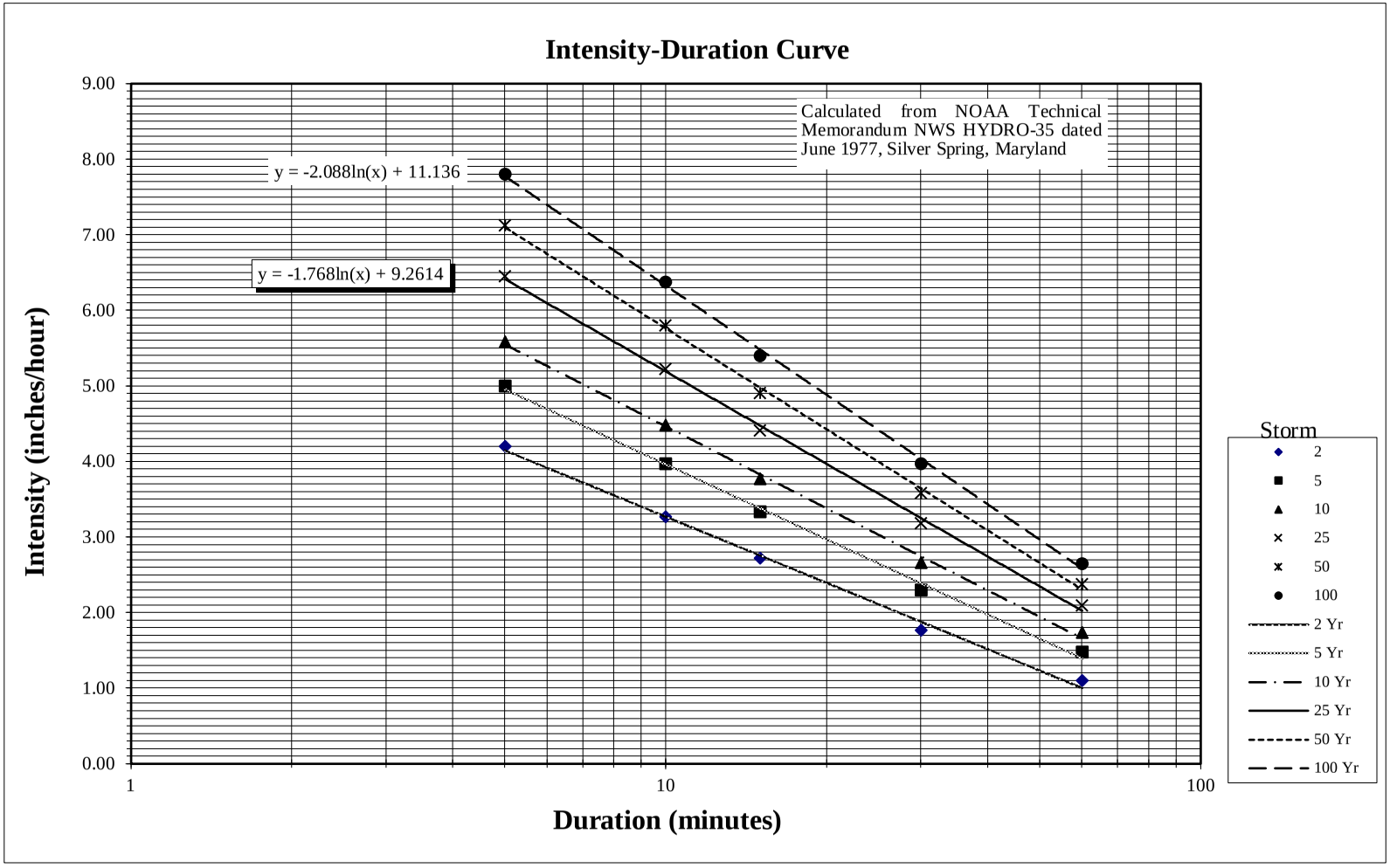
STORM RUNOFF DATA

Date: **1/19/23**
Revised:

Project: **Warwick Road**
Town: **Walpole, MA**

Job No: **17,282**
Calc. by: **RST**

Structure	Total Area (SF)	Ground Cover	Area (SF)	c	Σ(Area*c)	Average c	Total Area (Ac)
CB#1	50,802	imp	14,746	0.95	14,008.70	0.47	1.17
		lawn	28,706	0.30	8,611.80		
		wooded	7,350	0.20	1,470.00		
CB#2	5,212	imp	3,185	0.95	3,025.75	0.70	0.120
		lawn	2,027	0.30	608.10		
		wooded	0	0.20	0.00		


Intensity-Duration Curve
Calculated from NOAA Technical Memorandum NWS HYDRO-35 dated June 1977, Silver Spring, Maryland
y = -2.088ln(x) + 11.136
y = -1.768ln(x) + 9.2614
Intensity (inches/hour)
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1
10
100
Duration (minutes)
Storm
2
5
10
25
50
100
2 Yr
5 Yr
10 Yr
25 Yr
50 Yr
100 Yr

APPENDIX – C

Water Quality Volumes
Stormwater Recharge Volumes
& TSS Removal

APPENDIX – B
Stormwater Recharge & Water Quality Volume Calculations
Standard 3:

Project:
Warwick Road Extension
Walpole MA
Revised: August 22, 2022
January 19, 2022: June 1, 2023

Water Quality Volume (WQV): Based on 0.5 inch rainfall
Recharge Volume (Rv): Based on Soil Classification

Rv = F * Impervious Area
Rv = Required Recharge Volume
F = Depth Factor
Soil Type D – 0.1 inch *Recharge not recommended soil type D
K Factor = 0.27 in/hr (See Rawles Table Silt Loam)

Proposed Total Impervious Area:

Roof:	4,200 sf
Drives Paved:	5,053 sf
Roadway Paved:	6,340 sf
Total:	15,593 sf

Impervious Area to Drainage Basin:	8,375 s.f.
Impervious Area to Roof Drains:	4,200 s.f.
Impervious Area to bypass Basin (Driveway):	3,018 s.f.
Total Impervious Area:	15,593 s.f.
Total Impervious to Recharge:	12,575 s.f.
Total Impervious Area Uncaptured:	3,018 s.f.

Capture Adjustment:
12,575 s.f. / 15,593 s.f. = 81% > 65%
15,593 s.f. / 12,575 s.f. = 1.2 capture adjustment

Rv = F * Impervious Area
Rv = Required Recharge Volume
F = Depth Factor

The entire developable area is comprised of Hydrologic soil group ‘D”. When designing BMP’s for sites comprised of D soils and rock outcrops at the surface, then the required recharge volume only to the maximum extent practicable. DEP Stormwater Handbook does not recommend Infiltration systems installed in D soils.
Soil Type D – Depth Factor = 0.1 inch

Water Quality Volume:
Imp. Area Pavement to Drainage Basin: 8,375 s.f.
WQV = (8,375 sf * 0.5 in)/12 = 349 c.f.

Pretreatment provided with Proprietary Unit (CDS Unit 92% Removal)

Recharge Volume Required:
(Soil Type D – 0.1 inch)
Tot. Imp Area to Drainage Basin: 8,375 s.f.
Rv = (8,375 sf * 0.1 in)/12 = 70 c.f. x Capture Adjustment (1.2) = 44 c.f.
Recharge Volume provide below Basin Outlet: 367 c.f. (Outlet Inv. 214.50)

Area to Roof Recharge System: 2,100 s.f. (per house)
Rv = (2,100 sf * 0.1 in)/12 = 70 c.f. x Capture Adjustment (1.2) = 22 c.f.

Roof Recharge Storage Provided (2-systems per house): 188 c.f.

Time to drain basin below outlet (Static Method)
Drawdown time = Volume/(K*Bottom Area)
Volume below outlet = 367 c.f.
K=0.27 in/hr = 0.023 ft/hr
Bottom Area = 570 s.f. (Sand Bottom Area)
Drawdown time = 367 c.f./(0.023 ft/hr * 570 sf)
Drawdown time = 28 hrs < 72 hr **OK**

Time to drain roof infiltration (Static Method)
Drawdown time = Volume/(K*Bottom Area)
Total Storage Volume = 94 c.f.
K=0.27 in/hr = 0.023 ft/hr
Bottom Area = 77 s.f.
Drawdown time = 94 c.f./(0.023 ft/hr * 77 sf)
Drawdown time = 53 hrs < 72 hr **OK**

INSTRUCTIONS:

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

Non-automated: Mar. 4, 2008

Location: Warwick Rd Ext.

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 Catch Basin	0.25	1.00	0.25	0.75
CDS Unit	0.80	0.75	0.60	0.15

Total TSS Removal = 85%

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

Project: Warwick Rd Ext.
Prepared By: RST
Date: 8/22/22

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

APPENDIX – D

Soil test log data

Commonwealth of Massachusetts
City/Town of Walpole

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

A. Facility Information

Wall Street Development (Applicant)
Owner Name

Off Warwick Road
Street Address

Map/Lot #

Walpole
City

MA
State

02081
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: Source 71B Soil Map Unit

Ridgebury
Soil Name

Soil Limitations

Fine Sandy Loam
Soil Parent material

Moraine
Landform

3. Surficial Geological Report Available? ☐ Yes ☐ No If yes: Year Published/Source Map Unit

Description of Geologic Map Unit:

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

5. Within a velocity zone? ☐ Yes ☒ No

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

7. Current Water Resource Conditions (USGS): Month/Day/ Year Range: ☐ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of Walpole

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

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

Deep Observation Hole Number: 22-1 (Hole #) | 5/24/22 (Date) | am (Time) | _____ (Weather) | _____ (Latitude) | _____ (Longitude:)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Brush/tree mix (Vegetation) | Yes (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 2.0 (Slope (%))

Description of Location: _____

2. Soil Parent Material: Fine sand loam | Morraine (Landform) | _____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body n.a. feet | Drainage Way n.a. feet | Wetlands 40 feet | Property Line 40 feet | Drinking Water Well _ feet | Other _____ feet

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: 38" Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
6	A	L	10yr3/3								
30	B	SL	10yr5/6	30"	10y5/6	Many					
90	C	SL	2.5y5/4				5%	Cob	Med-Coarse Firm		

Additional Notes: _____

Commonwealth of Massachusetts
City/Town of Walpole

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

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

Deep Observation Hole Number: 22-2 (Hole #) 5/24/22 (Date) am (Time) _____ (Weather) _____ (Latitude) _____ Longitude:

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) Brush/Tree mix (Vegetation) yes (Surface Stones (e.g., cobbles, stones, boulders, etc.) 2.0 Slope (%)

Description of Location: _____

2. Soil Parent Material: Fine Sand Loam Morraine (Landform) _____ (Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body n.a. feet Drainage Way n.a. feet Wetlands 50+ feet
Property Line 40 feet Drinking Water Well n.a. feet Other _____ feet

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: 52" Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
6	A	L	10yr3/3								
22	B	SL	10yr5/6	22"	10yr5/6	Many					
70	C	SL	2.5y5/4				5%	Cobs	Med-Coarse		

Additional Notes: _____

Commonwealth of Massachusetts
City/Town of Walpole

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

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

Deep Observation Hole Number: 22-3 (Hole #) 5/24/22 (Date) am (Time) _____ (Weather) _____ (Latitude) _____ Longitude:

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) Brush/Tree mix (Vegetation) yes (Surface Stones (e.g., cobbles, stones, boulders, etc.) 2.0 Slope (%)

Description of Location: _____

2. Soil Parent Material: Fine Sand Loam Morraine (Landform) _____ (Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body n.a. feet Drainage Way n.a. feet Wetlands 50+ feet
Property Line 40 feet Drinking Water Well n.a. feet Other _____ feet

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

5. Groundwater Observed: ☒ Yes ☐ No If yes: 38" Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
6	A	L	10yr3/3								
22	B	SL	10yr5/6	22"	10yr5/6	Many					
60	C	SL	2.5y5/4				5%	Cobs	Med-Coarse		

Additional Notes: _____

Commonwealth of Massachusetts
City/Town of Walpole

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

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole #22-1	Obs. Hole #22-2
☐ Depth observed standing water in observation hole	_____ inches	_____ inches
☐ Depth weeping from side of observation hole	38" inches	52" inches
☐ Depth to soil redoximorphic features (mottles)	30" inches	22" inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number

_____ Reading Date

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

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

2. Estimated Depth to High Groundwater: _____ inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

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

☐ Yes ☐ No

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

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

Commonwealth of Massachusetts
City/Town of Walpole

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

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole #22-3	Obs. Hole #
☐ Depth observed standing water in observation hole	_____ inches	_____ inches
☐ Depth weeping from side of observation hole	38" inches	____ inches
☐ Depth to soil redoximorphic features (mottles)	22" inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number

_____ Reading Date

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

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

2. Estimated Depth to High Groundwater: _____ inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

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

☐ Yes ☐ No

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

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

Commonwealth of Massachusetts
City/Town of Walpole

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

F. Certification

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

Signature of Soil Evaluator	Date
Robert Truax SE#1746	
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License
Carl Baduf	Town Eng
Name of Approving Authority Witness	Approving Authority

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

Field Diagrams: Use this area for field diagrams:

APPENDIX – E

Stormwater Operation and Maintenance Plan

Standard 9

Stormwater Management Operation and Maintenance Plan

Maintenance Agreement
Warwick Road Extension
Walpole, Massachusetts

August 22, 2022
Revised: June 1, 2023

In accordance with Standard 9 of the Massachusetts Department of Environmental Protection Stormwater Handbook (February 2008), the attached on-site maintenance program for the proposed stormwater management system has been developed to ensure the Best Management Practices (BMP's) in place will remain functioning as designed. The Plan contains both construction period operations and maintenance as well as post construction responsibilities that shall "run" with the property if ownership is transferred.

Responsible Operator:

Wall Street Development Corp.
Attn: Lou Petrozzi
P.O. Box 272
Walpole, MA 02090
Phone: 781-326-0306

_____ _____
Date

Estimated Maintenance Budget:

• Catch Basin Cleaning (Annual cost):	$1,000.00 per cleaning
• Drainage Basin Grass Mowing:	$1,500.00 per year
• Road Sweeping:	$ 500.00 per service
• Drainage System Inspection:	$ 500.00 per inspection
Estimated Total Annual Cost:	$3,500.00/year

Construction Period Operation and Maintenance:

- It should be noted that the US EPA mandated NPDES stormwater program requires construction site operators engaged in clearing, grading, and excavating activities that disturb 1 acre or more, including smaller sites in a larger common plan of development or sale, to obtain coverage under an NPDES permit for their stormwater discharges. The Project is subject to this permit and therefore, a Stormwater Pollution Prevention Plan (SWPPP) will be prepared prior to commencement of construction. The SWPPP will contain additional construction period and post construction erosion control requirements.

Erosion Control Barriers:

Compost filter socks shall be installed where indicated on the plans and in other appropriate locations where warranted. These barriers shall be installed prior to the commencement of any work on-site and in accordance with the construction plans. A supply of filter socks and compost filter material shall be kept on-site to replace and/or repair barriers that are damaged or degraded. The barriers shall be observed and maintained on a weekly basis during construction.

Construction Entrances:

The purpose of stabilizing entrances to a construction site is to minimize the amount of sediment leaving the area as mud and sediment attached to vehicles. The entrances shall be sized according to the Massachusetts DEP and US EPA guidelines and will be maintained on a weekly basis during construction. A Detail is included in the Site Plans prepared for the Project.

Sediment Traps/Basins:

Sediment basins and rock dams can be used to capture sediment from stormwater runoff before it leaves a construction site. Both structures allow a pool to form in an excavated or natural depression, where sediment can settle. The pool is dewatered through a single riser and drainage hole leading to a suitable outlet on the downstream side of the embankment or through the gravel of the rock dam. Design a sediment trap to maximize the surface area for infiltration and sediment settling. This increases the effectiveness of the trap and decreases the likelihood of backup during and after periods of high runoff intensity. Site conditions dictate specific design criteria, but the minimum storage capacity should be 1,800 ft^3 per acre of total drainage area (Smolen et al., 1988). The volume of a natural sediment trap can be approximated using the following equation (Smolen et al., 1988): *Volume (ft^3) = 0.4 x surface area (ft^2) x maximum pool depth (ft).* Sediment traps have a useful life of about 18 to 24 months (USEPA, 1993), but their effectiveness depends on the amount and intensity of rainfall and erosion, and proper maintenance.

Dust Control:

Soils information for the site indicates that it is comprised of sandy soils. Therefore, Dust control BMPs to reduce surface activities and air movement that causes dust to be generated from disturbed soil surfaces will be required. The preferred measure for dust control is sprinkling/irrigation. This is an on-going/as-needed requirement until surfaces have been stabilized. There shall be a water truck on-site available as needed.

Diversions:

Temporary diversion swales and mounds will be constructed to divert stormwater away from areas under construction to limit sediment transport. These diversions will be relocated as construction progresses. Stone check dams will be installed in swales as necessary to limit scour and sediment transport.

Catch Basin Protection:

Temporary inlet protection barriers consisting of Silt Sacks® will be placed within all constructed inlets to prevent inflow of sediments into the constructed drainage system. The barriers shall remain in place until a permanent cover is established or diversions away from the inlets are constructed. The barriers shall be observed and maintained as necessary on a weekly basis and after every rainfall of 0.5 inches or more.

Drainage Basin:

Rope or fence off the area selected for the infiltration basin. Never allow construction equipment to drive across the area intended to serve as an infiltration basin. During Construction, the basin shall be observed during and after all storm events to ensure there is no sediment accumulation or degradation of infiltrative surfaces. Never use infiltration basin as temporary sediment traps for construction activities. To limit smearing or compacting soils, never construct the basin in winter or when it's raining. If the basin floor becomes compacted or smeared during construction, the area shall be tilled to a depth of 12 inches to restore infiltration rates prior to final grading. The Infiltration Basin shall be maintained by the Homeowners association of the subdivision.

Spill Control:

A contingency plan to address the spillage/release of petroleum products and any hazardous materials will be implemented for the site during construction. The plan will include the following measures:

- Equipment necessary to quickly attend to inadvertent spills or leaks shall be on-site in a secure but accessible location. Such equipment will include, but not be limited to, the following: urethane drain cover seals (mats), a spill containment kit which includes sand and shovels, suitable absorbent materials, storage containers, safety goggles, chemically resistant gloves and overshoe boots, water and chemical fire extinguishers, and first aid equipment.
- Spills or leaks will be treated properly according to material type, volume of spillage and location of spill. Mitigation will include preventing further spillage, containing any spilled material to the smallest practical area, removing spilled material in a safe and environmentally friendly manner, and remediating any damage to the environment.
- The contractor shall be familiar with the reporting requirements of the Massachusetts Contingency Plan (310 CMR 40.00) as issued by the Massachusetts Department of Environmental Protection (DEP); specifically Subpart C Notification of Releases and Threats of Release of Oil and Hazardous Materials and Subpart D Preliminary Response Activities and Risk Reduction Measures.
- For any large spills. The Massachusetts DEP Hazardous Waste Incident Response Group shall be notified immediately at 1-617-792-7653 and an emergency response contractor will be called in.

Post-Construction Stormwater Management
Operation and Maintenance Plan

Maintenance Agreement
Warwick Road Extension
Walpole, Massachusetts
August 22, 2022
Revised: June 1, 2023

In accordance with Standard 9 of the Massachusetts Department of Environmental Protection Stormwater Handbook (February 2008), the attached on-site maintenance program for the proposed stormwater management system has been developed to ensure the Best Management Practices (BMP's) in place will remain functioning as designed. The Plan contains both construction period operations and maintenance as well as post construction responsibilities that shall "run" with the property if ownership is transferred.

Maintenance Responsiblities:
Wall Street Development Corp. (Until Roadway Acceptance)
Town of Walpole (After Roadway Acceptance)

- Street Sweeping
- Catch Basin Cleaning
- CDS Treatment Unit
- Snow Removal and De-Icing

Maintenance Responsiblities:
Stormwater Drainage Basin
Drainage Basin – Homeowner Lot A

- Drainage Basin
- Drainage Basin Access

Post-Construction Period Operation and Maintenance:

Catch Basin and Manhole Maintenance:

Activity	Inspection Frequency
Inspect Units	2 Times per year
Clean Units	Whenever the depth of deposits is greater than ½ the sump depth (1 time per yr minimum)

Street Sweeping:

Activity	Inspection Frequency
Sweeping Paved surfaces	2 time per yr (spring & fall). Sweeping along South Street shall be done when necessary (no tracking of materials onto the street shall be allowed)

CDS Treatment Unit:

Activity	Inspection Frequency
Inspect Inlet and Outlet	2 time per yr. After a heavy rain event 1" storm or larger
Inspect Access Ports for Sediment buildup & Cleanup	2 times per yr. Accumulated sediment buildup shall be Vacuumed cleaned as necessary

Drainage Basin:

Activity	Inspection Frequency
Sediment Removal	Inspect Monthly Remove accumulated sediment buildup Grass Mowing during growing season (Keep grasses no greater than 6 inches & no lower than 3 to 4 inches)

Stormwater Outlet Structure:

Activity	Inspection Frequency
Inspect Outlet	1 time per yr. Remove accumulated sediment buildup at outlet and overgrown vegetation around the outlet.

Stormwater Construction Site Inspection Report

General Information			
Project Name			
MA DEP File No.		**Location**	
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Inspector's Qualifications			
Describe present phase of construction			
Type of Inspection: ❑ Regular ❑ Pre-storm event ❑ During storm event ❑ Post-storm event			
Weather Information			
Has there been a storm event since the last inspection? ❑Yes ❑No **If yes, provide:** Storm Start Date & Time: Storm Duration (hrs): Approximate Amount of Precipitation (in):			
Weather at time of this inspection? ❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snowing ❑ High Winds ❑ Other: Temperature:			
Have any discharges occurred since the last inspection? ❑Yes ❑No **If yes, describe:**			
Are there any discharges at the time of inspection? ❑Yes ❑No **If yes, describe:**			

Site-specific BMPs

- *Number the structural and non-structural BMPs identified in your SWPPP on your site map and list them below (add as many BMPs as necessary). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required BMPs at your site.*
- *Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.*

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes
1		❑Yes ❑No	❑Yes ❑No	
2		❑Yes ❑No	❑Yes ❑No	
3		❑Yes ❑No	❑Yes ❑No	
4		❑Yes ❑No	❑Yes ❑No	
5		❑Yes ❑No	❑Yes ❑No	
6		❑Yes ❑No	❑Yes ❑No	
7		❑Yes ❑No	❑Yes ❑No	
8		❑Yes ❑No	❑Yes ❑No	
9		❑Yes ❑No	❑Yes ❑No	
10		❑Yes ❑No	❑Yes ❑No	
11		❑Yes ❑No	❑Yes ❑No	

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes
12		❑Yes ❑No	❑Yes ❑No	
13		❑Yes ❑No	❑Yes ❑No	
14		❑Yes ❑No	❑Yes ❑No	
15		❑Yes ❑No	❑Yes ❑No	
16		❑Yes ❑No	❑Yes ❑No	
17		❑Yes ❑No	❑Yes ❑No	
18		❑Yes ❑No	❑Yes ❑No	
19		❑Yes ❑No	❑Yes ❑No	
20		❑Yes ❑No	❑Yes ❑No	

Overall Site Issues

Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at your site.

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	❑Yes ❑No	❑Yes ❑No	
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	❑Yes ❑No	❑Yes ❑No	
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	❑Yes ❑No	❑Yes ❑No	
4	Are discharge points and receiving waters free of any sediment deposits?	❑Yes ❑No	❑Yes ❑No	
5	Are storm drain inlets properly protected?	❑Yes ❑No	❑Yes ❑No	
6	Is the construction exit preventing sediment from being tracked into the street?	❑Yes ❑No	❑Yes ❑No	
7	Is trash/litter from work areas collected and placed in covered dumpsters?	❑Yes ❑No	❑Yes ❑No	
8	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	❑Yes ❑No	❑Yes ❑No	

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	❑Yes ❑No	❑Yes ❑No	
10	Are materials that are potential stormwater contaminants stored inside or under cover?	❑Yes ❑No	❑Yes ❑No	
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	❑Yes ❑No	❑Yes ❑No	
12	(Other)	❑Yes ❑No	❑Yes ❑No	

Non-Compliance

Describe any incidents of non-compliance not described above:

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: _____

Signature:_____ Date:_____

CONTECH®
ENGINEERED SOLUTIONS

CDS® Inspection and Maintenance Guide

CDS TECHNOLOGIES

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 should be cleaned out immediately. 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 power washed 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.

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	1.3	3.0	0.9	1.3	1.0
CDS2020	5	1.3	3.5	1.1	1.3	1.0
CDS2025	5	1.3	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

Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, earth stabilization and wastewater treament products. For information, visit www.ContechES.com or call 800.338.1122

The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; 7,296,692; 7,297,266; 7,517,450 related foreign patents or other patents pending.

CONTECH®
ENGINEERED SOLUTIONS
800.925.5240
www.ContechES.com

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.

APPENDIX – F

Illicit Discharge Statement

Standard 10

Illicit Discharge Compliance Statement

Warwick Road Extension
Walpole, Massachusetts

August 5, 2020

This statement is provided in accordance with the provisions of the Massachusetts Stormwater Management Standard #10.

To the best of the applicant's/owners knowledge there are no illicit discharges to the site's stormwater manangement system.

All proposed uses on the site will not generate, store or discharge any pollutants to the groundwater and/or wetland resource areas.

Any illicit discharges identified during or after construction will be terminated immediately.

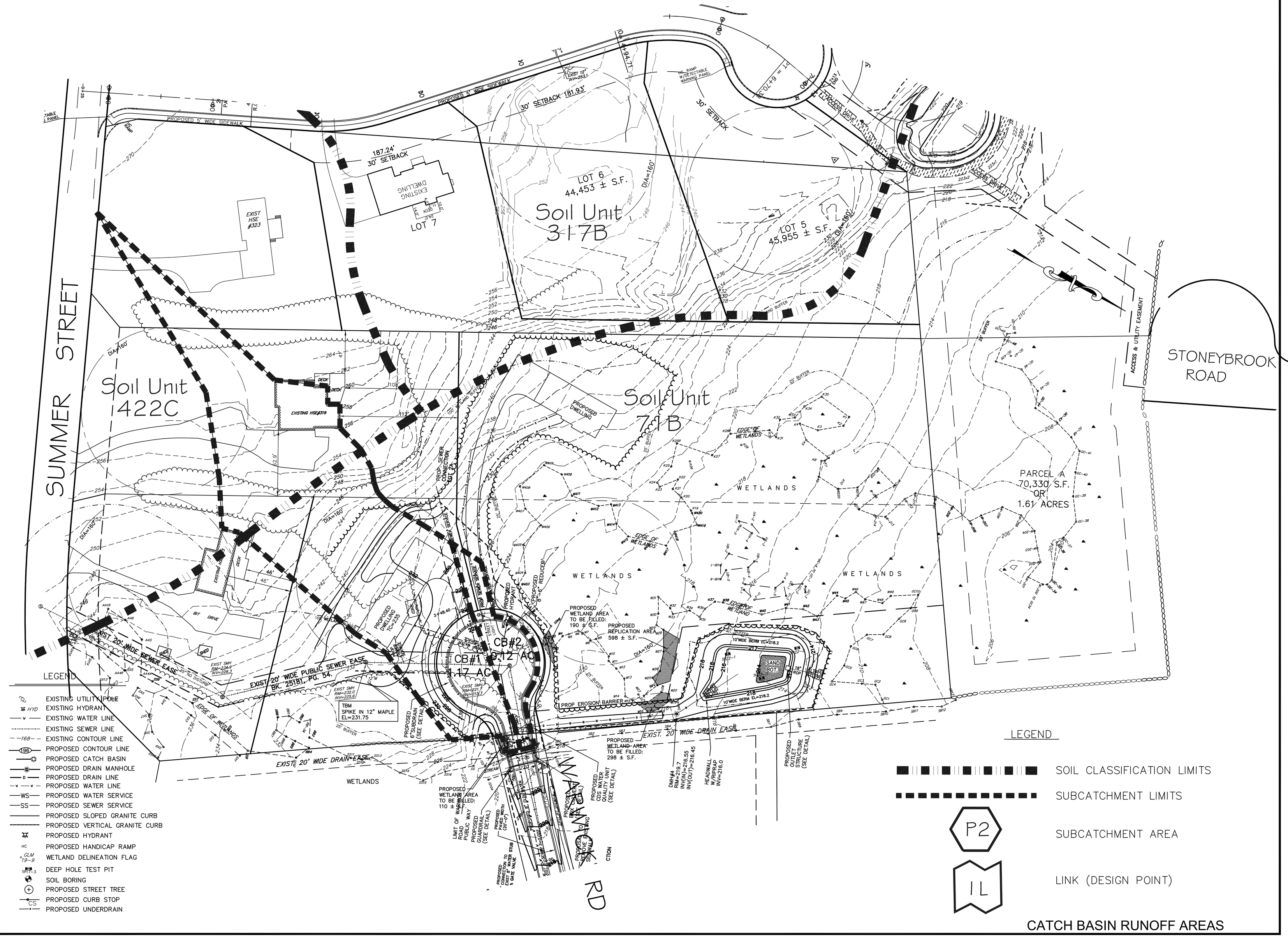
Applicant/Owner:

Wall Street Development Corp.
Attn: Lou Petrozzi
P.O Box 272
Westwood, MA 02090
Phone: 508-326-0360

APPENDIX – G

Supplemental Stormwater Plans

Pre-Development Subcatchment Areas
Post-Development Subcatchment Areas
Hydraulic Subcatchment Areas



CATCH BASIN RUNOFF AREAS

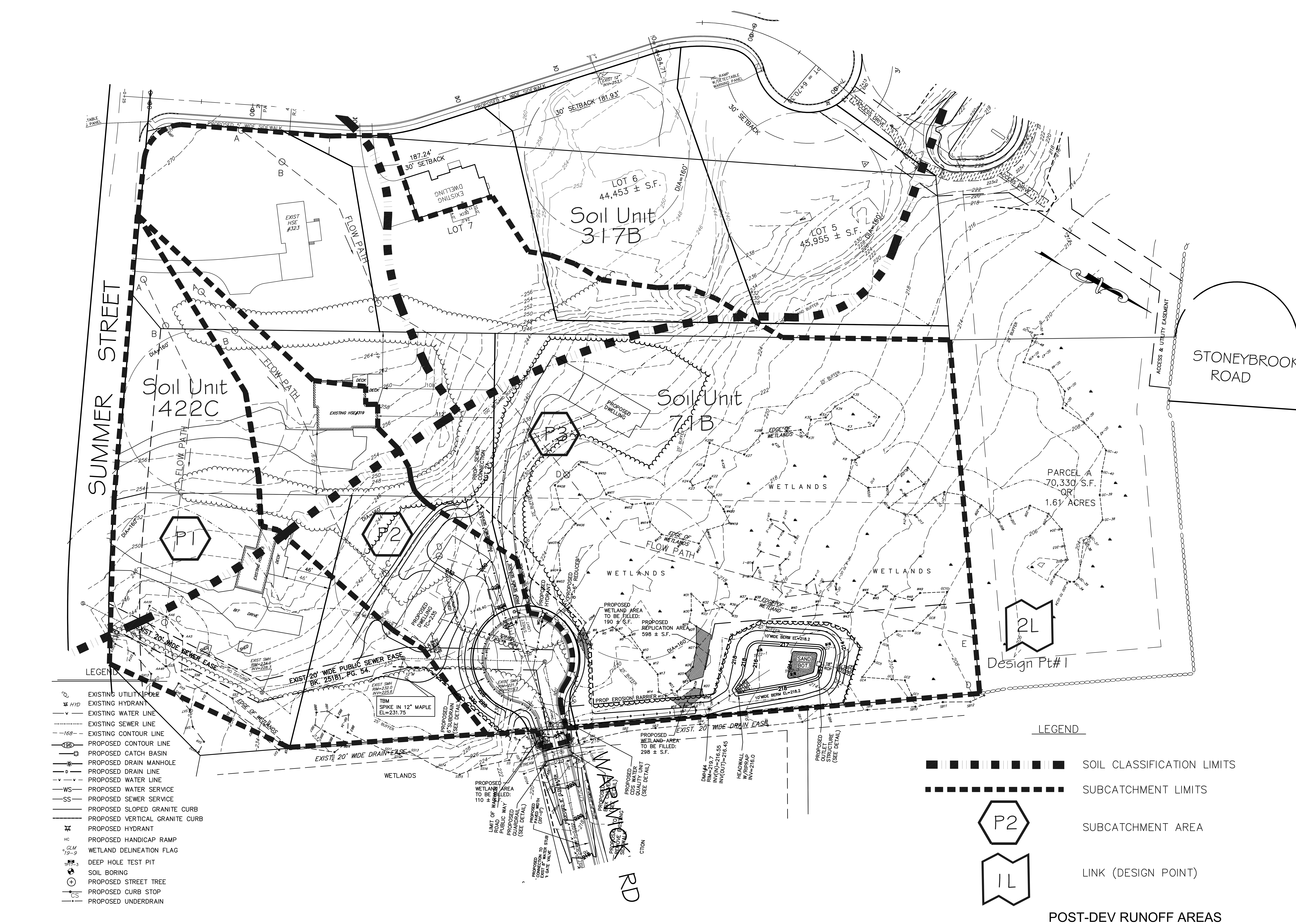
No.	DATE	REVISIONS DESCRIPTION

DEFINITIVE SUBDIVISION PLAN
" WARWICK ROAD EXTENSION
WALPOLE, MASSACHUSETTS

PREPARED FOR:
WALL STREET DEVELOPMENT CORP.
P.O. BOX 272
WESTWOOD, MASSACHUSETTS 02090

GLM Engineering Consultants, Inc.
19 EXCHANGE STREET
HOLLISTON, MA 01746
P: 508-429-1100
F: 508-429-7160
www.GLMengineering.com

JOB No.	17,282
DATE:	AUG. 22, 2022
SCALE:	1"=40'
SHEET:	3 of 3
PLAN #:	27,566



POST-DEV RUNOFF AREAS

REVISIONS		
No.	DATE	DESCRIPTION

DEFINITIVE SUBDIVISION PLAN
" WARWICK ROAD EXTENSION
WALPOLE, MASSACHUSETTS

PREPARED FOR:
WALL STREET DEVELOPMENT CORP.
P.O. BOX 272
WESTWOOD, MASSACHUSETTS 02090

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DATE:	AUG. 22, 2022
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SHEET:	2 of 3
PLAN #:	27,566

SUMMER STREET

STONEYBROOK ROAD

WARWICK RD

Soil Unit 422C

Soil Unit 317B

Soil Unit 71B

LOT 6
44,453 ± S.F.

LOT 7

LOT 5
45,955 ± S.F.

PARCEL A
70,330 S.F.
OR
1.61 ACRES

EXISTING DWELLING

EXIST HSE #323

EXISTING HSE#319

30' SETBACK

187.24'
30' SETBACK

30' SETBACK 181.93'

FLOW PATH

E1

E2

WETLANDS

EDGE OF WETLANDS

EDGE OF WETLAND

25' BUFFER

100' BUFFER

10'WIDE BERM EL=218.2

ACCESS & UTILITY EASEMENT

EXIST 20' WIDE PUBLIC SEWER EASE. BK. 25181, PG. 54.

EXIST 20' WIDE SEWER EASE. NO DISTURB

EXIST 20' WIDE DRAIN EASE.

EXIST 12" INV=253.1

EXIST SMH RIM=234.6 INV=228.1

EXIST SMH RIM=232.0 INV=225.6

EXIST SMH RIM=221.9 INV=215.3

TBM SPIKE IN 12" MAPLE EL=231.75

PROPOSED WETLAND AREA TO BE FILLED: 190 ± S.F.

PROPOSED REPLICATION AREA 598 ± S.F.

PROPOSED WETLAND AREA TO BE FILLED: 298 ± S.F.

PROPOSED WETLAND AREA TO BE FILLED: 110 ± S.F.

PROPOSED VERTICAL GRANITE CURB

PROPOSED RETAINING WALL

PROPOSED 6" SUBDRAIN (SEE DETAIL)

PROPOSED 4' WIDE BITUMINOUS SIDEWALK

PROPOSED SLOPED GRANITE CURB

PROPOSED CATCH BASIN (SEE DETAIL)

PROPOSED OUTLET STRUCTURE (SEE DETAIL)

PROPOSED GUARDRAIL (SEE DETAIL)

LIMIT OF ROAD PUBLIC WAY

DMH#4 RIM=218.7 INV(N)=216.55 INV(OUT)=216.45

HEADWALL W/RIPRAP INV=216.0

Design Pt# 1

L

LEGEND

- EXISTING UTILITY POLE
- EXISTING HYDRANT
- EXISTING WATER LINE
- EXISTING SEWER LINE
- EXISTING CONTOUR LINE
- PROPOSED CONTOUR LINE
- PROPOSED CATCH BASIN
- PROPOSED DRAIN MANHOLE
- PROPOSED DRAIN LINE
- PROPOSED WATER LINE
- PROPOSED WATER SERVICE
- PROPOSED SEWER SERVICE
- PROPOSED SLOPED GRANITE CURB
- PROPOSED VERTICAL GRANITE CURB
- PROPOSED HYDRANT
- PROPOSED HANDICAP RAMP
- WETLAND DELINEATION FLAG
- DEEP HOLE TEST PIT
- SOIL BORING
- PROPOSED STREET TREE
- PROPOSED CURB STOP
- PROPOSED UNDERDRAIN

LEGEND

- SOIL CLASSIFICATION LIMITS
- SUBCATCHMENT LIMITS
- E2 SUBCATCHMENT AREA
- IL LINK (DESIGN POINT)

PRE-DEV RUNOFF AREAS

No.	DESCRIPTION	DATE

REVISIONS

DEFINITIVE SUBDIVISION PLAN
" WARWICK ROAD EXTENSION
WALPOLE, MASSACHUSETTS

PREPARED FOR:
WALL STREET DEVELOPMENT CORP.
P.O. BOX 272
WESTWOOD, MASSACHUSETTS 02090

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